The Hong Kong Polytechnic University

School of Hotel and Tourism Management

ECONOMETRIC ANALYSIS OF TOURIST EXPENDITURES

Chenguang WU

A thesis submitted in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

April, 2010

CERTIFICATE OF ORIGINALITY

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it reproduces no material previously published or written, nor material that has been accepted for the awards of ay other degree or diploma, except where due acknowledgement has been made in the text.

____

Chenguang WU

To my parents

ABSTRACT

Tourism demand analysis has received considerable attention from both academics and practitioners. Accurate tourism demand modelling and forecasting can help tourism businesses to establish effective marketing and investment plans and the government to formulate appropriate policies. Different methodologies have been applied to tourism demand analysis, including advanced econometric techniques. Amongst them, the almost ideal demand system (AIDS) model, a system-of-equations approach, possesses distinct advantages over single-equation models, especially in analysing tourist expenditure allocation.

This study presents the first attempt to apply the time-varying parameter (TVP) version of the error-correction AIDS model to the analysis of tourist consumption of different tourism goods and services. The AIDS model includes several equations (each of which refers to one category of tourism goods and services) that are simultaneously estimated. This allows the investigation of the interaction amongst different kinds of demand. The incorporation of the TVP technique into the AIDS model gives the model superior performance compared to its constant-parameter counterpart by allowing the examination of the evolution of tourist expenditure patterns over time.

An empirical study is conducted in which the constant-parameter and TVP versions of the long-run AIDS and short-run error-correction AIDS models are employed to examine and compare tourist spending behaviour in Hong Kong.

The constant-parameter AIDS model addresses average tourist consumption behaviour whereas the TVP-AIDS model explores the evolution of tourist consumption behaviour over time. Tourists from eight major source markets are examined, and the demand elasticities (i.e., expenditure and price) that are associated with each of these source markets are computed and analysed. The results provide useful information to enhance Hong Kong's competitiveness as an international tourist destination.

Keywords: Tourism demand analysis, econometric approaches, error-correction AIDS model, TVP technique, Hong Kong inbound tourist expenditures

ACKNOWLEDGEMENTS

I would like to express my utmost gratitude to Professor Haiyan Song, my chief supervisor, for his invaluable guidance and selfless support. What I have learned from him is a precious treasure that I will cherish for the rest of my life.

I am sincerely grateful to Dr Kevin Wong, my co-supervisor, for his continuous encouragement and help. His optimistic attitude towards life often heartened me.

My special thanks go to Dr Gang Li for his patient guidance and direction during my period of study at the University of Surrey. His generous help made my stay in the UK enjoyable and unforgettable.

My appreciation also goes to The Hong Kong Polytechnic University for providing financial support and high-quality facilities for my PhD studies. I also extend my thanks to the School of Hotel and Tourism Management. It has become a family to me.

Finally, I express my heartfelt appreciation to my parents and little sister. Their support has been priceless. I also extend my earnest thanks to Ms Baijing Song and my wonderful friends and colleagues. Their company and encouragement have made my life in Hong Kong very special.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1 INTRODUCTION

1.1 Research background

International tourism has increased immensely over the past three decades, aided by the rapid development of the airline industry and decrease in transportation costs. Francesco Frangialli, the former Secretary General of the United Nations World Tourism Organisation (UNWTO), stated in his keynote speech at the International Tourism Bourse (ITB) in Berlin in 2007 that world tourism had entered a new historical phase of growth since 2005 in which international arrivals broke the 800 million mark. He cautioned that the path ahead needs to follow a more solid and responsible type of growth. The latest data from the UNWTO (2009, p.4) show that international tourist arrivals reached 922 million in 2008, with an average annual growth rate of 4.67% from 2005 to 2008. Despite the impact of the financial crisis in 2008 and the subsequent economic recession, international tourist arrivals still showed an annual growth rate of 1.99% in the 2007-2008 period.

International tourism plays an increasingly significant role in national and global economies. Visitor expenditures on shopping, hotel accommodation, food and beverage, transport and entertainment contribute substantially to developing and developed economies by generating gross domestic product (GDP), creating employment and providing socio-economic development opportunities. In 2008, more than 80 countries earned over USD 1 billion from international tourism, with worldwide receipts reaching USD 944 billion (UNWTO, 2009). Figures 1.1

and 1.2 show the annual international tourist arrivals and tourism receipts from 1990 to 2008, respectively.

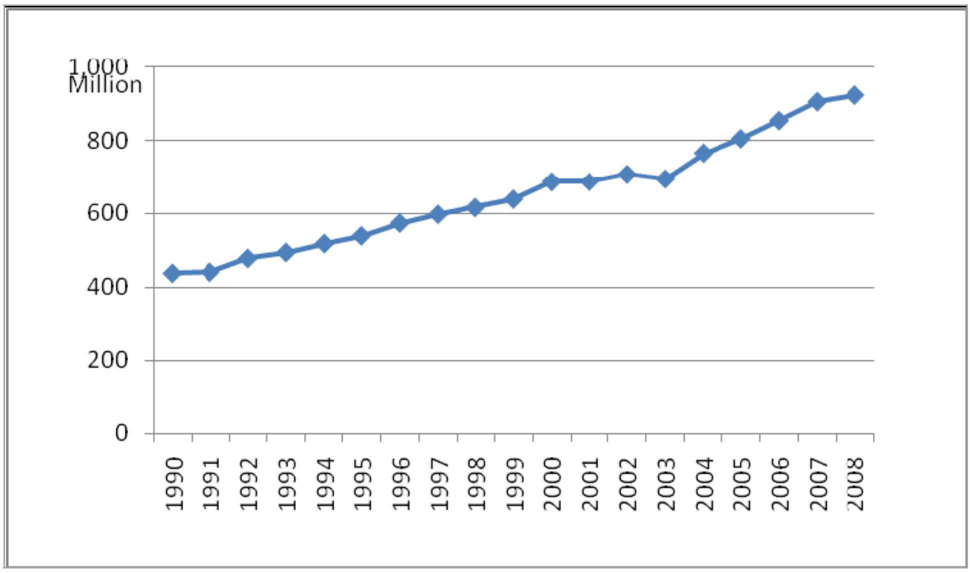

Figure 1.1 International tourist arrivals

Source: UNWTO

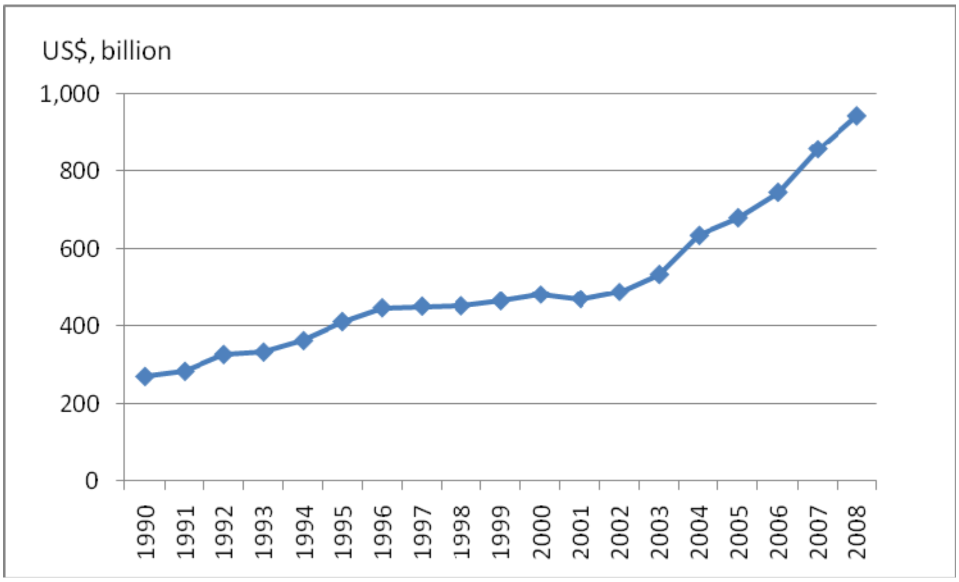

Figure 1.2 International tourism receipts

Source: UNWTO

Because of the importance of tourism to domestic and international economies and its close linkage to the hotel, restaurant, airline, and tour operator industries, amongst others, it has been attracting increasing attention from both academics and practitioners. Tourism demand analysis in particular has been a central focus in tourism research over the past two decades. At the micro level, accurate tourism demand forecasts can help tourism businesses to establish effective marketing and investment plans. At the macro level, tourism demand analysis is essential for government policy formulation.

A variety of methodologies have been applied to tourism demand analysis. In recent decades, tourism demand modelling and forecasting using econometric methods have become popular, which has resulted in great diversity in terms of both the scope of the analysis and modelling method used. Univariate time series techniques such as the naïve, autoregressive and moving average (ARMA) and exponential smoothing models, and advanced econometric techniques such as the autoregressive distributed lag model (ADLM), error-correction, time-varying parameter (TVP) and system-of-equations demand models have been employed and gained wide acceptance amongst researchers and practitioners. The level of forecasting performance of these techniques has also been widely studied and compared (see, for example, Blake et al., 2006; Kulendran & King, 1997; Kulendran & Witt, 2003a; Oh & Morzuch, 2005; Smeral & Wüger, 2005).

1.2 Scope of research

From an economics perspective, tourism is a product that can be purchased and consumed. Therefore, the conventional theory of demand for consumer goods and services can be used to explain and forecast the consumption behaviour of tourists. The formalised theory of demand has bridged the gap between pure theory of consumer behaviour and its empirical implementations, and stimulated the development and application of econometric methodologies. Although a variety of econometric techniques have been applied to tourism demand analysis, some of the latest ones have been barely used in the tourism context.

Some of the traditional methodologies employed in previous tourism demand analyses have limitations. Traditional regression models ignore the phenomenon of the nonstationarity of time series. As a result, the spurious regression problem can occur, which biases empirical results. More seriously, this can lead to the development of misinformed policies. In the late 1980s, the cointegration concept (Engle & Granger, 1987), unit root testing and the application of the error-correction technique were introduced to address the spurious regression problem. However, these approaches are still limited because different tourism categories cannot be systematically considered in a single-equation econometric model. This study thus aims to overcome these limitations by introducing a theoretically sound and effective framework for tourism demand analysis, especially that of various kinds of demand.

The limitations of single-equation models are overcome by system-of-equations demand models as the latter include a group of equations (one for each consumer demand category) that are simultaneously estimated. This allows the examination of the ways in which consumers choose bundles of products to maximise their preference or utility given their budget constraints. Although a number of system modelling approaches are available, the almost ideal demand system (AIDS) model, which was introduced by Deaton and Muellbauer (1980), is one of the most commonly used methods for analysing consumer spending behaviour as it has considerable advantages over other system modelling approaches. The AIDS model can be readily adopted to test for two basic theoretical restrictions, homogeneity and symmetry, through linear restrictions on the parameters. The homogeneity restriction requires that a proportional change in all prices and expenditures does not affect the quantities purchased, while the symmetry restriction requires that the substitution matrix be symmetric, that is, if a one unit increase in the price of product A leads to a certain change in the level of expenditure on product B, then a one unit increase in the price of product B leads to the same change in the level of expenditure on product A.

Although the AIDS model has been widely used in the economics literature in the analysis of household demand for non-durable goods (particularly food categories), it has been barely used in tourism demand research. Most previous studies have employed only the basic linear AIDS model, including those of De Mello, Pack, and Sinclair (2002), Divisekera (2003), Han, Durbarry, and Sinclair (2006), O'Hagan and Harrison (1984), Papanikos and Sakellariou (1997), Papatheodorou (1999), Syriopoulos and Sinclair (1993), and White (1985). In those studies, the total tourist expenditures of a particular origin country were grouped into expenditures at different destinations and the interrelationships amongst these groups were simultaneously modelled.

The basic linear AIDS model can examine the long-run equilibrium of the tourism demand system, but not short-run tourist decision making. As a result, the reliability of the empirical findings is questionable. Improvement to the model specifications by including an error-correction mechanism to capture the short-run nature of consumer decision making has not yet benefited tourism studies, with these exceptions: Cortes-Jimenez, Durbarry, and Pulina (2009), Durbarry and Sinclair (2003), Li, Song, and Witt (2004, 2006), and Li, Wong, Song, and Witt (2006). Durbarry and Sinclair (2003) developed a short-run error-correction AIDS model to analyse the demand for tourism to Italy, Spain and the UK by French residents. The error-correction AIDS model employed in their study, however, took a reduced form, as all of the short-run explanatory variables were omitted due to their statistical insignificance. Cortes-Jimenez et al. (2009) employed the error-correction AIDS model to analyse the outbound Italian tourism demand for four European countries: France, Germany, Spain and the UK. Li et al. (2004) also employed the error-correction AIDS model to analyse the demand for tourism in a number of Western European countries by UK residents. Li, Song, and Witt (2006) and Li, Wong, Song, and Witt (2006) combined the TVP technique with the error-correction AIDS model using the same dataset. These studies, however, focused on tourist expenditures in destinations but not tourism product categories.

Fujii, Khaled, and Mak (1985) investigated for the first time tourist expenditures on different consumer goods and services in a particular destination. They examined six broad categories of goods and services, including (1) food and drink, (2) lodging, (3) clothing, accessories and jewellery, (4) local transport, (5) recreation and entertainment and (6) other. The authors argued that such analysis is particularly important in assessing the effect of public policy on the pricing of goods and services at tourist destinations. The analysis of the interrelationships amongst the different kinds of demand sheds new light on identifying the comparative advantages of different sectors, such as retailing and lodging within the tourism industry. This study follows the same line of investigation to examine the allocation of tourist expenditure amongst various major tourism product categories, including shopping, hotel accommodation, meals outside hotels, and others, using the demand system model. Divisekera (2009a, 2009b) recently applied the basic AIDS model to Australian inbound and domestic tourist consumption analysis, respectively, for a number of tourism goods and services: food, accommodation, transportation, shopping and entertainment. The AIDS model adopted by Divisekera (2009a, 2009b) and Fujii et al. (1985), however, cannot reflect the short-run dynamics of the tourism demand system. This study thus fills this gap in the empirical research by introducing the error-correction AIDS model combined with the TVP technique to investigate the evolution of spending behaviour of tourists regarding different tourism goods and services in Hong Kong by residents from eight countries and regions.

The TVP technique is employed in this study to model tourist expenditure instead of constant-parameter estimation, which is commonly used in tourism studies. The TVP technique presents a significant development in econometrics (see, for example, Harvey, 1989), as it allows model parameters in the econometric models to vary over time, and hence the estimation of the evolution of tourist consumption behaviour (Song & Wong, 2003). According to Song and Wong (2003), changes in consumer habits over time correspond with those in income and price elasticities, and such changes can be captured through TVP estimation of the demand model. In the existing literature, most applications of the TVP technique to tourism demand modelling have been restricted to single-equation models (see, for example, Song & Witt, 2000; Song & Witt, 2003; Song & Wong, 2003; Song, Witt, & Jensen, 2003). Li, Song, and Witt (2006) and Li, Wong, Song, and Witt (2006) employed both the long-run TVP-AIDS and short-run homogenous error-correction TVP-AIDS models to analyse UK tourist expenditures in a number of destinations in Western Europe. The error-correction TVP-AIDS model employed in those two studies, however, did not take into account the symmetry restriction in the model specification. This study therefore also fills a gap in the theoretical research by applying for the first time a homogeneous-and-symmetrical error-correction TVP-AIDS model to tourism demand analysis. To the best of the author's knowledge, this approach has not yet been applied to consumer demand analysis in any other field either.

This study explores the allocation of tourism expenditure amongst different tourism goods and services (i.e., shopping, hotel accommodation and meals outside hotels) in Hong Kong by residents from eight origins, including Australia, mainland China, Japan, South Korea, Singapore, Taiwan, the United Kingdom (hereafter, UK) and the United States (hereafter, US). Therefore, the error-correction TVP-AIDS model is developed based on eight independent tourism demand systems. One of the main contributions of this research is the wide scope of the study compared to that of existing research. This study also fills a gap in the tourism literature by specifying homogeneity and symmetry restrictions in the error-correction TVP-AIDS model.

This study explores Hong Kong inbound tourism demand for the following two reasons. First, tourism has long played an important role in Hong Kong's economic development. It has been the second largest foreign currency earner since 1995, and the income generated by tourism has consistently been responsible for around 6% of Hong Kong's gross domestic product (GDP) over the last decade (Zhang, Wong, & Or, 2001). Sectors in Hong Kong, especially the retail, accommodation, catering, arts and entertainment segments, have either directly or indirectly benefited from international tourism in Hong Kong (Hiemstra & Wong, 2002). Second, although the tourism industry plays an ever-increasing role in the generation of wealth and employment in Hong Kong, it also faces critical challenges related to creating and maintaining a sustainable competitive advantage over other Asian destinations that are gaining in popularity, including mainland China, Singapore, Taiwan and Thailand. To develop effective tourism policies and strategies in response to these challenges, policy makers and tourism businesses in Hong Kong need to have accurate knowledge about the characteristics of its key source markets in relation to spending patterns and the determinants of these patterns.

1.3 Research objectives

As discussed in Section 1.2, this study is the first attempt to extend and apply a homogenous-and-symmetrical restricted error-correction TVP-AIDS model to tourism demand analysis. Using Hong Kong-related expenditure data, the author examines how tourists from different source markets allocate their tourism budget amongst different tourism product categories using the error-correction TVP-AIDS method. The few studies of the demand for different tourism goods and services using the system-of-equations demand approach include those of Divisekera (2009a, 2009b) and Fujii et al. (1985).

Below are the major objectives of this study.

(1) This study aims to model the expenditure allocation of tourists in Hong Kong amongst different categories of tourism goods and services including shopping, hotel accommodation, and meals outside hotels. The source markets include Australia, mainland China, Japan, South Korea, Singapore, Taiwan, the UK and the US, which together generated 82.4% of tourist arrivals to Hong Kong in 2008 (Hong Kong Tourism Board [HKTB], 2009). A series of AIDS models are estimated, starting with the basic long-run AIDS model. The error-correction term from the long-run AIDS model is then incorporated into the error-correction AIDS model to examine tourist spending behaviour in the short run. The TVP technique is applied to estimate both the long-run AIDS and short-run error-correction AIDS models to examine the time-varying behaviour of tourist expenditure.

(2) This study intends to quantify the effects of expenditure budget and price changes on the consumption behaviour of tourists from each source market by computing expenditure and own-price elasticities. This should provide a better understanding of tourist expenditure by origins and provide useful information for the formulation of pricing strategies on different tourism goods and services in Hong Kong.

(3) This study also seeks to calculate cross-price elasticity based on the eight system models to examine the substitutability or complementarity amongst the different categories of tourism goods and services. The findings could also shed light on the interrelationships between the categories of tourism goods and services and their characteristics.

(4) Based on the estimation for eight system-of-equations models, this study attempts to compare the impacts of changes in the expenditure budget (income) and price of tourism goods and services on tourism consumption amongst the eight source markets. This comparison is based on the calculated expenditure and price elasticities, and would enhance our understanding of the difference in the consumption behaviour of tourists from different origins.

(5) At the end, this study aims to recommend suitable tourism policies that could enhance Hong Kong's competitiveness as an international tourist destination. This would benefit the decision making of both the public and private sectors in Hong Kong.

1.4 Contributions of the study

This study applies long-run and short-run AIDS models in combination with the TVP technique to examine tourist expenditure allocation amongst different tourism product categories including shopping, hotel accommodation and meals outside hotels. The impacts of changes in expenditure budget (income) and price on the demand for the three categories of tourism goods and services are examined and compared. In total, eight inbound tourism source markets are examined, and for each market, a series of AIDS models are applied and estimated: basic long-run AIDS, short-run error-correction AIDS, long-run TVP-AIDS and short-run error-correction TVP-AIDS. The first two are constant-parameter models that examine average tourism consumption during the time span under consideration, and the latter two examine the evolution of tourism consumption over time. The theoretical and practical contributions of the study are discussed as follows.

1.4.1 Theoretical contributions

The econometric analysis of tourism demand is dominated by the single-equation approach. This approach, however, suffers from various theoretical and practical problems, which often lead to inaccurate results. The current study aims to overcome some of the basic limitations of the single-equation approach by employing a dynamic AIDS model, more specifically, the error-correction TVP-AIDS model, to investigate the evolution of the effects of various influencing factors on tourist expenditure in Hong Kong. This theoretically superior approach, which is advocated by Li, Song, and Witt (2006) and Li, Wong, Song, and Witt (2006), has never before been used in research into different categories of tourism goods and services. Hence, this study presents a first attempt to apply the error-correction TVP-AIDS model to expenditure allocation amongst a number of tourism goods and services. In addition, this study contributes to the literature by imposing homogeneity and symmetry through linear restrictions on the parameters of the error-correction TVP-AIDS model.

1.4.2 Practical contributions

This study introduces the application of the error-correction TVP-AIDS technique to the analysis of tourist expenditure on categorised tourism goods and services. In contrast to other econometric approaches, the abovementioned technique produces robust demand estimates and provides ample and reliable information for tourism decision makers in the public and private sectors. For example, based on the different consumption patterns that are identified through the estimation of the error-correction TVP-AIDS model, a diversified marketing strategy for different market segments could be developed, and based on the different price elasticity that is observed for each of the individual system models, a flexible pricing policy for different products could be adopted. The identification of a complementary effect between two different products would suggest the development of a joint marketing campaign by the two product suppliers. More importantly, with the application of the TVP technique, the evolution over time of tourist spending behaviour can be identified. This can help government policy makers and practitioners understand the dynamics of tourist consumption behaviour and hence formulate appropriate policies or marketing plans that take into consideration changes in tourist expenditure patterns.

1.5 Structure of the thesis

This thesis contains six chapters. Chapter 1 introduces the background, research scope, research objectives, potential contributions and limitations of this study.

Chapter 2 provides a detailed review of the research into tourism demand analysis, with an emphasis on tourism demand modelling and forecasting. Based on the review, research gaps are identified and the methodologies to be used are presented.

Chapter 3 presents respectively the basic long-run AIDS and short-run error-correction AIDS models. Time-varying parameters are incorporated into the model specifications to derive the long-run TVP-AIDS and short-run error-correction TVP-AIDS models. Formal tests for homogeneity and symmetry, which are two basic restrictions identified by consumer demand theory, are then discussed. The calculation of demand elasticity is also presented in the context of AIDS models. A pilot study is conducted using both the basic AIDS and error-correction AIDS models with the aggregate expenditure data; that is, the data are not disaggregated based on the different source markets. The empirical results reveal the impacts of price changes on the demand for the three categories of tourism goods and services. The expenditure and price elasticities are calculated and the practical implications of these elasticities are discussed.

Chapter 4 focuses on a descriptive analysis of the top eight source markets of Hong Kong's inbound tourism, which include Australia, mainland China, Japan, South Korea, Singapore, Japan, the UK and the US. The consumption patterns of tourists from these origins are analysed. The proxies of the dependent and independent variables in the AIDS framework in this study are then discussed. Finally, the preliminary root unit tests of these variables are conducted to derive the rationale for adopting the error-correction form of the AIDS models for the empirical study.

In Chapter 5, the constant-parameter AIDS models are estimated, including both the long-run AIDS and short-run error-correction AIDS models, for the eight source markets of Hong Kong's inbound tourism. The eight system models are analysed separately and the differences in spending behaviour amongst the tourists from the different markets are identified. The chapter concludes with a discussion of the economic implications.

Chapter 6 extends the study by combining the TVP approach with the AIDS models to examine tourist consumption from a time-varying perspective. The evolution of the expenditure and price elasticities in the time span under consideration is studied for each of the eight tourism systems. This is the first empirical application of theoretically restricted error-correction TVP-AIDS models to tourism demand analysis. The results provide both researchers and practitioners with a new angle from which to examine tourist consumption patterns over time.

Chapter 7 concludes the thesis and discusses potential research directions.

1.6 Chapter summary

Because of its significant contribution to regional and international economies, tourism has attracted considerable attention from both academics and practitioners. Tourism demand analysis has been a central focus in tourism research for some time. Accurate tourism demand modelling and forecasting can help tourism businesses to establish effective marketing and investment plans and the government to formulate appropriate policies. Many methodologies have been applied to tourism demand analysis, especially advanced econometric techniques.

In addition to single-equation models, system-of-equation ones are now being applied to tourism demand analysis. Amongst the latter, the AIDS model has a number of advantages over others; for example, it allows the allocation of and relationships amongst various tourism goods and services to be analysed and has more flexible functional forms. This study employs a series of AIDS models to analyse tourist expenditure in Hong Kong. This study is the first to apply the error-correction TVP-AIDS approach to the analysis of tourist consumption of categorised tourism goods and services, and its practical applications can help practitioners in the formulation of pricing and marketing strategies.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

Tourism demand analysis has long been an important area in tourism research, with the determinants of tourism demand of special interest. Over the past two decades, advanced econometric models have been applied in tourism modelling and forecasting research (Li, Song & Witt, 2005; Song & Li, 2008). Accompanying this is an extensive literature on quantitative tourism demand analysis. In this chapter, the main econometric models employed for tourism demand analysis are reviewed and their strengths and weaknesses are assessed. The literature review aims to identify existing research gaps and provide a rationale for the use of the system-of-equations demand models proposed in this research.

2.2 Tourism and tourism demand

Tourism has become a global phenomenon. Continuing economic growth and rising income levels worldwide coupled with the decrease in travel costs as a result of the rapid development of commercial airlines (including low-cost airlines in recent decades) have made tourism becoming very popular not only in developed but also in developing countries. In addition, the increase in the amount of leisure time, such as the adjustment of China's six-day working week to a five-day one in the 1990s, has resulted in increased opportunities for people to engage in tourism. Although many tourism activities are well known, defining tourism is still a complex issue because of the diversity in its meaning and scope. Tourism is studied in a variety of disciplines, including geography, economics, business, sociology and psychology, amongst others, and involves different stakeholders, such as national governments, business and social communities, which have their own interests in tourism. Tourism covers a number of purposes, including recreation, shopping, holiday, business trips, and visiting relatives/friends. In terms of the experience of tourism, a number of aspects are covered under the tourism umbrella including transportation, accommodations, food service, retail shopping, entertainment, travel agents and so on. Tourism was first defined in the 1930s as people being away from home for any period of less than a year and spending money in the place where they visit without earning it there (Ogilvie, 1933, as cited in Morley, 1990). Since then, attempts to define tourism have fallen into four broad subject areas, and include economic, technical and statistical, holistic or systems, and commonality-based approaches (McKercher, 2006). Tribe (2006) suggested that theorised and phenomenal worlds of tourism comprise five factors, namely, persons, rules, position, ends and ideology. Tribe (2006) also observed that although researchers have established many truths about tourism, the whole truth is left untold, resulting in gaps, silences and misconstructions. Nevertheless, a commonly accepted definition, which was given by the UNWTO (2004), is:

"Tourism comprises the activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited."

The UNWTO (2004) also established three criteria of a tourism activity:

"It involves a displacement outside the usual environment"; "The travel must occur for any purpose different from being remunerated from within the place visited: the previous limits, where tourism was restricted to recreation and visiting family and friends are now expanded to include a vast array of purposes"; and "Only a maximal duration is mentioned, not a minimal. Tourism displacement can be with or without an overnight stay."

Despite various crises such as wars, regional epidemics and global financial crisis, some of which have substantially affected tourist flows, international tourism has achieved an enormous and sustained growth rate over the past few decades. Chu (2004) noted that international tourism was second only to oil as the largest item of world trade. Williams (1998, p.2) stated that tourism had grown to the point that it was commonly recognised as the world's largest industry. According to the UNWTO (2009), international tourist arrivals rose from 25 million in 1950 to 922 million in 2008, with an average annual growth rate of around 6.4%. The income generated by these arrivals had an even greater growth rate (11.1%) during the same period, reaching around USD 944 billion in 2008. UNWTO states that the current business volume of tourism equals or surpasses that of oil exports, food products or automobiles.

The main driving force behind the rapid development of tourism is the impressive rate of global economic growth, which has increased the disposable income level worldwide. People are able to spend a greater proportion of their income on tourism activities. The increase in holiday entitlement and the shortening of the work week in many countries have also encouraged tourism development, while improvements in transportation have made international tourism feasible and convenient. The invention of jet planes in the 1950s and subsequent rapid growth of commercial airlines have resulted in greater cross-continent travel. In addition, the fast expansion of the Internet has facilitated tourism distribution channels and thus increased the levels of tourism activity.

With the growing importance of tourism to many national economies, it has attracted extensive interest amongst the academic, business and government sectors. Tourism demand is an especially popular topic in the literature.

Tourism demand for a particular destination was defined by Song and Witt (2000, p.2) as "the quantity of the tourism product (i.e., a combination of tourism goods and services) that consumers are willing to purchase during a specified period under a given set of conditions." They stated that the conditions related to the quantity of tourism demanded include "tourism prices for the destination (tourists' living costs in the destination and travel costs to the destination), the availability of and tourism prices for competing (substitute) destinations, potential consumers' incomes, advertising expenditure, tastes of consumers in the origin (generating) countries, and other social, cultural, geographic and political factors." (Song & Witt, 2000, p.2)

Advances in econometric methodologies over the last three decades have led to the mushrooming of the number of published empirical studies of tourism demand modelling and forecasting, with more than 150 articles published since 2000 (Li et al., 2005; Song & Li, 2008). A number of modern econometric methodologies have been employed in tourism demand analysis. Research has focused on two main issues. One is the generation of more accurate forecasts of tourism demand. In these studies, a number of alternative forecasting models are estimated and their performance is compared and evaluated according to various forecasting error measures. The second issue concerns the relationship between tourism demand and its influencing factors by looking at the specific model established.

Accurate tourism demand forecasts can benefit a variety of tourism stakeholders. Tourism involves a large number of goods and services from different sectors. Tourism demand is the foundation on which all tourism and tourism-related business decisions depend. Consequently, accurate demand forecasts are of interest to all tourism and tourism-related businesses, including hotels, restaurants, shops, ferry operators, tour operators, casinos and recreation facilities, as tourism demand affects their pricing and production strategies. Accurate forecasts can prevent losses incurred due to unfilled airline seats, ferry cabins and hotel rooms. In addition, accurate tourism demand forecasts contribute to decision making in terms of destination management, particularly for those destinations where tourism is one of the main sources of foreign exchange. Tourism demand modelling can help business decision makers understand the key determinants of demand for their tourism products and services so that they can formulate and implement the most effective tourism business strategies (Song & Turner, 2006).

Medium- and long-term tourism demand forecasts are needed for investment decisions in both the public and private sectors. For example, if a high rate of tourism growth is predicted for a destination, then the hotel and catering providers in the destination may invest in new outlets and the destination government may inject money in the construction of new infrastructure such as new railways, airports and public museums. Because long construction periods and great financial input are needed for such work, it is very important to produce highly accurate medium- and long-term tourism demand forecasts. This is particularly important amongst destinations where tourism is the dominant sector within the national economy, as forecasting failure can lead to a vast amount of money being wasted and the inability to satisfy the needs of potential tourists. In addition, the problems generated by the gap between the supply of and demand for these infrastructures cannot be easily solved in a relatively short period. Stakeholders in these destinations could, therefore, suffer economically, and related industries would also be weakened. Accurate tourism demand forecasts, however, can provide valuable guidance for the planning and implementing of infrastructure projects, which can maximise the benefits to stakeholders and contribute to the future development of the tourism industry within the destination.

2.3 Measures and determinants of tourism demand

As discussed, tourism demand for a particular destination refers to the quantity of tourism goods and services that consumers are willing to purchase during a specified period under a given set of conditions. In practice, the quantity of tourism products is likely to be influenced by a number of determining variables. Song and Witt (2000, p.2) documented that tourism quantity demanded is related to tourism prices in the destination, the availability and tourism prices of the substitute destinations, consumer income, advertising expenditure, consumer preferences, expectations and habit persistence, and other social, cultural, geographic and political factors. The population size of the origin and the exchange rates between the origin and destination have also been proposed to be factors influencing the quantity of tourism demand (Witt & Witt, 1995).

The effective use of such variables in tourism demand modelling depends on developing proper measures of them. For example, consumer income is usually measured by the GDP of the origin country or region (see, for example, Song & Witt, 2003; Song & Witt, 2006; Wong, Song, Witt, & Wu, 2007). Other measures such as real personal disposable income (PDI), national disposable income (NDI), gross national product (GNP) and gross national income (GNI) have also been used in empirical studies of tourism demand (Lim, 1997). However, accurate measures of these determinants are difficult to obtain because of data unavailability. For example, although marketing expenditure is believed to be an important determinant of tourism demand, it is seldom included in the modelling process because of the unavailability of data (Witt & Witt, 1995).

Furthermore, in reality, not all variables can be included in a single model as the additional explanatory variables can result in the lowering of the degrees of freedom for model estimation. To sum up, researchers have attempted to find the best proxies for tourism demand and its determinants to generate the "best" models, but this has proven to be very difficult (Song & Witt, 2000, p.3).

2.3.1 Measures of tourism demand

This study follows the UNWTO's definition of tourism demand, which describes visitors as all types of travellers engaged in tourism and tourists as overnight visitors. Thus, "visitors" encompass a wide range of people. That is, a visitor can be either a same-day visitor or a tourist. The number of visitor arrivals from an origin country or region to a destination reflects the quantity of tourism demand with respect to the population size of the origin. The analysis of tourism demand where visitor arrivals are employed as a proxy of tourism demand can help both businesses and government regarding staffing, planning and marketing. For example, based on the analysis of visitor arrivals, tourism businesses could enhance their marketing efforts if large numbers of unfilled coach seats, unused hire cars or unoccupied hotel rooms are forecast, or appropriate numbers of immigration counters could be opened, which would optimise the use of both the material and human resources of the immigration department. Hence, visitor arrivals are an important proxy for tourism demand, and numerous studies have used this variable to measure international tourism demand.

Tourist expenditure from an origin in the destination is another important proxy of tourism demand. The UNWTO argued that statistics on tourist expenditure are perhaps the "most important indicator required by policy makers, planning officials, marketers and researchers for monitoring and assessing the impact of tourism on the national economy." Many studies have used tourist expenditures to model and forecast tourism demand (see, for example, Akal, 2004; Ashworth & Johnson, 1990; Jensen, 1998; Payne & Mervar, 2002; Uysal & Roubi, 1999).

Other variables used to measure tourism demand include tourist nights spent in a destination by residents from a particular origin (Kim & Uysal, 1998), and the market share of the particular origin in terms of visitors or expenditure when the objective is to forecast the distribution of tourism demand (see Witt & Witt, 1995).

2.3.2 Determinants of tourism demand

In tourism demand analysis, the determinants of tourism demand and their measures are key issues. Both theoretical and empirical studies have paid considerable attention to the selection and measurement of determinants of tourism demand, and their suitability in tourism demand analysis has been tested empirically (Li et al., 2005). Some variables are widely accepted by both researchers and practitioners as determinants of tourism demand, including consumer income, own price of tourism goods and services, substitute prices of tourism products, transportation costs, marketing expenditure, seasonality factors and one-off event effects, amongst others. (see, for example, Li et al., 2005; Song

& Li, 2008). The functional relationship between the demand for tourism in a destination and its determinants can be written as

$$Q_{ij} = f\left(Y_j, P_i, P_s, T, M, D, \varepsilon\right), \quad (2.1)$$

where Q_{ij} is the quantity of tourism demand in destination i by tourists from origin j, and

Y_j	is the income level in origin j;
P_i	is the own price of tourism for destination i;
P_s	is the substitute price of tourism for the origin country j;
T	is the transportation cost of tourists from origin j to destination i;
M	is the marketing expenditure by destination i;
D	is a vector of dummy variables including seasonal and one-off event dummies; and
ε	is the disturbance term that captures the influence of all other factors on the quantity of tourism demand in destination i by the tourists from origin j.

Consumer income Y_j has been found to be one of the most important influencing variables of the demand for international tourism. Both economic theory and empirical findings support the positive effect of this variable on tourism demand. Existing studies employ a range of alternative consumer income measures. Amongst them, real GDP is commonly employed by international tourism demand studies. Song and Witt (2000, p.4) stated that when addressing holiday demand or visiting friends and relatives (VFRs), the appropriate measure is personal disposable income or private consumption, whereas when studying business tourism demand, the appropriate measure is a more general income variable (such as national income or GDP), or aggregate imports/exports between the origin and destination countries, which reflects business activity. Based on the literature, Song and Witt (2006) also concluded that real personal disposable income is the best proxy for tourism demand when investigating holiday or VFR travel. GDP, GNP and GNI in real terms are more suitable for the empirical study of business travel or the combination of business and leisure travel when these two types of data are inseparable. Other possible proxies are real private consumption expenditure (Song, Witt, & Jensen, 2003) and per capita national income (Gunadhi & Boey, 1986).

Own price of tourism P_i is another important determinant of tourism demand. According to economic theory, the price change of a consumer good has an inverse effect on the demand for this good; hence, own price of tourism is expected to have a negative impact on tourism demand. The measure of own price includes the cost of travelling to the destination and the cost incurred when staying in the destination, such as shopping, eating, hotel bills, and so forth. The consumer price index (CPI) in a destination is usually employed as a proxy for the own price of tourism in that destination. The justification for this can be found in Witt and Witt (1995). In practice, the own price variable P_i is normally defined by the relative CPIs between the destination and the origin adjusted by the relevant exchange rates (Song, Wong, & Chon, 2003), and can be written as

$$P_i = \frac{CPI_i / EX_i}{CPI_j / EX_j}, \tag{2.2}$$

where CPI_i and CPI_j are the consumer price indices of the destination and origin, respectively, and EX_i and EX_j are the counterpart exchange rates, respectively. The implicit assumption behind employing CPI as the proxy is that the price of tourism goods and services tends to change in the same direction and in proportion with the overall consumer price in the destination (Witt &Witt, 1995). However, one should not ignore the risk of using CPI, as in reality, the price changes of tourism goods and services may not necessarily coincide with it.

The price of substitute destination P_s also influences international tourism demand. A tourist may consider a number of competing destinations before choosing one. Consequently, tourism costs in competing destinations are likely to influence destination choice. For this reason, the substitute price of tourism in the competing destinations should be included in the tourism demand model. In practice, as more than one competing destination usually exists for a given destination, a weighted average price index for a set of alternative destinations should be used as the substitute price. The substitute price variable P_s is given as follows (Song, Wong, & Chon, 2003):

$$P_s = \sum_{i=1}^{n} \frac{CPI_i}{EX_i} w_i , \tag{2.3}$$

where i = 1, 2, …, n denotes the n substitute destinations, and w_i is the share of tourists travelling to the ith substitute destination amongst all tourists to these n destinations. This can be calculated from $w_i = \frac{VA_i}{\sum_{i=1}^{n} VA_i}$, in which VA_i is the number of visitor arrivals from the origin to the substitute destination i . As the number of visitors arriving at these destinations tends to change over time, w_i is not a fixed value but also varies over time.

Tourism goods and services, unlike many other imports, have to be bought at the destination. Consequently, tourists (apart from those who travel on package tours) have to pay for their travel to the destination. For this reason, the transportation cost T should be part of the total tourism consumption expenditure. Transportation cost is thus another important determinant in explaining international tourism demand. However, selecting suitable measure of transportation costs for tourism demand analysis is difficult, because of the varying modes of travel to a particular destination and the unavailability of data on aggregate travel costs.

Marketing expenditure M also influences international tourism demand. Both national tourism organisations and private businesses such as travel agents and tour operators in the destination engage in promotional activities to persuade potential tourists to visit the destination. The forms of marketing include media advertising, public relations, trade shows and exhibitions. Song and Witt (2000) stated that the promotional activities of national tourism organisations are destination specific and are therefore more likely to influence tourism flows to the destination concerned. However, this variable seldom appears in tourism demand studies because of data unavailability.

When monthly or quarterly data are used, seasonal characteristics may influence the modelling process. The HEGY technique developed by Hylleberg, Engle, Granger, and Yoo (1990) is a common method to test for seasonality in the time series variables used for tourism demand modelling and forecasting. Seasonal dummies are employed to take account seasonal variations in tourism demand in the modelling process. A detailed explanation of the modelling of seasonality in tourism demand is given in Section 2.4.7.

One-off events also affect tourism demand. For example, the oil crises in 1973 and 1979 reduced international tourism demand during these years because of their negative impact on travel costs. The global financial crises of 2008 and 2009 also negatively affected tourism demand in many destinations. The severe acute respiratory syndrome (SARS) epidemic in 2003 greatly reduced the numbers of international visitors to Hong Kong in that year. The epidemic started in the second quarter of 2003 and visitor arrivals decreased drastically from 4.3 million in the first quarter to 1.6 million in the second quarter of that year, with a decline of 61.7%. Once the epidemic was over, visitor arrivals bounced back to 4.4 million in the third quarter of 2003. In such cases, one-off event dummies are employed to take into account the impact of the events. Normally, an event dummy variable takes a value of one when the event happens and zero otherwise. For example, Wong et al. (2007) included a dummy variable accounting for the 9/11 incident in 2001 in their model of tourism demand in Hong Kong and the results showed that this event had a significantly negative effect on the demand for Hong Kong tourism by visitors from the US.

The time lags of both independent and dependent variables are often included in demand models to take into consideration the dynamic effect of the variables on tourism demand. Modern econometric methodologies consider dynamic effects by including lagged variables in the specification of the demand model. A good example is the use of the general-to-specific methodology in tourism demand modelling (Song & Witt, 2003; Song, Witt, & Li, 2003).

The exchange rate of the destination is usually considered to have a negative impact on the demand for this destination. The majority of studies of international tourism demand have found that the exchange rate plays an important role in determining destination choice either as a separate explanatory variable or as an adjustment factor in the own and cross price indices. Such studies include, amongst others, those of Kulendran and Witt (2001), Li et al. (2004), Li, Song, and Witt (2006), Li, Wong, Song, and Witt (2006), Song and Witt (2003), Song, Romilly, and Liu (2000), and Song, Witt and Li (2003). A small number of researchers have found no effect of exchange rate on tourism demand (e.g., Lee, Var, & Blaine, 1996; Loeb, 1982; Vanegas & Croes, 2000).

Witt and Witt (1995) argued that the population of the origin affects demand for tourism in the destination. However, this variable has not often been used in demand modelling for the following two reasons. First, population tends to be highly correlated with income. Hence, multicollinearity can occur. Second, population is relatively stable and does not change much over time, and the inclusion of this variable normally does not add any explanatory power of the demand model.

2.4 Tourism demand analysis

Tourism demand studies have advanced significantly over the last two decades. Researchers and practitioners have analysed tourism demand from different perspectives, using different methodologies. Tourism demand analysis can be divided into two broad groups: qualitative and quantitative. Some researchers use a combination of these two approaches to exploit their respective advantages and draw robust conclusions.

2.4.1 Qualitative and quantitative methods

The use of qualitative research methods in the social sciences began to gain recognition in the 1970s. Qualitative research is undertaken to gain an in-depth understanding of different kinds of human behaviour and the reasons behind them. In contrast to quantitative techniques, which reply on large amounts of data, qualitative methods rely on a small sample, to gather rich information about people's experiences, motivations and behaviour. The application of qualitative methods in tourism demand studies includes the use of the Delphi method (e.g., English & Kearnan, 1976; Kibedi, 1981; Liu, 1988), scenario projection method (Schwaninger, 1989), and consensus approach (Luiz & Witt, 1995).

The use of quantitative methods in tourism demand modelling and forecasting has also attracted considerable interest. Song, Wong, and Chon (2003) divided the quantitative approaches used in tourism demand analysis into two broad groups: non-causal and causal modelling methods. The former focuses on modelling and forecasting based on the historic trends in tourism demand without taking into consideration other potential influencing factors. The univariate time series methods belong to this group. Causal methods, in contrast, usually take into account in the modelling process those factors that could potentially affect demand for tourism. Widely used techniques in this group are econometric approaches. Advances in econometric techniques over the past two decades have led to their widespread use in tourism demand analysis.

Quantitative methods, unlike their qualitative counterparts, usually require a large amount of numeric data for statistical analysis. They are used to address "what if" issues, which makes them very different from qualitative methods. A detailed explanation of the differences between the two methods is given in Table 2.1. The two techniques have distinct advantages and weaknesses and cannot be replaced by the other. Researchers in a variety of research areas are increasingly interested in combining these two techniques to gain a comprehensive understanding of the topic under study.

Table 2.1 Comparison between qualitative and quantitative methods

Qualitative methods	Quantitative methods
Small focused sample	Large sample
A variety of data formats, including text, sound, and image	Quantifiable data only
More exploratory	More conclusive
Rich data including people's experiences and motivations	Often impersonal
Statistical tests are not required	Statistical analysis is used to draw conclusions
Research findings cannot be generalised	Research findings can be generalised if sample is large enough
Measures of attitudes and opinions often require that judgements be made by the researcher, which opens up the issue of researcher bias	Attitudes and opinions are measured by scoring and rating scales

Quantitative techniques have long been used in tourism demand analysis. Since the 1980s, advanced econometric techniques have been employed for tourism demand modelling and forecasting, and are introduced in the following sections.

2.4.2 Different tourism demand modelling methods

Tourism demand modelling methods can be categorised into different groups based on various features (see Figure 2.1). Most empirical studies of tourism demand are based on single-equation models, which suffer from a number of limitations. Eadington and Redman (1991) noted that these approaches cannot be used to analyse the interdependence amongst budget allocations to different consumer goods and services. In addition, they cannot be used to test the homogeneity and symmetry hypotheses associated with demand theory. The system-of-equations approach proposed by Stone (1954), however, overcomes these limitations, as it involves a group of equations (one for each consumer product) that are simultaneously estimated; hence, system-of-equations models have been applied in tourism demand analysis (e.g., Cortes-Jimenez et al., 2009; De Mello et al., 2002; Divisekera, 2003; Durbarry & Sinclair, 2003; Han et al., 2006; Li, Song, & Witt, 2006).

Existing tourism demand modelling methods can also be grouped into constant-parameter and TVP models. In traditional regression models, the estimated coefficients are assumed to be constant during the whole sample period. However, the data generating process may change over time because of changes in consumer behaviour and economic conditions (Song & Witt, 2000, p.124). As a result, the impact of the independent variables on tourism demand may vary. The constant-parameter model cannot incorporate these changes, whereas the TVP technique can. Therefore, the latter has increasingly been used in tourism studies in recent years (e.g., Li, Song, & Witt, 2006; Song & Wong, 2003).

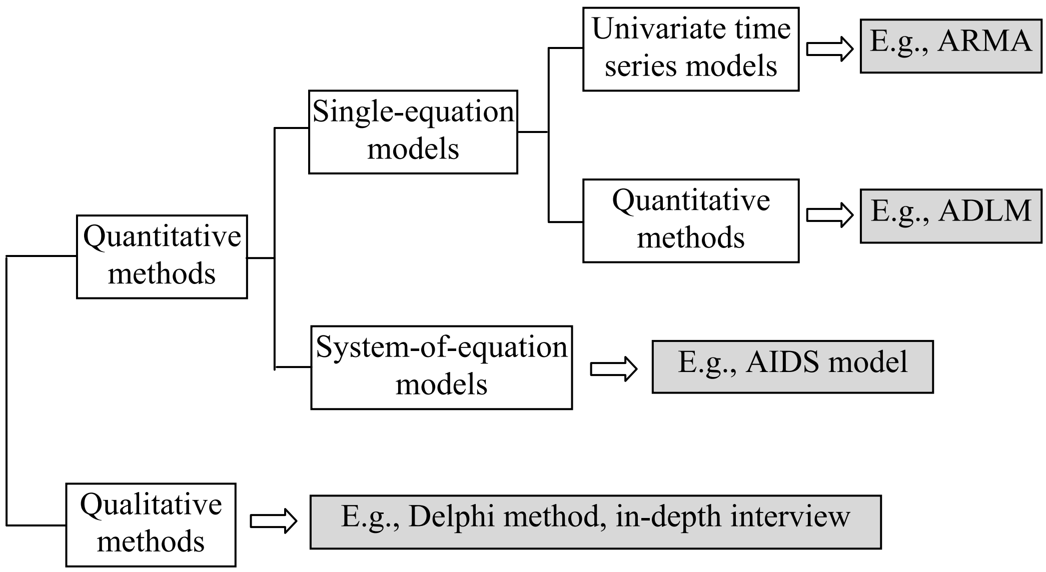

Figure 2.1 Classification of tourism demand models

2.4.3 Univariate time series models

Univariate time series techniques are used to forecast tourism demand based only on historic trends. In past empirical studies, the naïve model, exponential smoothing method, autoregressive (AR) model and Box-Jenkins procedure (Box & Jenkins, 1970) are the most commonly used univariate time series models.

The naïve (no-change) model is the simplest forecasting model. It treats the observation at period $(t-1)$ as the forecast of period t. When seasonal data are examined, the forecast at period t is the observation at period $(t-4)$ for quarterly data and that at period $(t-12)$ for monthly data. Another naïve model, constant-growth-rate model, is also widely applied, which treats the growth rate (or seasonal growth rate for seasonal data) at period $(t-1)$ (at period $(t-4)$ for quarterly data and $(t-12)$ for monthly data) as the forecast of the growth rate (or seasonal growth rate) at period t. Researchers often use the results of the naïve model as a benchmark for forecasting tourism demand.

The moving average (MA) model is a simple forecasting method in which forecasts are represented as the simple average of the latest n observations. The expression is specified as:

$$\hat{y}_t = \frac{1}{n}\sum_{i=t-n}^{t-1} y_i , \qquad (2.4)$$

where $\hat{y}_t$ is a forecast of tourism demand at time t, y_i stands for the actual observations, t denotes time and n represents the rank of the moving average.

During implementation, higher weights can be assigned to recent observations and lower weights to distant observations when considering the rationality.

The exponential smoothing approach, another time series method, incorporates the exponential weighted average technique to smooth the studied series. Widely used models of this approach include the single and double exponential smoothing models and the Holter-Winter (Winters, 1960) no seasonal, additive and multiplicative exponential smoothing models. The Holter-Winter mltiplicative model is represented as follows:

$$\hat{y}_{t+k} = (\alpha_t + b_t k)c_{t-s+k} \text{ ,} \tag{2.5}$$

where $\hat{y}_{t+k}$ is the forecast at the time (t+k), α_t stands for the intercept, b_t denotes the slope and c_t represents the seasonal factor. These three parameters are respectively specified as follows:

$$a_t = \alpha \frac{y_t}{c_{t-s}} + (1-\alpha)(a_{t-1} + b_{t-1}) \tag{2.6}$$

$$b_t = \beta(a_t - a_{t-1}) + (1-\beta)b_{t-1} \tag{2.7}$$

$$c_t = \gamma \frac{y_t}{a_t} + (1-\gamma)c_{t-s} \quad . \tag{2.8}$$

α, β and γ are three smoothing coefficients that satisfy the condition $0 \le \alpha, \beta, \gamma \le 1$, whereas s is the length of the seasonal cycle with s = 12 for monthly data and s = 4 for quarterly data. The equations listed above demonstrate that these three parameters are obtained from smoothing. The seasonal parameter makes this method suitable for forecasting series that include both time trends and seasonal variations. Because of the characteristics of the smoothing technique, this approach is more suitable when only a few observations are available.

The autoregressive (AR) model treats dependent variables as a function of its lagged values and random error, and is a special case of the autoregressive moving average (ARMA) model. More details of the AR approach can be found below in the detailed discussion of the ARMA model.

The ARMA model includes the AR, MA and ARMA models. The general model takes the following form:

$$y_t = \sum_{i=1}^{p} \phi_i y_{t-i} + u_t + \sum_{i=1}^{q} \theta_i u_{t-i} \tag{2.9}$$

The first part of the right-hand side of the equation is an autoregressive term with a lag length *p*. The second part denotes the moving average term with the lag lengths q, ϕ_i and θ_i as the coefficients to be estimated. The AR(*p*) and MA(*q*) models are both specific forms of the ARMA model with $q = 0$ in the former and $p = 0$ in the latter.

The autoregressive integrated moving average (ARIMA) and seasonal ARIMA (SARIMA) models are generalisations of the ARMA model. They are respectively used for series that have only one unit root or one unit root plus a seasonal trend. As tourism demand series are usually non-stationary and one unit root can be found in most series, the ARIMA model has proven to be a reliable approach in modelling and forecasting monthly or quarterly tourism demand, as demonstrated by Goh and Law (2002).

Time series techniques have two obvious advantages: no significant obstacle to data collection exists, and they are easy to understand and use. However, they cannot be used to explore the impact of other factors on tourism demand. Therefore, price elasticity cannot be computed.

Recent empirical studies have improved time series approaches by including explanatory variables in univariate time series models (e.g., Akal, 2004; Athanasopoulos & Hyndman, 2008; Smeral & Wüger, 2005). Akal (2004) incorporated explanatory variables into the ARMA model to forecast international tourism revenues for Turkey, and the results showed that this model outperformed simple econometric techniques. In an empirical study of Australian domestic tourism, Athanasopoulos and Hyndman (2008) found that the exponential smoothing model combined with exogenous variables captured the time series dynamics well and outperformed the regression models. Smeral and Wüger (2005) also found that more accurate forecasts could be generated when more explanatory variables were included in the forecasting model.

2.4.4 Multivariate econometric models

In contrast to univariate time series techniques, multivariate econometric models take into consideration influencing factors when modelling and forecasting tourism demand. As discussed, the factors that affect tourism demand include own price of tourism goods and services, substitute prices, tourist income, transportation costs, marketing expenditure, seasonality and one-off events.

Policy makers in tourist destinations, especially those where tourism is the major source of foreign exchange, have made great efforts to understand the key determinants of demand for their tourism products and services to formulate and implement the most effective policies and strategies. Consequently, many econometric studies of tourism demand have been conducted, which have made significant contributions to the tourism demand literature (Li et al., 2005; Song & Li, 2008; Witt & Witt, 1995).

During the past two decades, econometric techniques have advanced significantly. These new developments have played an important role in the understanding of tourist consumption behaviour and demand for tourism goods and services. Li et al. (2005) reviewed 84 studies of tourism demand published since the 1990s and found that the majority of them used econometric methods. For example, Song and Witt employed the general-to-specific approach (ADLM) to forecast inbound tourism to South Korea from four major origin countries (2003), and the vector autoregressive (VAR) model to generate ex ante forecasts of tourist flows to Macau from eight major origin countries and regions (2006). This section briefly introduces the main multivariate econometric approaches used in tourism demand analysis.

2.4.4.1 Traditional static regression model

The traditional static regression model usually employs the ordinary least square (OLS) method to estimate the relationship between the independent and dependent variables. However, lagged variables are normally not included in the model. Dritsakis and Athanasiadis (2000) applied a static regression model to study factors that influence tourism demand in Greece.

The application of this technique in modelling and forecasting tourism demand has been criticised by Engle and Granger (1987), who suggested that traditional OLS estimation may lead to the spurious regression problem when the considered variables are non-stationary. In such cases, the results of the statistical tests based on regression models with non-stationary variables are unreliable and even misleading; therefore, the inferences drawn from these models tend to be suspect. The incorporation of the cointegration technique into the model in the late 1980s effectively prevented the spurious regression problem.

Series variables that are considered in tourism demand analysis, including tourist expenditure, visitor arrivals, consumer income and exchange rate, are usually non-stationary. The predominant use of traditional regression approaches in tourism forecasting studies started to change from the mid-1990s, as more researchers began to apply modern econometric techniques to model and forecast tourism demand.

2.4.4.2 Error-correction model

Engle and Granger (1987) stated that in an economic system, if the linear combination of two non-stationary variables is a stationary series, then a cointegration relationship exists between these two variables. In the case where more than two variables are involved, multiple cointegrating relationships can be identified using the same principle. Engle and Granger (1987) proved that if the variables under consideration are cointegrated, then a corresponding error-correction model can be established that takes into account short-run dynamics. Thus, long-run cointegrating and short-run error-correction models can eliminate the spurious regression problem associated with traditional static models. Both types of models have been widely applied in various tourism contexts (e.g., Kulendran & Witt, 2003b; Lim & McAleer, 2001; Song et al, 2000).

2.4.4.3 Autoregressive distributed lag model (ADLM)

Known as the general-to-specific approach, the ADLM is a dynamic econometric modelling technique that was first proposed by Hendry (1986). This method involves a general functional form that contains both the current and lagged values of the variables. Stepwise reduction is then applied for the estimation of the model. The following equation represents the general ADLM:

$$y_t = \alpha + \sum_{i=1}^{p} \phi_i y_{t-i} + \sum_{i=0}^{q} \beta_i X_{t-i} + \varepsilon_t , \qquad (2.10)$$

where y_t denotes tourism demand, X_t denotes a vector of exogenous independent variables with a lag length of q, and α, ϕ_i and β_i are the coefficients or coefficient vectors requiring estimation.

Before the ADLM was introduced, a large number of studies of tourism demand modelling and forecasting used the specific-to-general approach (Song & Witt, 2003). In this approach, a relatively simple model based on demand theory must satisfy criteria including a high R-squared value, statistically significant variables and a lack of autocorrelation and heteroscedasticity in the error term. If some of these criteria are not satisfied, then the model is re-estimated by including new explanatory variables in a stepwise fashion, changing the functional form or using a different estimation method. This process continues until all of the above criteria are satisfied.

Song and Witt (2003) stated that the specific-to-general modelling process has a number of problems. First, this approach tends to result in a complicated final model specification that involves too many variables, and different researchers may obtain different models with the same dataset. Second, the dynamic characteristic of demand behaviour cannot be captured by the model, which can lead to poor forecasting performance. Third, the spurious regression problem may exist, and thus the final model cannot reflect the real relationship between the dependent and independent variables.

However, the general-to-specific modelling approach, which was originally proposed by Davidson, Hendry, Saba, and Yeo (1978) and Hendry (1986), can overcome the limitations associated with the specific-to-general approach, as it has a clear model specification, estimation and selection strategy (Song & Witt, 2003).

In recent years, the general-to-specific modelling approach has frequently been applied to tourism demand forecasting (e.g., Song & Witt, 2003; Song, Witt, & Jensen, 2003; Song, Witt, & Li, 2003). The modelling process of this approach follows four steps (Song & Witt, 2003, p.68): first, a general ADLM is specified based on economic theory and the properties of the data; second, restriction tests are carried out based on the assumptions imposed by specific models on the coefficients in the general ADLM; third, diagnostic testing is performed on the specific models that are found to be superior to the general ADLM according to the restriction tests; and finally, the best models for policy evaluation and forecasting purposes are selected based on both the diagnostic tests and consistency of the models with economic theory.

By following these steps, the final specific model should be simple in structure and possess desirable statistical properties, such as the absence of autocorrelation, heteroscedasticity, multicolinearity and non-normality. In addition, all variables in the final model should be statistically significant.

2.4.4.4 Vector autoregressive (VAR) model

The econometric models previously discussed are limited to the case where tourism demand y_t is determined by a set of independent variables, x_1, x_2,…, x_t. These independent variables are assumed to be exogenous and not to be influenced by the dependent variable (tourism demand). Nonetheless, this assumption does not always hold in economics. The VAR model (Sim, 1980) addresses this problem. It treats all variables including tourism demand and its determinants as endogenous, except deterministic variables such as trend, intercept and dummy variables. Endogenous variables are those that are influenced by other variables within the economic system. However, the traditional regression model, the error-correction model and the ADLM assume that all of the variables are exogenous except tourism demand. Lagged variables are included in the VAR model to capture the dynamic nature of the dataset. The lag length must be chosen carefully as too many lags results in over-parameterisation whereas too few lags results in a loss of forecasting information. The general criteria for the determination of the lag length are the Akaike information criteria (AIC) and Schwarz information criterion (SIC). The VAR model has been widely used in macroeconomic modelling and forecasting since it was first introduced in 1980. Song and Witt (2006) and Witt et al. (2003) successfully employed this technique to generate employment and tourism flows, while De Mello and Nell (2005) applied it to examine the demand for French, Spanish and Portuguese tourism by UK residents.

One of the advantages of the VAR model is that impulse response analysis can be carried out for policy simulation. This kind of analysis focuses on the impact of unitary changes of the error terms (shocks) on the dependent variables, which enables policy development and evaluation. Song and Witt (2006) discussed the details of impulse response analysis.

Although multivariate econometric models have been widely used by government and tourism-related businesses in strategy and policy formulation, they cannot be used to analyse the interdependence amongst budget allocations to different consumer goods and services by tourists (Eadington & Redman, 1991). For example, a decrease in hotel room rates may stimulate tourist spending on shopping and entertainment. However, the multivariate approach cannot adequately capture the influence of the price change of one tourism product (or in a particular destination) on the demand for other tourism products (or destinations) because it lacks an explicit foundation in consumer demand theory. Therefore, the demand elasticity, especially the cross-price elasticity, that is derived using the multivariate econometric approach, does not reflect real substitution effects, and consequently may lead to unreliable policy recommendations. Another limitation of this approach is that the tests for homogeneity and symmetry according to demand theory cannot be adequately performed.

2.4.5 System-of-equations demand models

System-of-equations demand models belong to the multivariate econometric group, but have some unique features. For example, they are explicitly derived based on consumer demand theory. Therefore, the theoretical assumptions can usually be formally tested and imposed. Such models are also capable of analysing the interdependence of expenditures on a bundle of tourism products by tourists, and the cross-elasticities amongst them can therefore be examined. Hence, these models are discussed in detail in this section. The existing literature shows that of the system-of-equations demand approaches, the almost ideal demand system (AIDS) model is the most commonly employed in tourism research and in the demand analysis of other consumer products. In the field of tourism demand analysis, Li et al. (2004) used the long-run static and short-run error-correction AIDS models to examine tourism demand in five European destinations by UK residents. Li, Song, and Witt (2006) and Li, Wong, Song, and Witt (2006) combined the TVP technique with the AIDS model for outbound tourism market share analysis in the UK.

2.4.5.1 Almost ideal demand system (AIDS) model

The basic AIDS model was proposed by Deaton and Muellbauer (1980). This model can analyse the interrelationships amongst budget allocations to different tourism goods and services. A group of equations (one for each tourism product) are estimated simultaneously, which allows the examination of how consumers choose bundles of tourism goods and services to maximise their utility given budget constraints. Although a number of system modelling approaches are available, the AIDS model is one of the most commonly used methods in analysing consumer spending behaviour, as it has a number of advantages over the others. For example, it has a flexible functional form and does not impose any prior restrictions on elasticities. In this model, goods can be either normal or inferior, and pairs of goods can either substitute for or complement each other.

The AIDS model has been used in tourism research for more than twenty years. Fujii et al. (1985) employed the long-run linear AIDS model for the analysis of tourist expenditure categories including food and drink, lodging, recreation and entertainment, local transport, clothing, and other expenditure. The income, own-price and cross-price elasticities of demand were first estimated based on the expenditures by visitors to a tourist destination. White (1985) employed the linear AIDS model to estimate the budget allocations of American travellers to different western European countries, while O'Hagan and Harrison (1984) also analysed expenditure allocation amongst a number of origins. Taube, Huth, and MacDonald (1990) extended the AIDS model by incorporating consumer expectations into the model specification. Shaikh and Larson (2003) applied AIDS to pure cross-sectional data instead of time series data for recreation demand analysis in California. Li et al. (2004) employed an error-correction AIDS model to examine outbound tourism demand for several countries in Western Europe by UK residents. Using the same set of tourism demand data, Li, Song, and Witt (2006) and Li, Wong, Song, and Witt (2006) combined the TVP technique with the AIDS model.

2.4.5.2 Other system-of-equations demand models

In contrast to their single-equation counterparts, system-of-equations demand approaches can capture a complete set of information in the data generating process, which includes the own-price and cross-price elasticities amongst various tourism goods and services. Single-equation approaches do not allow researchers to exploit the restrictions set by economic theory, or to investigate the interaction of the demands for different commodities.

The first attempt to estimate a system of demand equations derived explicitly from consumer theory was made by Stone (1954), who developed a linear expenditure system (LES) that consistently aggregates the expenditures of individual consumers on different products without requiring all products to have unitary income elasticities. However, this LES model requires positive compensated cross-price elasticities (i.e., all products must be substitutes) and positive income elasticities (i.e., products may not be inferior), which restricts the application of this model in empirical studies.

Since the LES model was first implemented, a number of other system-of-equations demand models have been developed. Apart from the AIDS model, the two most important models that attempt to test the homogeneity and symmetry restrictions of demand theory are the Rotterdam model (Barten, 1964; Theil, 1965, 1976, 1980) and translog model (Christensen, Jorgenson & Lau, 1975; Jorgenson & Lau, 1975). Researchers have used these models for tourism demand analysis. For example, Walker and White (1980) used Stone's (1954) LES model to examine the outbound travel behaviour of Americans, while Smeral and Weber (2000) and Smeral, Witt and Witt (1992) also applied the LES model for tourism forecasting. Van der Stelt and Velthuijsen (1989) and van Dijk, Hagens and Windmeijer (1991) adopted the Rotterdam model to examine tourism demand in a number of regions, and Tapin (1980) used the system-of-equations approach to estimate the substitute price elasticities between foreign and domestic travel by Australian travellers. Anderson and Blundell (1983) incorporated a static long-run equilibrium solution within a system of error-correction-type equations, and Chambers (1992) estimated an alternative dynamic model formulated in continuous time as a system of stochastic differential equations.

2.4.6 Other models

In addition to univariate time series and multivariate econometric approaches, methods developed for application in different fields of research have been applied to the analysis of tourism demand, such as the artificial neural networks (ANN) model.

The ANN model grew out of research into artificial intelligence in the early 1960s and has rapidly developed since the 1980s. Today, this approach is widely applied in different areas as control and forecasting tools. It attempts to mimic the fault tolerance and capacity to learn of biological neural systems by modelling the low-level structure of the brain. Three basic parts are involved in a well-defined neural network: one input, one output and one or more hidden layers.

In the context of tourism demand analysis, the input layer of the ANN model comprises the independent variables, that is, the factors that determine the demand for tourism. The output layer denotes the demand for tourism, which is the dependent variable. The hidden layer is the core part of the model. In this layer, the non-linear modelling process is performed. During the process, different weights are assigned to each independent variable; therefore, each node of the hidden layer is a weighted value of the input variables. Another set of weights is then allocated to make the dependent variable at the output layer a weighted value of the nodes at the hidden layer. Finally, the training process is repeated until a set of optimal weights is obtained. These weights can limit the diversity between the computed output and observed values of the dependent variables within a threshold value.

Empirical studies indicate that the ANN model performs well compared with other tourism demand models (see, for example, Kon & Turner, 2005; Law & Au, 1999; Uysal & Roubi, 1999).

Nevertheless, such a model has limitations. First, a large amount of data is needed for the learning process. In addition, although it can generate accurate forecasts, the relationships amongst the different variables remain unknown. As a result, the impact of independent variables on the dependent variable cannot be analysed. Moreover, own- and cross-price elasticities cannot be calculated, as the manipulation in the hidden layer is a black-box process.

Au and Law (2000, 2002) borrowed the rough set approach from the field of artificial intelligence in computer science to examine respectively sightseeing expenditure and tourism dining patterns in Hong Kong, and found that it has superior forecasting performance.

State space models have been employed recently for tourism demand analysis, which incorporate the TVP technique. In standard statistical models, all influencing factors are assumed to be observable. Using historic data, these models obtain forecasts through the parameters that are estimated based on regression analysis or time series methods. However, some variables that affect the real state of the system are unobserved in practice. Models that contain unobservable variables are called unobservable component models. In contrast to standard regression methods, state space models can estimate different state vectors for analysis and forecasting by building a relationship between the observable variables and unobservable inner structures of the system. An efficient recursive algorithm named the Kalman filter (Kalman, 1960) is used to estimate the models.

Blake et al. (2006) employed a computable general equilibrium model to examine tourism demand in Scotland, while Dwyer, Forsyth, and Spurr (2007) used the same model to estimate the economic yield of inbound tourism expenditure in Australia. The spectral analysis technique has been applied to detect and describe tourism flow cycles over time (Coshall, 2000), and the autoregressive conditional heteroscedasticity (ARCH) technique, which is widely employed in financial modelling, has also been applied to analyse tourism demand volatility (Chan, Lim, & McAleer, 2005).

2.4.7 Seasonality adjustment

In economics, many observed data series show seasonality. Tourism demand datasets usually feature strong seasonality for the following reasons. First, tourism demand is normally affected by such variables as exchange rates and GDP, which tend to demonstrate strong seasonal variation. Second, the supply conditions of the tourism industry are closely related to seasonal variations in a destination. Therefore, each tourist destination tends to provide different experiences to tourists in different seasons. The seasonal or calendar effect influences destination choice. For example, as summer is the nicest time in the UK, people generally prefer to travel there in the summer than in the winter. Third, seasonal festivals or public holidays can cause seasonality in tourism demand data. For instance, Christmas holidays lead to great increases in tourist arrivals in many countries. In summary, seasonality is a general property of tourism demand data.

Demand models that do not take seasonality into account may lead to misunderstandings about tourist consumption behaviour and generate unreliable forecasting results. For instance, one cannot conclude that tourism promotion in the second quarter performs worse than that in the third quarter as tourist arrivals are fewer in the former, because the greater number of tourist arrivals in the latter may be due to seasonality. Therefore, seasonality needs to be modelled in tourism demand modelling and forecasting studies.

Fluctuations in time series are caused by four factors: trend, seasonality, cycle and irregularity. Two forms reflect the relationship between the studied time series and these four factors, namely, the additive and multiplicative models, which are respectively specified as follows:

Additive model: $$y_t = T_t + S_t + C_t + L_t \tag{2.11}$$

Multiplicative model: $$y_t = T_t \times S_t \times C_t \times L_t, \tag{2.12}$$

where T_t, S_t, C_t and L_t represent trend, seasonality, cycle, and irregularity, respectively. The specification of these two models shows that in the additive model, the time series is the sum of the four factors, whereas the multiplicative model is a product of the four factors. The former is more appropriate when *T*, *S* and C are dependent on each other, whereas the latter is more suitable where T, S and C are independent of each other. Kim (1999) showed that in the additive case, seasonality does not change substantially over time with the level of the time series. In the international tourism forecasting domain, multiplicative seasonality is applied more often in modelling the seasonality of tourism demand.

Seasonal dummies are also widely used in tourism demand analysis that involves quarterly or monthly data. Taking quarterly data as an example, three seasonal dummies are included to reflect the seasonality in tourism demand as follows:

$$Seasonal_1 = \begin{cases} 1 & quarter 1 \\ 0 & otherwise \end{cases}$$

$$Seasonal_2 = \begin{cases} 1 & quarter 2 \\ 0 & otherwise \end{cases} \tag{2.13}$$

$$Seasonal_3 = \begin{cases} 1 & quarter 3 \\ 0 & otherwise \end{cases}.$$

Through the inclusion of these three dummies in the demand models, the seasonal effect in the tourism demand system can be captured.

The employment of seasonal difference operators in the modelling process is another way to remove seasonality effects. In most empirical studies, one can expect to find unit roots at zero (annual) frequency and possibly at other seasonal (half yearly, quarterly or monthly) frequencies. Thus, there is a risk of over-differencing when seasonal difference operators are used directly (Gustavsson, 2001). Therefore, seasonal unit root tests have been developed by a number of researchers, including Dickey, Hasza, and Fuller (1984), Engle, Granger, and

Hallman (1988), Engle, Granger, Hylleberg, and Lee (1993) and Hylleberg et al. (1990). The HEGY technique developed by Hylleberg et al. (1990) is a commonly used method to test for seasonal unit roots in time series variables in tourism demand modelling and forecasting. The unit root test for quarterly time series is illustrated as follows.

Let y_t represent a quarterly time series, which can be written as

$$\Delta_4 y_t = (1 - L^4) y_t = \pi_1 z_{1,t-1} + \pi_2 z_{2,t-1} + \pi_3 z_{3,t-2} + \pi_4 z_{3,t-1} + \varepsilon_t , \quad (2.14)$$

where

$$z_{1,t} = (1 + L + L^2 + L^3) y_r \quad (2.15)$$

$$z_{2,t} = -(1 - L + L^2 - L^3) y_r \quad (2.16)$$

$$z_{3,t} = -(1 - L^2) y_r , \quad (2.17)$$

and L is a lag operator.

Equation 2.14 is then estimated and the one-tailed t statistic for $\pi_1 = 0$ and $\pi_2 = 0$ and the F statistic for $\pi_3 = \pi_4 = 0$ are calculated. The rejection of the null hypothesis $\pi_1 = 0$ means that series y_t does not have non-seasonal unit roots, the rejection of the null hypothesis $\pi_2 = 0$ suggests that the series y_t does not have annual seasonal unit roots, and the rejection of the null hypothesis $\pi_3 = \pi_4 = 0$ indicates that series y_t does not possess semi-annual unit roots.

Based on the test results, the seasonal filter $(1 + L)$ is used to remove the seasonal unit root at the annual frequency in the variables in which $\pi_2 = 0$ is not rejected, while $(1+L^2)$ is used to eliminate the semi-annual seasonal roots of the variables in which $\pi_3 = \pi_4 = 0$ cannot be rejected. $(1+L+L^2+L^3)$ is employed to take out both the annual and semi-annual seasonal unit roots. Studies that employ the HEGY method to test and deal with seasonality in tourism demand include those of Alleyne (2006), Kulendran and Wong (2005), and Wong et al. (2007).

2.4.8 Elasticity analysis

Tourism demand theory states that the quantity of a tourism product demanded rises when the price of the product falls. Price elasticity measures the sensitivity of the quantity of the product demanded in responding to a change in the price of the product. Price elasticity is calculated as the percentage change in the quantity demanded divided by the percentage change in the price of the product. As the percentage change in quantity normally has a negative relationship with the percentage change in price, the price elasticity is negative (save for inferior goods). That is,

$$E_p = \frac{\Delta q / q}{\Delta p / p}, \tag{2.18}$$

where E_p is price elasticity, and p and q are the price and quantity of the tourism product demanded, respectively. Price elasticity has important implications for the development of appropriate pricing strategies for a tourism product or destination. The values of price elasticities may reflect the following characteristics of tourism products.

$|E_p| > 1$ The absolute value of price elasticity exceeding unity means that tourism demand is price elastic. An increase in tourism price may lead to a more than proportional decrease in the quantity of tourism demand.

$\left|E_p\right| = 1$ The absolute value of price elasticity equalling unity means that tourism demand is price unit-elastic. An increase in tourism price may lead to an equally proportional decrease in the quantity of tourism demand.

$\left|E_p\right| < 1$ The absolute value of price elasticity being less than unity means that tourism demand is price inelastic. An increase in tourism price may lead to a less than proportionate decrease in the quantity of tourism demand.

The marginal revenue (MR) at any point can be calculated according to the formula $MR = p \times \left(1 - \frac{1}{\left|E_p\right|}\right)$, when price elasticity and price value are available. According to economic theory, total revenue (TR) continues to increase as long as MR is positive. As a result, it can be concluded that when

$\left|E_p\right| > 1$, the total revenue deceases when the price increases;

$\left|E_p\right| = 1$, the total revenue remains constant when the price increases; and

$\left|E_p\right| < 1$, the total revenue increases when the price increases.

This conclusion will benefit practitioners and government in formulating appropriate pricing strategies.

Expenditure elasticity of demand is another indicator of importance to tourism planners. Expenditure elasticity measures the sensitivity of quantity changes in response to consumer expenditure budget changes. It is denoted as the percentage change in the quantity demanded divided by the percentage change in the expenditure budget.

$$E_x = \frac{\Delta q/q}{\Delta x/x}, \tag{2.19}$$

where E_x is the expenditure elasticity, x is the expenditure budget of tourists and q is the quantity of tourism product demanded. For most tourism products, total expenditure budget has a positive influence on the quantity demanded, that is, normal consumer products have positive expenditure elasticities. Expenditure elasticity varies amongst different types of products. For example, the expenditure elasticities of necessities are usually lower than those of luxury products. Estimations of expenditure elasticity with regard to tourism demand could benefit tourism-related companies and government in targeting specific tourism segments.

In the general linear regression model of tourism demand, when the dependent and independent variables are transformed into log-log form, the coefficients of the independent variables in the lo-log model become corresponding elasticities (Song & Witt, 2000, p.11).

2.4.9 Time-varying parameter (TVP) technique

Most existing studies employ the constant-parameter model to perform tourism demand analysis. The assumption of the constant-parameter model is that the effects of the independent variables on tourism demand are constant over time. However, in practice, this assumption is generally too strict to satisfy. Therefore, specifying demand models in TVP form is more suitable. The TVP technique relaxes the constant-parameter restriction and has been successfully applied to tourism modelling and forecasting.

Generally speaking, the TVP technique is employed in a state space model, which is estimated using an efficient recursive algorithm known as the Kalman filter. This technique is increasingly being used in tourism demand analysis (e.g., Riddington, 1999; Song & Witt, 2000, pp.131-134; Song, Witt, & Jensen, 2003). The TVP technique has been also incorporated into the AIDS model. For instance, Mazzocchi (2003) used the static TVP-AIDS model with time-varying homogeneity and symmetry constraints to analyse the demand for food in Italy. Li, Song, and Witt (2006) and Li, Wong, Song, and Witt (2006) estimated unrestricted static TVP-AIDS and error-correction TVP-AIDS models in tourism contexts.

2.4.10 Estimation methods

Different methods can be used to estimate the models. A general system-of-equations demand model is given by

$$w_i = f_i\left(Z;\theta\right) + \varepsilon_i, \qquad (2.20)$$

where f is the function specification, Z is a vector of the explanatory variables, θ is a vector of the parameters to be estimated and ε is a vector of the disturbance terms with the following properties:

$$E\left(\varepsilon_t\right) = 0 \quad (2.21a)$$

$$E\left(\varepsilon_t \varepsilon_s'\right) = 0 \quad (2.21b)$$

$$E\left(\varepsilon_t \varepsilon_t'\right) = \Sigma \quad (2.21c)$$

$$E\left(\varepsilon_t \mid H_s\right) = 0 \quad (2.21d)$$

$$\varepsilon_t \sim N\left(0, \Sigma\right), \quad (2.21e)$$

where H_s is the instrument set, which includes all of the exogenous variables, and Σ is the covariance matrix of the errors with all diagonal elements equal.

Equation 2.20 can be estimated as $w_i = f_i\left(Z; \hat{\theta}\right) + \hat{\varepsilon}_i$ by different estimation methods, which are shown in Table 2.2 (Edgerton et al., 1996, p. 77).

Table 2.2 Estimation methods

Single-equation methods	
Ordinary least squares (OLS)	$min\left(\hat{\varepsilon}_i'\hat{\varepsilon}_i\right)$
Ordinary two-stage least squares (2SLS)	$min\left(\hat{\varepsilon}_i'P\hat{\varepsilon}_i\right)$
Limited information system methods	
Systemwise least squares (SLS)	$min\ tr\left(\hat{E}'\hat{E}\right)$
Systemwise two-stage least squares (S2SLS)	$min\ tr\left(\hat{E}'P\hat{E}\right)$
Full information system methods	
Seemingly unrelated regression (SUR)	$min\ tr\left(S^{-1}\hat{E}'\hat{E}\right)$
Iterated seemingly unrelated regression (ISUR)	$min\ tr\left(\hat{S}^{-1}\hat{E}'\hat{E}\right)$
Maximum likelihood (ML)	$min\ det\left(\hat{E}'\hat{E}\right)$
Three-stage least squares (3SLS)	$min\ tr\left(S^{-1}\hat{E}'P\hat{E}\right)$
Iterated three-stage least squares (I3SLS)	$min\ tr\left(\hat{S}^{-1}\hat{E}'P\hat{E}\right)$

Source: Edgerton et al. (1996, p.77)

$\hat{E}$ is a $\left(t\times\left(n-1\right)\right)$ matrix of residuals with i^{th} row $\hat{\varepsilon}_i'$, P is a $\left(T\times T\right)$ projection matrix with $P=H\left(H'H\right)^{-1}H'$, S is the estimation of Σ derived from OLS/SLS and $\hat{S}$ is the estimate of Σ derived iteratively.

According to Edgerton et al. (1996, pp.77-78), when estimating system models, the definitions of 2SLS and 3SLS are based on the assumption that the same instruments are used in all of the equations. If there are no cross equation restrictions, then the single-equation and limited information system methods are identical. For linear models, the OLS, SLS, SUR, ISUR and ML methods are identical when all equations have the same explanatory variables, as are the 2SLS, S2SLS, 3SLS and I3SLS methods. However, when the symmetry restriction is imposed, the SUR estimation performs more efficiently than the OLS one (Syriopoulos, 1995). Most empirical studies employ SUR (Zellner, 1962) to estimate the AIDS model.

2.4.11 Diagnostic tests

According to Li et al. (2005), diagnostic checking of tourism demand models was relatively lacking before the mid-1990s. As a result, the inferences from the estimated models might have been highly sensitive to statistical assumptions, especially those of models estimated from a small data set (Lim, 1997). Nowadays, researchers consider credible only those models that pass most, if not all, of the available diagnostic statistics. The estimation of system models is based on the assumptions given in Equations 2.21(a) to (e). However, these assumptions may not automatically be satisfied during the model estimation process, and thus should be tested to ensure the reliability of the estimation results. When these assumptions are violated, the model should be adjusted until the assumptions in the aforementioned equations hold. Common tests for model misspecification include those for autocorrelation, heteroscedasticity and non-normality.

2.4.11.1 Tests for autocorrelation

Goodness of fit, the *F* statistic and the Durbin-Watson autocorrelation statistic are the diagnostic statistics traditionally used in earlier studies. The Durbin-Watson statistic (Durbin & Watson, 1950, 1951) was frequently used in testing for first-order autocorrelation in tourism demand models, but it is invalid if the lagged dependent variables are incorporated in the right-hand side of the model. Recent studies, however, test for higher-order autocorrelation using the Lagrange multipliers (LM) developed by Breusch (1978) and Goldfrey (1978).

Autocorrelation exists when $E\left(\varepsilon_t \varepsilon_s'\right) = 0$ in Equation 2.21b is not satisfied. This means that the error terms at different times are not independent of each other. The Durbin-Watson statistic is often used to check the problem of autocorrelation. However, it can detect only first-order autocorrelation.

Breusch-Godfrey test

According to Edgerton et al. (1996, p.80), the Breusch-Godfrey test has the advantages of (1) being applicable in the presence of lagged endogenous variables, (2) being applicable for testing higher-order autocorrelation, (3) being asymptotically equivalent to the Lagrange multiplier test and (4) being computationally simple. In a single-equation linear model $y_t = X_t\beta + \varepsilon_t$, the null hypothesis for the Breusch-Godfrey test is $H_0 : \alpha_1 = \alpha_2 = \ldots = \alpha_g = 0$ in the equation below:

$$y_t = X_t\beta + \alpha_1\hat{\varepsilon}_{t-1} + \alpha_2\hat{\varepsilon}_{t-2} + \ldots + \alpha_g\hat{\varepsilon}_{t-g} + \upsilon_t, \qquad (2.22)$$

where g denotes the order of the autoregressive errors to test. Under the assumption of the null hypothesis, the F statistic, which is asymptotically distributed as $F\left(g, T-k-g\right)$ where T is the number of observations and υ_t is the disturbance term, can be employed for this test.

However, as Edgerton et al. (1996, p.81) mentioned, the Breusch-Godfrey test is suitable only for single-equation models. Performing this test separately for each equation in the demand system and then combining the results to generate the conclusion for the whole system can lead to erroneous conclusions due to dependent test statistics. Therefore, the systemwise Breusch-Godfrey test advanced by Godfrey (1988) can be applied to check for autocorrelation in the demand system as a whole.

Systemwise Breusch-Godfrey test

In Godfrey's (1988) version of the systemwise Breusch-Godfrey test, the null hypothesis is that $H_0 : \alpha_{ij} = 0 \ \forall i,j$ in the following regression system:

$$\hat{\varepsilon}_{it} = f_i\left(x_t, \theta\right) + \sum_{j=1}^{n-1} \alpha_{ij} \hat{\varepsilon}_{j,t-1} + \upsilon_{it}, \tag{2.23}$$

where f_i is the function of x_i and θ is the vector of the parameters to be estimated. In addition, given the adding-up restriction of the AIDS model, only $n-1$ residuals can be used as the dependent or independent variables. The likelihood ratio test statistic is suitable for the test of the null hypothesis. The test statistic is

$$\Lambda^* = \left(\frac{hs - r}{m_1 m_2}\right)\left(\frac{1 - \Lambda^{1/s}}{\Lambda^{1/s}}\right), \tag{2.24}$$

with $\Lambda = det\,\hat{\Sigma}_R / det\,\hat{\Sigma}_U$, $s = \sqrt{\frac{(m_1 m_2)^2 - 4}{m_1^2 + m_2^2 - 5}}$, $h = T - k - \frac{1}{2}(m_2 - m_1 + 1)$ and $r = \frac{1}{2} m_1 m_2 - 1$, where m_1 is the number of restrictions per equation to be tested, m_2 is the number of estimated equations in the system and k is the number of parameters per equation in the unrestricted system. Σ_R and Σ_U are the error covariance matrices under the null and alternative hypotheses, respectively. This statistic Λ^* is approximately distributed as $F(m_1 m_2, hs - r)$ under the null hypothesis. A large-scale Monte Carlo experiment using this system-wide Breusch-Godfrey test by Edgerton and Shukur (1995) indicated that the test of this F statistic is superior to the alternative statistics.

Edgerton et al. (1996, p.84) also offered three possible solutions when autocorrelation is a problem. The first is to explore a better dynamic specification, the second is to model the residual autocorrelation and the last is to accept the loss of efficiency caused by autocorrelation but to obtain consistent estimates of the standard errors of the parameters.

2.4.11.2 Tests for heteroscedasticity

For a general linear statistical model $y = X\beta + \varepsilon$, where $E(\varepsilon_t) = 0$ and $E(\varepsilon\varepsilon') = \sigma^2\psi$, heteroscedasticity exists when the diagonal elements of ψ are not identical, which means that Equation 13.19c cannot be satisfied. A model with a heteroscedasticity problem may not yield the best linear unbiased estimator (BLUE) of the coefficients or unbiased variance estimates, which may lead to misleading inferences. Consequently, it is of interest to test for heteroscedasticity to obtain the best model. A number of tests have been developed to address the problem of heteroscedasticity of the model residuals, which include the Breusch-Pagan (Breusch & Pagan, 1980), Glejser (Glejser, 1969), Godfeld-Quandt (Goldfeld & Quandt, 1965), Park (Park, 1966), Spearman rank correlation (Spearman, 1904) and White (White, 1980) tests. This section introduces the Goldfeld-Quandt and Breusch-Pagan tests, as they have been found to have the best levels of performance and ease of computation amongst the various tests.

Goldfeld-Quandt test

The Goldfeld-Quandt test for heteroscedasticity (Goldfeld & Quandt, 1965) is a test that does not rely on asymptotic properties. In this approach, the null hypothesis is that the errors are of homoscedasticity $H_0 : \sigma_1^2 = \sigma_2^2 = \ldots = \sigma_T^2$, where T is the sample size. Accordingly, the alternative hypothesis is $H_1 : \sigma_1^2 \le \sigma_2^2 \le \ldots \le \sigma_T^2$. In this test, the variances σ_i^2 are sorted in increasing order. These variances are then divided into two groups with the corresponding two separate regressions run respectively. These two regressions can be written as

$$\begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} \beta + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix}, \qquad (2.25)$$

where y_i is $(T_i \times 1)$, X_i is $(T_i \times K)$, β is $(T \times 1)$, ε_i is $(T_i \times 1)$, $y' = (y_1', \times y_2')$, $X' = (X_1', \times X_2')$, $\varepsilon' = (\varepsilon_1', \times \varepsilon_2')$, $T_1 + T_2 = T$ and K is the number of explanatory variables. If the null hypothesis is true, then no significant difference exists between the residual sums of squares of the two regressions. Goldfeld and Quandt (1965) suggested that the test can be made even more powerful by omitting some of the central observations of the error variances. The steps for implementing this test can be found in Judge, Hill, Griffiths, Lutkepohl, and Lee (1988), and are presented as follows.

(1) Assuming that H_1 is true, order the observations according to the magnitude of error variances starting from the smallest.

(2) Omit r central observations.

(3) Run two separate regressions, one using the first $(T-r)/2$ observations and the other using the last $(T-r)/2$ observations.

(4) Compute the statistic $\lambda = S_2/S_1$ where S_1 and S_2 are the residual sums of squares from the first and second regressions, respectively. Under the null hypothesis of homoskedasticity, λ has an F distribution with $\left[(T-r-2K)/2,(T-r-2K)/2\right]$ degrees of freedom.

(5) Compare the computed value for λ with a relevant critical value from the F distribution and accept or reject the null hypothesis accordingly.

In addition, Judge et al. (1988) noted that the choice of the value of r is not obvious, and that based on experience, r = 4 for T = 30 and r = 10 for T = 60 are reasonably satisfactory values.

Breusch-Pagan test

The Breusch-Pagan test (Breusch & Pagan, 1980) assumes that the variances of the regression residuals are functions of more than one explanatory variable. The alterative hypothesis is

$$w = (w_1, w_2, ..., w_n)', \tag{2.26}$$

where f is a function independent of t, $z_t' = \left(1, z_t^{*\prime}\right) = \left(1, z_{t2}, z_{t3}, \ldots, z_{tS}\right)$ is a vector of the observable explanatory variables and $\alpha' = \left(\alpha_1, \alpha^{*\prime}\right) = \left(\alpha_1, \alpha_2, \ldots, \alpha_S\right)$ is a vector of the unknown coefficients. Under the null hypothesis $\alpha^* = 0$ and the normal distribution of the error term ε_t, it can be shown that one-half of the differences between the regression sum of squares and the residual sum of squares from the regression $\frac{\hat{\varepsilon}_t^2}{\tilde{\partial}^2} = z_t'\alpha + v_t$ is distributed asymptotically as $\chi^2(S-1)$. As a result, this statistic can be employed in the Breusch-Pagan test for heteroscedasticity.

2.4.11.3 Other tests for model misspecification

A number of tests are available for testing the problem of model misspecification. For example, the Jarque-Bera Lagrange multiplier test (Jarque & Bera, 1980) can be used to test for normality of the regression errors. The Ramsey RESET test (Ramsey, 1969) can be applied in linear allocation models that involve regressing budget shares on the original explanatory variables and powers of the predicted budget shares. The Hausman-Wu test (Hausman, 1978; Wu, 1983) is useful to test for the endogeneity of the variables. Many recent studies have also employed structural break and forecast failure tests. Unit root tests appear in a large number of tourism demand studies, especially those using error-correction models. In addition to unit root tests for annual data, seasonal unit root tests for quarterly or monthly data are commonly conducted. The HEGY unit root test is the most widely used test in tourism demand modelling that involves seasonal data (e.g., Alleyne, 2006; Kulendran & Wong, 2005; Wong et al., 2007). Seasonality testing is discussed in detail in Section 2.4.7.

2.4.12 Functional forms

In this section, important issues related to the functional forms of tourism demand models are discussed. These include the log-linear functional form, the treatment of exogenous and endogenous variables in the models and long-run and short-run models.

2.4.12.1 Log-linear functional form

The specification of the demand model in most existing studies is in log-linear form, which means that the variables are log transformed before the model is estimated. Therefore, if tourism demand is measured by tourist arrivals TA_t, then the natural logarithm of tourist arrivals $log(TA)_t$ is treated as the dependent variable in the model, while the independent variables undergo the same transformation. The reason for this transformation stems from economic theory, which holds that the relationship of economic variables is mostly exponential rather than linear. Logarithmic transformation can change the non-linear exponential relationship into a linear one, which can be conveniently estimated using the OLS method. Another advantage of the log-linear model is that the estimations of the parameters are equal to the demand elasticities, which simplifies the calculation of the elasticities in the simple linear demand models. However, in cases where the data are already in relative format, such as the inflation rate or market share, logarithmic transformation is usually not performed.

2.4.12.2 Exogenous and endogenous variables

An exogenous variable is one whose value is causally independent from other variables in the model or system. That is, changes in the other variables in the model do not affect the value of an exogenous variable. In contrast, the value of an endogenous variable does change when an exogenous variable changes.

The same variable may be treated differently in different models. For example, tourism demand is normally considered to be an endogenous variable while all independent variables are treated as exogenous. However, in the VAR model, all variables are treated as endogenous except the intercept, time trend and dummy variables.

2.4.12.3 Long-run and short-run models

A long-run model describes the state of the long-run equilibrium of the demand system, but cannot trace the temporary deviation of the demand system from the equilibrium. In contrast, a short-run model takes into account temporary deviation from the long-run equilibrium. A short-run model, therefore, can be applied to trace the move from a state of disequilibrium to equilibrium. The cointegration model is an example of a long-run model, in which only the long-run equilibrium during the sample period is identified, but the move from disequilibrium to equilibrium cannot be traced. An example of the short-run model is the ADLM, in which the lagged independent and dependent variables are included on the right-hand side of the model. Therefore, it can trace the short-run disequilibrium of tourism demand. Long- and short-run models are also called static and dynamic models, respectively, in the literature.

2.5 Forecasting performance assessment

Over the last three decades, along with the development of econometric methodologies has been that of quantitative modelling techniques, which have been used in tourism demand modelling and forecasting. These methods include time series analysis, econometric models and other non-linear modelling approaches (Li et al., 2005). As forecasting accuracy is important to tourism practitioners and decision, it is crucial for researchers to identify the best techniques for tourism demand forecasting.

2.5.1 Measures of forecasting accuracy

Existing empirical studies of tourism demand analysis indicate that the various forecasting models have different levels of forecasting accuracy. No single forecasting technique consistently performs well under a variety of conditions. Forecasting performance is influenced by a number of factors, such as different datasets, origin-destination pairs and time horizons (Witt & Song, 2001). In practice, several measures are used to examine forecasting accuracy. The most widely used are the mean absolute percentage error (MAPE) and root mean square percentage error (RMSPE). Other measures include the mean absolute error (MAE), Theil's U statistic, the acceptable output percentage (Z) and the normalised correlation coefficient (γ).

Before looking at these measures, two important concepts, ex post and ex ante forecasts, should be explained. According to Song and Witt (2000, p.159), when data are available from time *1* to *N*, as shown in Figure 2.2, forecasts from time *n* to *N* based on the model estimation from time *1* to *n* are called ex post forecasts. The availability of actual data from time *n* to *N* allows for comparisons between the forecasts and the actual values. Therefore, the evaluation of forecasting performance is possible. Ex ante forecasts refer to the forecasts after time *N*, for which actual data are not available. As a result, although in practice ex ante forecasting is more important for practitioners and managers, only the forecasting performance of ex post forecasts can be measured.

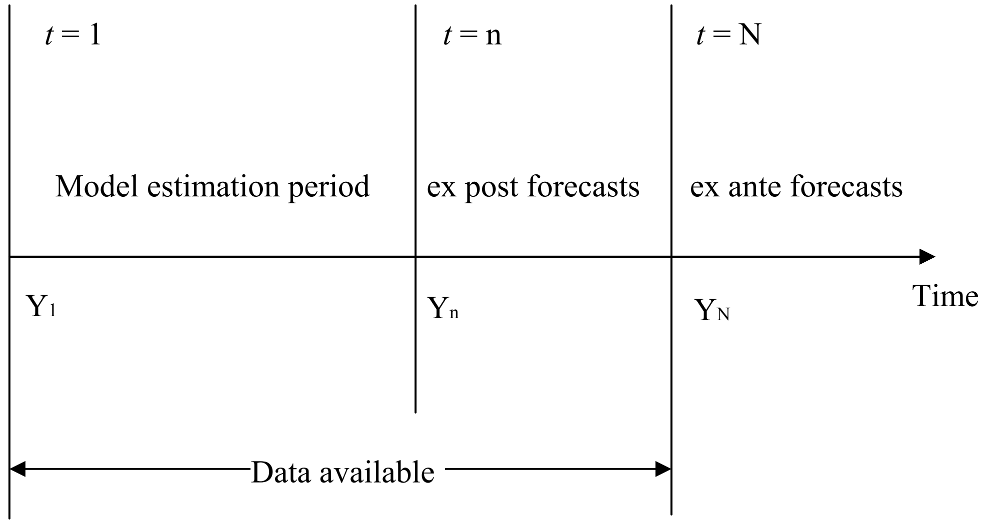

Figure 2.2 Time horizon of forecasts

Source: Song and Witt (2000, p. 159)

Table 2.3 gives the formulae of commonly employed measures to assess forecasting performance, where m is the length of the forecasting horizon, Y_t is the actual values of tourism demand and $\hat{Y}_t$ denotes the corresponding forecasts of Y_t.

Table 2.3 Measures of tourism demand forecasting accuracy

Measure	Formula
Mean absolute percentage error (MAPE)	$MAPE = \frac{1}{m}\sum_{t=1}^{m}\frac{\lvert Y_t - \hat{Y}_t\rvert}{Y_t}$
Root mean square percentage error (RMSPE)	$RMSPE = \sqrt{\frac{1}{m}\sum_{t-1}^{m}\left(\frac{Y_t - \hat{Y}_t}{Y_t}\right)^2}$
Mean absolute error (MAE)	$MAE = \frac{1}{m}\sum_{t=1}^{m}\lvert Y_t - \hat{Y}_t\rvert$
Theil's U statistic	$U = \sqrt{\frac{\sum_{j=1}^{m-1}\left(\frac{Y_{j+1} - X_{j+1}}{X_j}\right)^2}{\sum_{j=1}^{m-1}\left(\frac{X_{j+1} - X_{j+1}}{X_j}\right)^2}}$
Acceptable output percentage (Z)	$Z = \frac{\sum_{i=1}^{n} i}{n}\times 100\%$ for $\begin{cases} i=1 & \text{if } \frac{\lvert X_i - Y_i\rvert}{Y_i}\le 5\% \\ i=0 & \text{otherwise}\end{cases}$
Normalised correlation coefficient (γ)	$r = \frac{\sum_{i=1}^{n}(X_i \times Y_i)}{\sqrt{\sum_{i=1}^{n}(X_i)^2 \times \sum_{i=1}^{n}(Y_i)^2}}$

2.5.2 Comparison of tourism demand forecasting models

A large number of studies have compared the level of tourism forecasting accuracy of different models. Kulendran and King (1997) compared the forecasting performance of error-correction, AR, ARIMA, basic structural equation and regression-based time series models. Their results demonstrated that the error-correction model performed poorly compared with the time series models. The reason for this may lie in the way that the non-stationary and seasonal data are treated in the model specification. Kulendran and Witt (2003a) examined seven forecasting models including ARIMA, error-correction and several structural time series models and found that the length of the forecasting horizon is highly related to a model's relative forecasting performance. Oh and Morzuch (2005) explored the performance of eight models in forecasting inbound tourism demand in Singapore and concluded that the selection of performance measures and forecasting horizons are the two main factors affecting the forecasting performance of the models.

Song et al. (2000) generated ex post forecasts of the outbound tourism demand of UK residents to twelve destinations over a period of six years using an error-correction model. They also compared the forecasting performance of the error-correction model with that of the AR, ARIMA and VAR models. The results suggested that the error-correction model outperformed all other competitors. Witt et al. (2003) evaluated the forecasting performance of six econometric models together with two univariate time series models using data of international tourism to Denmark. The results showed that the TVP model performed consistently well in one-year-ahead forecasting, but the best model varied when longer forecast horizons were considered. Investigating demand for Austrian tourism, Smeral and Wüger (2005) found that complex data adjustment procedures with adequate model structures generated more accurate forecasts than simpler ones. Blake et al. (2006) examined seven quantitative forecasting methods and found that the forecasting accuracy of these models differed significantly. They concluded that several simple forecasting methods performed better than econometric models. Burger, Dohnal, Kathrada, and Law (2001) compared the forecasting performance of a variety of techniques, namely, naïve, moving average, decomposition, single exponential smoothing, ARIMA, multiple regression, genetic regression and ANN models, and the empirical results showed that the ANN method performed the best.

The mixed findings of the extensive research into measures of forecasting accuracy shows that no single model performs the best in all situations. According to Witt and Song (2001), factors that influence the accuracy of individual forecasting methods include origin-destination pairs, different forecasting horizons, data frequency and researchers' knowledge of the forecasting models.

2.5.3 Forecast combination

Forecast combination refers to the integration of the individual forecasts that are generated by different models through appropriate weighting schemes. Forecast combination was initially studied in the general forecasting literature. Bates and Granger (1969) conducted seminal work in this area. They combined two sets of forecasts of airline passenger data in which the weights were calculated based on the historic performance of each individual model. Their major finding was that the combined forecasts yielded much lower mean-square errors than either of the original individual forecasts. Clemen (1989) reviewed the development and application of combination techniques in various forecasting areas before 1989. He found that forecasting accuracy could be substantially improved through combining individual forecasts. A simple average combination method in which the individual forecasts are equally weighted has been widely applied in the forecasting literature (Fang, 2003; Hibon & Evgeniou, 2005; Makridakis & Winkler, 1983). In the combined forecast, $f_c = fw$ is combined with $f = (f_1, f_2, ..., f_n)$, and $w = (w_1, w_2, ..., w_n)'$, where w is a $(n \times 1)$ vector with every element equal to $\frac{1}{n}$.

Many studies have used more advanced combination methods to achieve the optimal weights for combining individual forecasts. In these procedures, the past performance of a single forecast model is the key criterion for deciding the optimal weight w. Makridakis and Winkler (1983) applied several versions of the variance-covariance weighting method to examine the performance of combined forecasts. The results showed that most of the combined forecasts performed better than the individual ones. Walz and Walz (1989) compared the performance of a Bayesian method with that of an unconstrained regression procedure in combining forecasts through a study of four macroeconomic variables, and found that the Bayesian procedure generated more accurate combined forecasts. Diebold and Pauly (1990) applied the shrinkage technique to incorporate prior information into the estimation of combination weights. The empirical results of their study based on US GNP data showed that estimated combination weights largely shrunk towards equality.

A number of empirical and simulation studies in different fields suggest that combination techniques outperform the best constituent single individual forecast. However, Hibon and Evgeniou (2005) concluded that the best individual method and combination forecasts performed similarly based on an analysis of 3003 series of the M3-competition. They studied only simple average combinations, and found that combining forecasts decreased forecasting risk but that combination forecasts did not significantly outperform the best single forecast. Koning, Franses, Hibon, and Stekler (2005) examined the performance of combination forecasts based on three univariate models and discovered that the combined forecasts did not outperform the single ones.

Although forecast combination is an area of great interest in the wider forecasting literature, very little research into this topic has been conducted in tourism forecasting research. One empirical tourism study of forecast combination since the 1980s is that of Wong et al. (2007), who examined the relative accuracy of combination and single model forecasts for one quarter ahead but did not consider whether the former were statistically significantly better than the latter. They found that combination forecasts almost always outperformed the worst single forecasts but only outperformed the best single forecasts in less than 50% of the cases studied.

Song, Witt, Wong and Wu (2009) applied the same dataset to further explore model performance through forecast combination. They used three combination methods to obtain combined forecasts for different forecasting horizons (one, two, four and eight quarter(s) ahead). The empirical results demonstrated that forecast combination did not always improve forecasting performance, as only around 50% of the combined forecasts outperformed the best single model. This result is in line with that of Hibon and Evgeniou (2005) and Wong et al. (2007). However, the percentage was higher for the long-term forecasts (eight quarters ahead), which suggests that forecast combination may be more beneficial for long-term forecasting. Song et al. (2009) also found that nearly all combination forecasts outperformed the worst single forecasts over all forecasting horizons, which implies that combination forecasts reduce the risk of complete forecast failure, and that combined forecasts performed significantly better than the average single model ones in all cases, which strongly indicates that combination forecasts be used in tourism research.

2.5.4 Forecasting using the AIDS model

In univariate time series or multivariate econometric models, the dependent variables are mostly measures of tourism demand, such as visitor arrivals or tourist expenditure. Therefore, the relative forecasts generated are the absolute values of tourism demand. However, in the AIDS model, the dependent variables are shares of tourism demand, such as the expenditure shares of a number of tourism products or destinations, but not direct tourism demand itself. Therefore, the AIDS model can produce only forecasts of tourism demand share distribution, and not absolute values of tourism demand. This difference means that directly comparing forecasting performance between them is infeasible.

Li et al. (2004), Li, Song, and Witt (2006) and Li, Wong, Song, and Witt (2006) compared forecasting accuracy amongst various versions of the AIDS model and found that the short-run error-correction one outperformed the long-run one. This indicates that the forecasting ability of the AIDS model is likely to improve when a more correctly specified model (incorporating an error-correction mechanism, for example) is employed. They also found that incorporating the TVP technique into the AIDS model greatly improved their forecasting performance, which is consistent with previous TVP studies.

Because of limited data availability, this study does not assess the ex post forecasting ability of the different versions of the AIDS model employed. Instead, it mainly focuses on the estimation of tourist demand to gain new insights into the evolution of the consumption behaviour of tourists over time.

2.6 Consumer demand theory

Consumer behaviour theory underpins the econometric modelling and forecasting of tourism demand. The AIDS modelling approach is explicitly derived from this theory. This section presents a brief introduction to consumer demand theory, which is partially based on its explication in Edgerton et al. (1996, Chapter 3).

2.6.1 Preferences and utility maximisation

Given the scenario where a consumer faces possible consumption bundles in the consumption set, he/she is assumed to have preferences concerning these consumption bundles. Preferences are assumed to be reflexive, complete, transitive, continuous, strongly monotonic and strictly convex. These terms are explained as follows: $q = (q_1, \ldots, q_n)$ is a vector of n commodities, where q_i denotes the quantity consumed of the ith commodity, the superscripts denote different bundles and the symbols $\succ=$, $\succ$ and $\sim$ denote "strictly preferred to," "weakly preferred to" and "indifferent to," respectively.

(1) Reflexive. Each bundle of commodities is as good as itself for the consumer; that is, for any bundle q, $q \succ= q$.

(2) Complete. All bundles of commodities can be ranked and compared; that is, for any two bundles q^1 and q^2, $q^1 \succ= q^2$, $q^1 \prec= q^2$ or $q^1 \sim q^2$.

(3) Transitive. The consumer's preferences are consistent; that is, if $q^1 \succ= q^2$ and $q^2 \succ= q^3$, then $q^1 \succ= q^3$.

(4) Continuous. For any q^2, the sets $\left\{q^1 \mid \left(q^1 \succ= q^2\right)\right\}$ and $\left\{q^1 \mid \left(q^2 \succ= q^1\right)\right\}$ are closed sets.

(5) Strongly monotonic. The consumer prefers more to less of all goods and services; that is, if $q^1 \succ= q^2$ and $q^1 \neq q^2$, then $q^1 \succ q^2$.

(6) Strictly convex. The consumer prefers averages to extremes; that is, if $q^1 \neq q^2$, $q^1 \succ= q^3$ and $q^2 \succ= q^3$, then $tq^1 + (1-t)q^2 \succ q^3$ for $0 < t < 1$.

Given that the consumer has a particular preference, an indifference curve can be employed to show the different bundles of goods and services amongst which a consumer is indifferent. That is, the consumption of these different bundles of goods and services will give the same utility (satisfaction) to the consumer. In Figure 2.3, I_1 and I_2 are two indifference curves, and at each point on the curve I_1, the consumer has no preference for one bundle over another. For example, the consumer would receive the same utility (satisfaction) from the bundles $\left(q_a^1, q_a^2\right)$ and $\left(q_b^1, q_b^2\right)$.

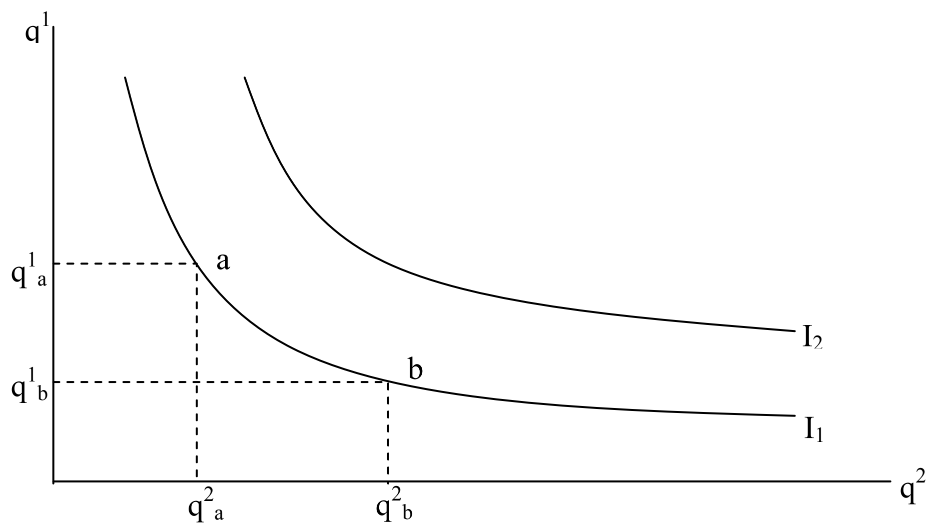

Figure 2.3 Indifference curves

Utility is a device employed to represent preferences rather than something from which the preferences are derived (Geanakoplis, 1987). As a result, the utility function of a consumer is a function of a bundle of goods and services and represents the utility (satisfaction) this bundle of goods and services brings to the consumer. It can be proven that when the consumer's preference ordering meets the reflexive, complete, transitive, continuous and strongly monotonic assumptions, then there exists a corresponding continuous utility function (Edgerton et al., 1996, p.56).

Utility maximisation means that, subject to a linear budget constraint on a bundle of goods and services, a consumer is assumed to allocate his or her total expenditure in a way that can maximise the utility function

$$max\ \ u=v\left(q_{1,\dots,}q_{n}\right)\ subject\ to\ x=\sum_{i=1}^{n}p_{i}q_{i}\ , \qquad (2.27)$$

where p_i, is the price per unit of the *i*th good or service; q_i denotes the quantity of the *i*th good or service that the consumer holds; *u* refers to the utility that the bundles of goods and services bring to the consumer; and *x* represents the total expenditure. When all goods and services are considered, total expenditure equals disposable income.

2.6.2 Duality in consumer theory

The utility maximisation problem is also known as the primal problem. For this problem, when the first-order conditions are solved, the Marshallian demand functions can be obtained as follows:

$$q_i=g_i\left(x,p_1,\ \dots,\ p_n\right)\ for\ \ i=1,\dots,n\ . \qquad (2.28)$$

Substitute q_i into the utility function, and the indirect utility function can be derived as

$$u=\psi\ \left(x,p\right). \qquad (2.29)$$

This primal utility maximisation problem can also be replaced by minimising the total expenditure required to reach a given level of utility. That is,

$$min\ x=\sum_{i=1}^{n} p_i q_i \ subject\ to\ u=v\left(q_{1,\dots,}q_n\right) \quad . \tag{2.30}$$

This problem is called the dual problem. This, together with the utility maximisation problem, is termed the duality of consumer theory. For the dual problem, when the first-order conditions are solved, the Hicksian demand functions can be obtained as

$$q_i=h_i\left(u,p_1,\dots,p_n\right)\ for\ i=1,\dots,n\ . \tag{2.31}$$

Similarly, when q_i is substituted into the utility function, the expenditure function is generated as

$$x=c\left(u,p\right). \tag{2.32}$$

According to Edgerton et al. (1996, p.57), any expenditure function that is consistent with utility maximisation has the following properties:

(1) homogeneous of degree one in price, which means that $x=c\left(u,tp\right)=tc\left(u,p'\right)$ for $t>0$;

(2) an increase in *u* implies an increase in $c\left(u,p\right)$, which means that $u>u'$ can lead to $c\left(u,p\right)>c\left(u',p\right)$;

(3) a non-decrease in price ($p\geq p'$) implies a non-decrease in $c\left(u,p\right)\geq c\left(u,p'\right)$, which means that if price increases, then at least as much expenditure will be required to stay at the same utility level;

(4) concave in price, which means that

$$c\left[u, tp + (1 - p')\right] \geq tc(u, p) + (1 - t)c(u, p') \quad for\ 0 \leq t \leq 1\ ;$$

(5) continuous in price for $p_i > 0$ for all *i*; and

(6) derivable.

Duality in consumer theory is summarised in Figure 2.4. It provides a convenient way to derive demand functions. The generation of the expenditure function makes feasible the use of the AIDS model in this study of Hong Kong tourism demand analysis. The specification of $c(u, p)$ can be derived first, which satisfies the six properties of the expenditure function as indicated above. The specified expenditure function can be inverted to give the corresponding indirect utility function, which can then be substituted into the derived Hicksian demand functions, leading to the Marshallian demand functions. This procedure is adopted to derive the AIDS model, which is discussed in detail in Chapter 3.

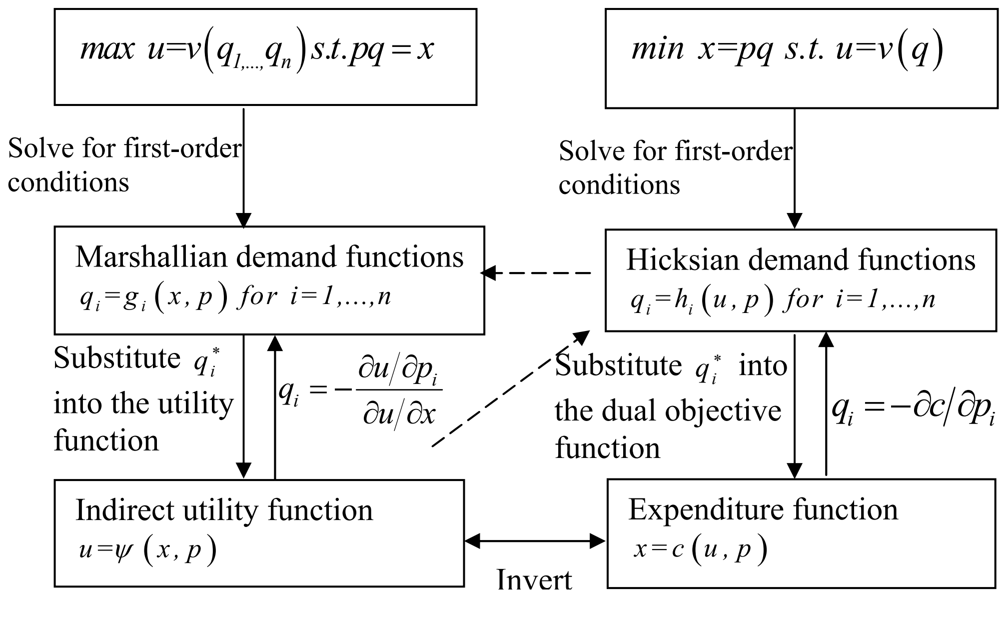

Figure 2.4 Duality in consumer theory

Source: Edgerton et al. (1996, p. 57)

2.7 Research gap

Since the AIDS model was first introduced in 1980, its application in tourism demand analysis has been relatively rare. Most studies have employed only the long-run specification of the AIDS model and focused on tourism expenditure in a group of destinations by tourists from a particular origin. The short-run error-correction TVP-AIDS model with the theoretical assumptions imposed has been little used in tourism demand analysis. From the empirical perspective, the improvement to the AIDS model specification, in terms of the inclusion of an error-correction mechanism to capture short-run tourist consumption behaviour patterns, has not yet been exploited in tourism studies. To address this research gap, the present study uses different specifications of the AIDS model to investigate the expenditure patterns of tourists regarding a group of tourism goods and services using Hong Kong inbound tourism data. The different versions of the model include the long-run AIDS, short-run error-correction AIDS, long-run TVP-AIDS and short-run error-correction AIDS models.

It is anticipated that this research will further develop this analytical technique, which will contribute to a better understanding of tourist consumption behaviour not only in Hong Kong but also in other parts of the world. Using an AIDS-based framework, eight leading contributors of Hong Kong tourism receipts are investigated. They include Australia, mainland China, Japan, South Korea, Singapore, Taiwan, the UK and the US. The spending differentials of tourists from these origins are expected to significantly influence tourism product provision by different sectors of the economy. This is systematically analysed in this research using the proposed methodology. Using data from *A Statistical Review of Hong Kong Tourism* (HKTB, 2009), the main data source, this study examines tourist consumption behaviour. Consumption is divided into four spending categories, namely, shopping, hotel accommodation, meals outside hotels and other expenditures. These four categories of tourism goods and services form a complete demand system, and different AIDS models are applied to each of the origins considered. The expenditure and own-price elasticities are calculated for each system to examine the effects of changes in budget and price on the demand for each category of tourism products. In addition, cross-price elasticities are estimated to identify the interrelationships amongst the different kinds of tourism demand. The adoption of the TVP technique allows the examination of the evolution of tourist consumption behaviour over time. The research findings are expected to offer useful information for policy makers in both the public and private sectors. For example, if different consumption patterns are identified, then a diversified marketing strategy for different market segments would be appropriate. If different price elasticities are observed, then a flexible pricing policy for different tourism goods and services should be adopted. The identification of a complementary effect between two different products would suggest that a joint marketing campaign by the two parties would be effective.

2.8 Chapter summary

This chapter presents the definitions of tourism and tourism demand, followed by an explanation of the measures and determinants of tourism demand. Tourism demand is normally measured by visitor arrivals and tourist expenditure, while its determinants include consumer income, own price of tourism, substitute price of the alternative tourism products or destinations, transportation costs, marketing expenditure, seasonality and one-off events.

This chapter reviews the main models that have been investigated in the literature on tourism demand analysis, and focuses on univariate time series, multivariate econometric and system-of-equations demand methods. Following the application of traditional regression and univariate time series models in the 1970s and 1980s, advanced econometric models have emerged as the main techniques in tourism demand modelling and forecasting. These include the ADLM and error-correction, VAR and AIDS models. Issues in tourism demand modelling such as seasonality adjustment, elasticity analysis, estimation method, diagnostic testing and functional form are discussed in detail. With regard to the assessment of forecasting performance, the most widely employed measures are the MAPE and RMSPE.

CHAPTER 3 METHODOLOGY

3.1 Introduction

Based on the advantages of the system modelling approach, which have been elaborated in the previous chapter, this study employs different versions of the AIDS model to analyse tourist expenditure in Hong Kong. Sections 3.2-3.4 discuss these models. The long-run constant-parameter AIDS model is considered first, followed by the corresponding short-run version of the model, which incorporates error-correction terms to capture the short-run dynamics of expenditure patterns. Then, the TVP technique is combined with the long-run and short-run error-correction AIDS models to derive the long-run TVP-AIDS and short-run error-correction TVP-AIDS models, respectively. In comparison to the constant-parameter AIDS models, the TVP versions of the AIDS model are capable of reflecting the evolution of tourist expenditure patterns over time.

In this chapter, the theoretical restrictions and their tests under the AIDS framework are discussed. Based on the estimation of the AIDS models, the calculation of the expenditure and price elasticities is explained.

3.2 Basic AIDS model

The AIDS model is one of the most widely used econometric techniques to analyse consumer behaviour. A number of empirical studies of tourism demand analysis have employed this method (e.g., Divisekera, 2003; Durbarry & Sinclair, 2003; Han et al., 2006; Li et al., 2004; Li, Song, & Witt, 2006; Li, Wong, Song, & Witt, 2006; White, 1985). This section discusses in detail the basic version of the AIDS model.

3.2.1 Specification of the static AIDS model

Neoclassical consumer theory suggests that a tourist normally maximises his or her utility function $u(q_1,...,q_k)$ given a total budget $x = \sum_{i=1}^{k} p_k q_k$, where p_k and q_k are respectively the price and quantity of the *k*th tourism good or service considered in the system. Regarding the duality theory, this problem can be solved by minimising the expenditure (or cost) function given the price and utility. The advancement of the AIDS model is based on the expenditure function of the price-independent, generalised-logarithmic (PIGLOG) class of preferences, which permits exact aggregation over customers. PIGLOG expenditure is defined as

$$\log c(u, p) = (1-u)\log a(p) + u \log b(p)\,, \tag{3.1}$$

where $c(u,p)$ is the expenditure (or cost) function, u and p are utility and price, respectively, and a and b denote two categories of tourism products. The PIGLOG expenditure (or cost) function focuses on minimising the necessary expenditures to obtain a given utility level u at the given price p.

Based on the PIGLOG expenditure function, Deaton and Muellbauer (1980) proposed the specific flexible functional forms of $log\, a(p)$ and $log\, b(p)$ (see Equations 3.2 and 3.3) to satisfy the desirable properties.

$$\log a(p) = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_k \sum_j \gamma_{kj}^* \log p_k \log p_j \qquad (3.2)$$

$$\log b(p) = \log a(p) + \beta_0 \prod_k p_k^{\beta_k} \ , \qquad (3.3)$$

where $k, j = 1,...,n$ are the indices for commodities, and a_0, a_k, β_0, β_k and γ_{kj}^* are the parameters to be estimated. Therefore, the expenditure function is rewritten as

$$\log c(u,p) = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_k \sum_j \gamma_{kj}^* \log p_k \log p_j + u\beta_0 \prod_k p_k^{\beta_k} \ . \qquad (3.4)$$

The rationale is to satisfy the need to have enough parameters for a flexible functional form, where at any single point, its derivatives $\partial c/\partial p_i$, $\partial c/\partial u$, $\partial^2 c/\partial p_i \partial p_j$, $\partial^2 c/\partial u \partial p_i$ and $\partial^2 c/\partial^2 u^2$ can be set equal to those of an arbitrary expenditure function. As the derivative with respect to the price in a cost function equals the quantities demanded – $\frac{\partial c(u,p)}{\partial p_i} = q_i$, $\frac{\partial \log c(u,p)}{\partial \log p_i} = \frac{\partial c(u,p)/c(u,p)}{\partial p_i / p_i} = \frac{p_i q_i}{c(u,p)} = w_i$. Therefore, for Equation 3.4, taking the partial derivative with respect to the price on both sides yields the budget share of the cost function:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log \frac{x}{P} , \qquad (3.5)$$

where w_i is the budget share of the ith good or service; p_j is the price of the jth good or service; x is total expenditure (expenditure budget) on all goods and services in the system; x/P is real total expenditure; a_i, b_i and γ_{ij} are the parameters that need to be estimated; and $\gamma = \left(\gamma_{ij} + \gamma_{ji}\right)/2$. $logP$ is denoted as

$$\log P = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_j \sum_k \gamma_{kj} \log p_k \log p_j , \tag{3.6}$$

where a_0 and α_k are the parameters to be estimated. Equation 3.6 is the specification of the basic AIDS model.

However, the specification of Equation 3.6 shows that the relationship between price index P and the prices of individual goods is nonlinear. The nonlinearity of this specified AIDS model results in a complicated nonlinear estimation of the system, which can lead to difficulties in empirical studies. Deaton and Muellbauer (1980) suggested that a linear approximation can be obtained, as $logP$ is a pure function of price and P is essentially a price index, by replacing the specification of $logP$ with an aggregate price index to linearise the demand system. Deaton and Muellbauer (1980) found that the linear specification is an appropriate representative for the nonlinear specification in Equation 3.6. Many subsequent studies have followed this practice to simplify the estimation of AIDS models. The aggregate price index that Deaton and Muellbauer (1980) suggested is the Stone price index $\log P^*$:

$$\log P^* = \sum_i w_i \log p_i \, . \tag{3.7}$$

Replacing $\log P$ in Model 3.5 with $\log P^*$ specified in Equation 3.7, the AIDS model is linearised, and its stochastic form for empirical study can be written as

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log \frac{x}{P^*} + \sum_k \varphi_{ik} dum_k + \varepsilon_i , \tag{3.8}$$

where P is the aggregate price index, dum_k is the kth dummy variable, which captures the effect of a one-off event, a_i, b_i, φ_{ik} and γ_{ij} are the parameters to be estimated and ε_i is a disturbance term.

This linear AIDS model has been used more in the demand literature than its nonlinear counterpart because of its feasibility for empirical studies. Therefore, in this study, if there is no special clarification, the AIDS model refers to the linear version. This study does however use another aggregate price index, the Tornqvist price index (Tornqvist, 1936), instead of the Stone price index to linearise the AIDS model. The rationale for and construction of the Tornqvist price index are discussed in Section 3.2.2.

This basic AIDS model is essentially static and can reflect the long-run equilibrium of tourist expenditure allocation. However, because of habit persistence or imperfect information, consumer behaviour in reality is not always static or in a state of equilibrium. The specification of the short-run AIDS model is discussed in Section 3.3.

3.2.2 Proxy of the aggregate price index

As discussed in Section 3.2.1, in estimating Equation 3.8, an aggregate price index, the Tornqvist price index, is employed to linearise the demand system. The Tornqvist price index takes the form of

$$\ln P = \sum_{i=1}^{N} w_i \ln\left(p_{it} / p_{i0}\right) \tag{3.9}$$

or

$$P = \prod_{i=1}^{N} \left(p_{it} / p_{i0} \right)^{w_i} , \qquad (3.9b)$$

where zero represents the base period, and *t* represents period *t*. The weight w_i is defined as the average of the expenditure shares between the base and comparison periods for item i, or $w_i = \left(w_{i1} + w_{i0} \right) / 2$, and w_i s are positive and equal to one.

The Stone (1954) price index is the most commonly used proxy of the aggregate price index in AIDS models in empirical studies. Other aggregate price indices, such as the Laspeyres price and the Paasche price indices, have been used in previous studies (see, for example, Buse & Chan, 2000; Moschini, 1995). The Tornqvist price index has attracted attention because of its superior properties. It belongs to the class of superlative indices identified by Diewert (1976), which has such properties as being exact for linearly homogeneous functions. These are second-order approximations for any utility function and are thus less likely to be subject to substitution bias.

Balk and Diewert (2001) demonstrated that the Tornqvist price index is linearly homogeneous in comparison-period prices; that is, the price index is λ times higher if the comparison-period prices are λ times as high as they actually are ($P(\lambda p^1, q^1, p^0, q^0) = \lambda P(p^1, q^1, p^0, q^0)$, where *p* is price and *q* is quantity). Also, the Tornqvist price index satisfies the time reversal test, which means that the price index for period 1 relative to period 0 and the price index for period 0 relative to period 1 are reciprocal; that is, $P(p^1, q^1, p^0, q^0) = 1 / P(p^0, q^0, p^1, q^1)$.

In a Monte Carlo experiment, Buse and Chan (2000) showed that the Laspeyres and Tornqvist indices were distinctly superior to the Stone and Paasche ones in generating unbiased expenditure and price elasticities from the AIDS model. However, when the sample size increased, only the Tornqvist index showed a statistically significant reduction in bias. Given the theoretical and experimental advantages of the Tornqvist index, it is employed in this study to linearise the demand system. Fujii et al. (1985) also employed the Tornqvist index to represent the aggregate price index in their static AIDS model.

3.2.3 Theoretical restrictions

As discussed in Chapter 2, consumer demand theory holds that the expenditure function should satisfy some restrictions given budget constraints or utility maximisation. To comply with these theoretical properties of demand theory, adding-up, homogeneity and symmetry restrictions are imposed on the parameters in the AIDS model (Equation 3.5).

The adding-up restriction implies that budget shares sum to unity, which is in accordance with reality, and requires that $\sum_i \alpha_i = 1$, $\sum_i \gamma_{ij} = 0$ and $\sum_i \beta_i = 0$ in Equation 3.5. However, setting the independent variables (budget shares) sum to unity leads to the residual variance-covariance matrix being singular and hence the model cannot be estimated. Therefore, this assumption can be realised by omitting one equation from the system for model estimation. Then the coefficients in the omitted equation can be calculated based on the adding-up rules.

Homogeneity requires $\sum_j \gamma_{ij} = 0, \ \forall i$ in Equation 3.5. This restriction means that a proportional change in all prices and real expenditures would not affect the quantities purchased. In other words, the consumers do not suffer from money illusion. The homogeneity assumption can be tested equation by equation.

The symmetry restriction requires $\gamma_{ij} = \gamma_{ji}, \ \forall i, j$, which indicates that the substitution matrix is symmetric; hence, this restriction takes consistency in consumer choice into account. In the AIDS framework, in contrast to homogeneity, symmetry implies cross-equation restrictions on the parameters.

3.2.4 Model advantages

Deaton and Muellbauer (1980) stated that the AIDS model possesses numerous advantages compared with other system-of-equations models: (1) it gives an arbitrary first-order approximation of any demand system; (2) it satisfies exactly the axioms of choice; (3) it aggregates perfectly over consumers without invoking parallel linear Engel curves; (4) it has a functional form that is consistent with known household budget data; (5) it is simple to estimate, which largely avoids the need for non-linear estimation; and (6) it can easily be used to test for homogeneity and symmetry through linear restrictions on the fixed parameters.

In addition, the AIDS model is derived from the consumer cost function corresponding to PIGLOG consumer preferences, which permits an exact aggregation over consumers without imposing identical preferences. Regarding aggregate data, a representative consumer is assumed to rationally make the budget allocation. Therefore, although the AIDS model is developed on the basis of microeconomic theory, it can readily be generalised for aggregate data (Deaton & Muellbauer, 1980; Edgerton et al., 1996, p.65).

Deaton and Muellbauer (1980) argued that although other system demand models also possess some of the abovementioned advantages, not one includes all of them apart from the AIDS model. As a result, the AIDS model has received much attention since it was proposed in 1980 and been applied to analyse demands for different consumer goods (see Attfield, 1997; Balcombe & Davis, 1996; Karagiannis & Mergos, 2002; Karagiannis, Katranidis & Velentzas, 2000; Karagiannis & Velentzas, 1997).

3.3 Short-run error-correction AIDS model

In the long-run AIDS model, it is assumed that no difference exists between consumer short-run and long-run consumption behaviour; that is, consumer consumption behaviour is always in “equilibrium.” However, in reality, habit persistence, adjustment costs, imperfect information, incorrect expectations and misinterpreted real price changes often prevent consumers from adjusting their expenditure instantly based on price and income changes (Anderson & Blundell, 1983). Therefore, until full adjustment takes place, consumers are "out of equilibrium." This is one of the reasons that most long-run AIDS models cannot satisfy the theoretical restrictions (Duffy, 2002). It is necessary, therefore, to augment the long-run equilibrium relationship with a short-run adjustment mechanism. In addition, the long-run AIDS model overlooks the statistical properties of the data and the dynamic specification arising from the time series. It is widely accepted that most economic data are non-stationary, and that the presence of unit roots may invalidate the asymptotic distribution of the estimators. Consequently, traditional statistics such as t, F and R^2 are unreliable, and OLS estimation of the long-run AIDS model tends to have the spurious regression problem (Chambers, 1993).

Engle and Granger (1987) first proposed the cointegration and error-correction models. These models have been widely used by researchers and practitioners in modelling and forecasting macroeconomic activities over the last two decades. Engle and Granger (1987) showed that the long-run equilibrium relationship can be conveniently examined using the cointegration technique, and that the error-correction model describes the short-run self-adjustment characteristics of economic activities. If the variables in the regression are cointegrated, then the spurious regression problem will not occur.

Before examining the cointegration relationship, unit root tests (or orders of integration) need to be carried out for all variables concerned in the model apart from the dummy ones. If seasonal data are used, then seasonal unit roots should be tested. The augmented Dickey-Fuller (ADF) statistic and the HEGY procedure (Hylleberg et al., 1990), which are discussed in Chapter 2, can be applied to test for the unit roots in the time series used for model estimation. Once the integration orders of the time series are identified, the Engle and Granger (1987) two-stage approach can be employed to test for the cointegration of the variables in the models (Song & Witt, 2000, p.68). After confirmation of the cointegration relationships between the dependent variables and the linear combination of independent variables in the long-run AIDS model, an error-correction representation of the AIDS model can be derived and econometrically estimated using appropriate algorithms.

In this study, Engle and Granger's (1987) two-step modelling procedure is adopted to specify the error-correction AIDS models. According to Engle and Granger (1987), if a number of non-stationary variables are all integrated of order one, and the residuals of the model resulting from these variables are stationary, then these variables are said to be cointegrated. This cointegration relationship reflects the long-run equilibrium of the system under study. Once the cointegration relationship is detected in the first step of the modelling process, a flexible dynamic version of the cointegration model can be specified. The error-correction term, which is measured by the lagged residuals of the long-run equilibrium model, is included as an explanatory variable in the dynamic model, where both the dependent and independent variables are in their first difference. The error-correction model permits a gradual adjustment towards a new equilibrium state in the long run and therefore can effectively capture the short-run dynamic consumption behaviour of tourists. This model is specified as

$$\Delta w_i = \alpha_i + \sum_j \lambda_{ij} \mu_{j,t-1} + \sum_j \gamma_{ij} \Delta \log p_j + \beta_i \Delta \log \frac{x}{P} + \sum_k \varphi_{ik} dum_k + \varepsilon_i , \qquad (3.10)$$

where $\mu_{j,t-1}$ is the error-correction term that measures the adjustment of decision errors made in the previous period, and the estimated residual term from the long-run AIDS model of Equation 3.8; Δ is the difference operator; and the coefficient λ_{ij} is the adjustment of equation *i* responding to the disequilibrium of the budget allocation related to tourism good or service *j* at time *t*-1.

Equation 3.10 is a simplified error-correction AIDS model, as it does not contain any lagged dependent or independent variable (apart from the error-correction term). The reasons for not including them are two folds. First, the published studies, such as Li, Wong, Song and Witt (2006) and Song et al. (2000), show that these lagged variables tend to be insignificant in the empirical analysis; Second, the sample size of this study restricts the inclusion of more variables, as this may lead to the loss of the degrees of freedom in the model estimation.

However, the estimation of the coefficient vector $\lambda_{(ij)}$ may cause the loss of a large number of degrees of freedom. A conventional strategy is to set the off-diagonal value to zero; that is, the short-run adjustment only happens in response to the disequilibrium of the own budget allocation for tourism good or service *i*. The adding-up condition requires the diagonal elements of $\lambda_{(ij)}$ to be equal in each equation in the system (Edgerton et al., 1996, p.197). Therefore, Equation 3.10 can be rewritten in the following form:

$$\Delta w_i = \alpha_i + \sum_j \lambda \mu_{j,t-1} + \sum_j \gamma_{ij} \Delta \log p_j + \beta_i \Delta \log \frac{x}{P} + \sum_k \varphi_{ik} dum_k + \varepsilon_i , \qquad (3.11)$$

where the coefficients of $\mu_{j,t-1}$ are restricted to be equal to λ for all equations. Equation 3.11 is the specification of the short-run AIDS model to be estimated in this study. It is estimated using Zellner's (1962) seemingly unrelated regression (SUR) method, as this method allows the correlation of errors amongst the equations.

The two-stage error-correction AIDS model has been applied in studies of demand for non-durable goods and food products. Attfield (1997), Fanelli, and Mazzocchi (2002) and Skjerpen and Swensen (2000) described the application of this approach, and Durbarry and Sinclair (2003), Li et al. (2004), Li, Song, and Witt (2006) and Li, Wong, Song, and Witt (2006) used it in tourism demand analysis.

3.4 TVP-AIDS model

The specifications of the foregoing fixed-parameter AIDS models imply that the speed of the short-run adjustment is constant over time. However, this assumption does not hold in reality. The TVP technique relaxes the fixed-parameter restriction in the models. It is thus appropriate to specify models with TVPs to analyse the evolution of the long-run equilibrium and short-run adjustment of an economic phenomenon over time. The long-run TVP model has been successfully applied in economic studies. Recently, the TVP error-correction model has received much attention. However, only a few studies have combined the TVP technique with the AIDS model. For example, Leybourne (1993a, 1993b) estimated a TVP version of the AIDS model on an equation-by-equation basis. Mazzocchi (2003) explored the TVP-AIDS model with time-varying homogeneity and symmetry constraints. Li, Song, and Witt (2006) and

Li, Wong, Song, and Witt (2006) developed the long-run TVP-AIDS and short-run error-correction TVP-AIDS models, and applied them in the context of tourism forecasting for the first time. However, the AIDS models in their studies were estimated only on an equation-by-equation basis. Mazzocchi (2006) also employed the expectation-maximisation (EM) algorithm for the construction of long-run and short-run TVP-AIDS models to investigate UK demand for alcohol and tobacco. The short-run TVP-AIDS model in his study, however, was specified as an autoregressive distributed lag rather than an error-correction model. In this section, the specifications of the long-run TVP-AIDS and short-run error-correction TVP-AIDS models employed in the following empirical study are discussed.

3.4.1 Long-run TVP-AIDS model

Equation 3.8 can be rewritten as a TVP-AIDS model, and each equation of the system can be denoted in the following one-dimensional state space form:

$$w_{it} = z_t' \pi_{it} + \vartheta_i dum_t + u_{it} \tag{3.12}$$

$$\pi_{it+1} = \pi_{it} + \xi_{it}, \tag{3.13}$$

where w_{it} and u_{it} are the *i*th elements of w_t and u_t, respectively; z' is the transpose of the independent variable matrix *z*; δ_{it} is the relative vector of the disturbance terms; and π_{it} is an unobserved state vector following a multivariate random walk. $u_{it} \sim N(0, H_t), t = 1,...,T$ and $\pi_1 \sim N(c_1, P_1), \xi_{it} \sim N(0, Q_t)$, where H_t and Q_t are initially assumed to be known.

The whole system can be presented as

$$w_{it} = z_t^* \Pi_t^* + \vartheta dum_t + u_{it} \tag{3.14}$$

$$\Pi_{t+1}^* = \Pi_t^* + \xi_t^* , \tag{3.15}$$

where $z_t^* = I_n \otimes z_t'$ $\Pi_t^* = (\pi_{1t,} \pi_{2t,...,} \pi_{nt})'$ $\xi_t^* = (\xi_{1t}, \xi_{2t}, ..., \xi_{nt})'$. Combined with the restrictions on the coefficient matrix Π_t^* (i.e., $M = G\Pi_t^*$), where G is the coefficient matrix of the restrictions, Equations 3.14 and 3.15 can be rewritten as

$$W_t = Z_t^* \Pi_t^* + D_t + U_t , \tag{3.16}$$

where $W_t = (w_t, M)'; Z_t^* = (z_t^*, G)'; D_t = (\vartheta dum_t, 0)'; U_t = (u_t, 0)'$.

This long-run TVP-AIDS model overcomes the limitations of the constant-parameter AIDS one and better reflects consumer behaviour. Equation 3.16 can easily be transformed into a short-run error-correction AIDS model if all of the variables in 3.16 are cointegrated.

3.4.2 Error-correction TVP-AIDS model

Each equation of the unrestricted error-correction TVP-AIDS model can be described as

$$\Delta w_{it} = (z_t^{\Delta})' \pi_{it}^{\Delta} + \vartheta_i^{\Delta} dum_t + u_{it}^{\Delta} \tag{3.17}$$

$$\pi_{it+1}^{\Delta} = \pi_{it}^{\Delta} + \xi_{it}^{\Delta} , \tag{3.18}$$

where $z_t^{\Delta} = (\Delta z_{it}, w_{t-1} - \Pi z_{t-1})'$; π_{it}^{Δ} is the corresponding parameter vector; ϑ_i^{Δ} is the coefficient vector of the dummy variables; u_t^{Δ} is the disturbance vector of the measurement equation; and ξ_t^{Δ} is the disturbance vector of the state equation.

The state space model derived from the whole unrestricted error-correction TVP-AIDS one is specified as follows:

$$\Delta w_t = (z_t^{\Delta *})' \pi_{it}^{\Delta} + \vartheta dum_t + u_{it}^{\Delta} \tag{3.19}$$

$$\Pi_{t+1}^{\Delta} = \Pi_t^{\Delta} + \xi_t^{*\Delta}, \tag{3.20}$$

where $z_t^{\Delta *} = I_{n+1} \otimes (z_t^{\Delta})'; \Pi_t^{\Delta} = (\pi_{1t}^{\Delta}, \pi_{2t}^{\Delta}, ..., \pi_{nt}^{\Delta})'; \xi_t^{\Delta *} = (\xi_{1t}^{\Delta}, \xi_{2t}^{\Delta}, ..., \xi_{nt}^{\Delta})'$.

Similar to the case for the long-run TVP-AIDS models, when restrictions are imposed on the coefficient matrix Π_t^{Δ} (i.e., $M^{\Delta} = G^{\Delta}\Pi_t^{\Delta}$), Equations 3.19 and 3.20 can be rewritten as:

$$W_t^{\Delta} = Z_t^{\Delta *}\Pi_t^{\Delta} + D_t^{\Delta} + U_t^{\Delta}, \tag{3.21}$$

where $W_t^{\Delta} = (w_t^{\Delta}, M^{\Delta})'; Z_t^{\Delta *} = (z_t^{\Delta *}, G^{\Delta})'; D_t^{\Delta} = (\vartheta^{\Delta} dum_t, 0)'; U_t^{\Delta} = (u_t^{\Delta}, 0)'$.

In contrast to the constant-parameter models, the long-run TVP-AIDS (Equation 3.16) and error-correction TVP-AIDS (Equation 3.21) models recursively estimate the parameters using the Kalman filter algorithm and generate the minimum-mean-square-error estimator of the state vector. This technique allows parameters in econometric models to vary over time. As a result, in the TVP-AIDS models, the dynamics of economic regime changes can be readily accommodated, which cannot be realised by fixed-parameter models. However, following Li, Song, and Witt (2006) and Li, Wong, Song, and Witt (2006), the error-correction TVP-AIDS model is estimated equation by equation and symmetry is not imposed on the model. This research extends the empirical analyses by estimating the whole system using a homogeneity-and-symmetry-restricted error-correction TVP-AIDS model in the context of tourist expenditure.

3.5 Theoretical restriction tests

As noted in Chapter 2, a system of Marshallian demand functions under a linear budget constraint automatically satisfies the general restrictions suggested by demand theory, including adding-up, the homogeneity of degree zero and symmetry. Section 3.2.3 has discussed the realisation of these restrictions imposed on an AIDS model. Using the AIDS model in an empirical study, the adding-up restriction can be obtained by omitting one equation from the system in the estimation process. The coefficients in the omitted equation can then be calculated based on the adding-up restriction.

However, homogeneity and symmetry need to be formally tested before the AIDS model is established in relation to demand theory. Deaton and Muellbauer (1980) stated that as there is no cross-equation restriction for homogeneity, it is easy to test the restriction equation by equation. Symmetry can be tested either based on the assumption of homogeneity or jointly with homogeneity. The conventional methods to test homogeneity or homogeneity and symmetry together include the Wald, likelihood ratio and Lagrange multiplier tests (Li et al., 2004). However, these tests may lead to considerable bias towards the rejection of the null hypothesis, especially amongst large demand systems with relatively few observations (Balcombe & Davis, 1996; Bera, Byron, & Jarque, 1981; Laitinen, 1978; Li et al., 2004; Meinser, 1979). Given the limited number of observations available, this study adopts the sample-size-corrected statistic developed by Court (1968) and Deaton (1974) to test for homogeneity, symmetry and the joint restriction of symmetry and homogeneity. The statistic is calculated as

$$T_1 = \frac{tr\left(\Omega^R\right)^{-1}\left(\Omega^R - \Omega^U\right)/q}{tr\left(\Omega^R\right)^{-1}\Omega^U/(n-1)(N-k)}, \tag{3.22}$$

where Ω^R and Ω^U denote the estimated residual covariance matrices with and without restrictions imposed, respectively; N is the number of observations; n is the number of equations in the system; k is the number of estimated parameters in each equation; *N, n* and *k* are all based on the unrestricted models; q is the number of restrictions; and T is approximately distributed as $F(q, N-k)$ These statistics have been used in a number of AIDS model studies (see, for example, Baldwin, Hadid, & Phillips, 1983; Chambers, 1990; Li et al., 2004).

3.6 Elasticity analysis

Because of the flexible functional form of the AIDS model, elasticity analysis is easily performed. The main demand elasticities in the AIDS model include expenditure, uncompensated price and compensated price. These elasticities can be calculated as functions of the estimated parameters, and have certain implications.

3.6.1 Expenditure elasticity

An important advantage of the AIDS model over other utility-theoretic functional forms is that there is no restriction on substitution for price and expenditure elasticities. In the AIDS model, the expenditure elasticity reflects the sensitivity of demand to changes in expenditure budget, and is defined as

$$\varepsilon_{ix} = \frac{\beta_i}{w_i} + 1 . \qquad (3.23)$$

According to demand theory, the value of the expenditure elasticity has standard implications. Specifically, if the expenditure elasticity is greater than one, then the tourism product is a luxury, whereas if it is less than one but greater than zero, then the tourism product is a necessity.

3.6.2 Uncompensated price elasticity

The uncompensated price elasticity demonstrates how a change in the price of one tourism product affects the demand for this product and other products in the system, holding total expenditure and the prices of other products constant. Generally, uncompensated price elasticities of demand in the linear AIDS model are defined as

Own-price elasticities: $$\varepsilon_{ii} = \frac{d\,log\,q_i}{d\,log\,p_i} = \frac{\gamma_{ii}}{w_i} - \frac{\beta_i}{w_i}\frac{d\,log\,P}{d\,log\,p_i} - 1 \qquad (3.24a)$$

Cross-price elasticities: $$\varepsilon_{ij} = \frac{d\,log\,q_i}{d\,log\,p_j} = \frac{\gamma_{ij}}{w_i} - \frac{\beta_i}{w_i}\frac{d\,log\,P}{d\,log\,p_j} . \qquad (3.24b)$$

In the AIDS model, in the case where the aggregate price index is used as discussed, Equations 3.24 (a) to (b) hold:

$$\frac{d\,log\,P^*}{d\,log\,p_i} = w_i + \sum_k w_k\,log\,p_k\left(\frac{d\,log\,w_k}{d\,log\,p_i}\right) = w_j + \sum_k w_k\,log\,p_k\left(\varepsilon_{kj} + \delta_{kj}\right), \qquad (3.25)$$

where δ_{kj} is the Kronecker delta with $\delta_{kj} = 1 \text{ for } k=j;\ \delta_{kj} = 0 \text{ for } k \neq j$. Therefore, the uncompensated price elasticities can also be described as

Own-price elasticities: $$\varepsilon_{ii} = \frac{d\log q_i}{d\log p_i} = \frac{\gamma_{ii}}{w_i} - \frac{\beta_i}{w_i}\left(w_i + \sum_k w_k \log p_k \left(\varepsilon_{ki} + \delta_{ki} \right) \right) - 1$$

(3.26a)

Cross-price elasticities: $$\varepsilon_{ij} = \frac{d\log q_i}{d\log p_i} = \frac{\gamma_{ij}}{w_i} - \frac{\beta_i}{w_i}\left(w_i + \sum_k w_k \log p_k \left(\varepsilon_{kj} + \delta_{kj} \right) \right).$$

(3.26b)

With specific assumptions imposed on $\frac{d\log P^*}{d\log p_i}$, the approximate forms of the counterparts of Equations 3.26(a) to (b) can be generated (Buse, 1994).

Assumption I: expenditure shares are constant. Under this assumption, it is found that $\frac{d\log P^*}{d\log p_j} = w_j$. Therefore, the following elasticities can be generated (Fujii et al., 1985):

Own-price elasticities: $$\varepsilon_{ii} = \frac{\gamma_{ii}}{w_i} - \beta_i - 1 \quad (3.27a)$$

Cross-price elasticities: $$\varepsilon_{ij} = \frac{\gamma_{ij}}{w_i} - \frac{\beta_i w_j}{w_i}. \quad (3.27b)$$

Assumption II: either preferences are homothetic or the group price is constant. Under this assumption, we can obtain $\frac{d\log P^*}{d\log p_j} = 0$. Then, the following elasticities can be generated:

Own-price elasticities: $$\varepsilon_{ii} = \frac{\gamma_{ii}}{w_i} - 1 \quad (3.28a)$$

Cross-price elasticities: $$\varepsilon_{ij} = \frac{\gamma_{ij}}{w_i}. \quad (3.28b)$$

In this study, the first assumption is adopted, and therefore Equations 3.28(a) to (b) are employed to calculate the uncompensated price elasticities.

3.6.3 Compensated price elasticity

The compensated price elasticities measure the effect of price changes on the demand for products, under the assumption that real expenditures hold constant. They can be calculated respectively as

Own-price elasticities: $$\varepsilon_{ii}^* = \varepsilon_{ii} + w_i \varepsilon_{ix} \quad (3.29a)$$

Cross-price elasticities: $$\varepsilon_{ij}^* = \varepsilon_{ij} + w_j \varepsilon_{ix}. \quad (3.29b)$$

When the aggregate price index is employed for the reduced linear AIDS model, the compensated price elasticities can be written as

Own-price elasticities: $$\varepsilon_{ii}^* = \frac{\gamma_{ii}}{w_i} + w_i - \frac{\beta_i}{w_i}\left(\sum_k w_k \log p_k \left(\varepsilon_{ki} + \delta_{ki} - w_i\right)\right) - 1 \quad (3.30a)$$

Cross-price elasticities: $$\varepsilon_{ij}^* = \frac{\gamma_{ij}}{w_i} + w_j - \frac{\beta_i}{w_i}\left(\sum_k w_k \log p_k \left(\varepsilon_{kj}^* + \delta_{kj} - w_j\right)\right). \quad (3.30b)$$

Similarly, under Assumption I, that is, that expenditure shares are constant, the compensated price elasticities can be reduced to

Own-price elasticities: $$\varepsilon^*_{ii} = \frac{\gamma_{ii}}{w_i} + w_i - 1 \quad (3.31a)$$

Cross-price elasticities: $$\varepsilon^*_{ij} = \frac{\gamma_{ij}}{w_i} + w_j \,. \quad (3.31b)$$

Under Assumption II, that is, either preference is homothetic or the group price is constant and independent of the prices of individual products, the elasticities are calculated as

Own-price elasticities: $$\varepsilon^*_{ii} = \frac{\gamma_{ii}}{w_i} + w_i - \beta_i \quad (3.32a)$$

Cross-price elasticities: $$\varepsilon^*_{ij} = \frac{\gamma_{ij}}{w_i} + w_j - \frac{\beta_i w_j}{w_i} \,. \quad (3.32b)$$

In the AIDS model, cross-price elasticities can be calculated whether products in the system are substitutable or complementary. The sign of the calculated ε^*_{ij} indicates the substitutability or complementarity between the allocations under consideration. Negative compensated cross-price elasticities demonstrate that the two products under consideration are complementary whereas positive ones imply that the two products are substitutive.

3.7 Consumer budgeting process

Separability is always an issue in system modelling research. In reality, an immense number of goods and services are available to tourists. It is impossible to analyse a complete demand system consisting of an infinite number of equations, each representing one good or service. The usual solution to this problem is to assume *a priori* weak separability amongst the goods and services. This implies that all of the goods and services can be categorised into broader groups and that a change of price in one goods and services category will affect the demand for all goods and services of another group in the same manner (Edgerton et al., 1996, p.69). This assumption is therefore applied to this study. Tourists are assumed to allocate their budget in a three-stage budgeting process. First, a resident from a particular source market determines the amount of money to spend on tourism and non-tourism goods and services. Second, the tourist divides his or her tourism budget between tourism products in one specific destination (Hong Kong in this study) and those in other selected destinations. Third, the tourist then allocates his or her expenditure to a group of tourism goods and services in this specific destination. This three-stage budgeting process is illustrated in Figure 3.1.

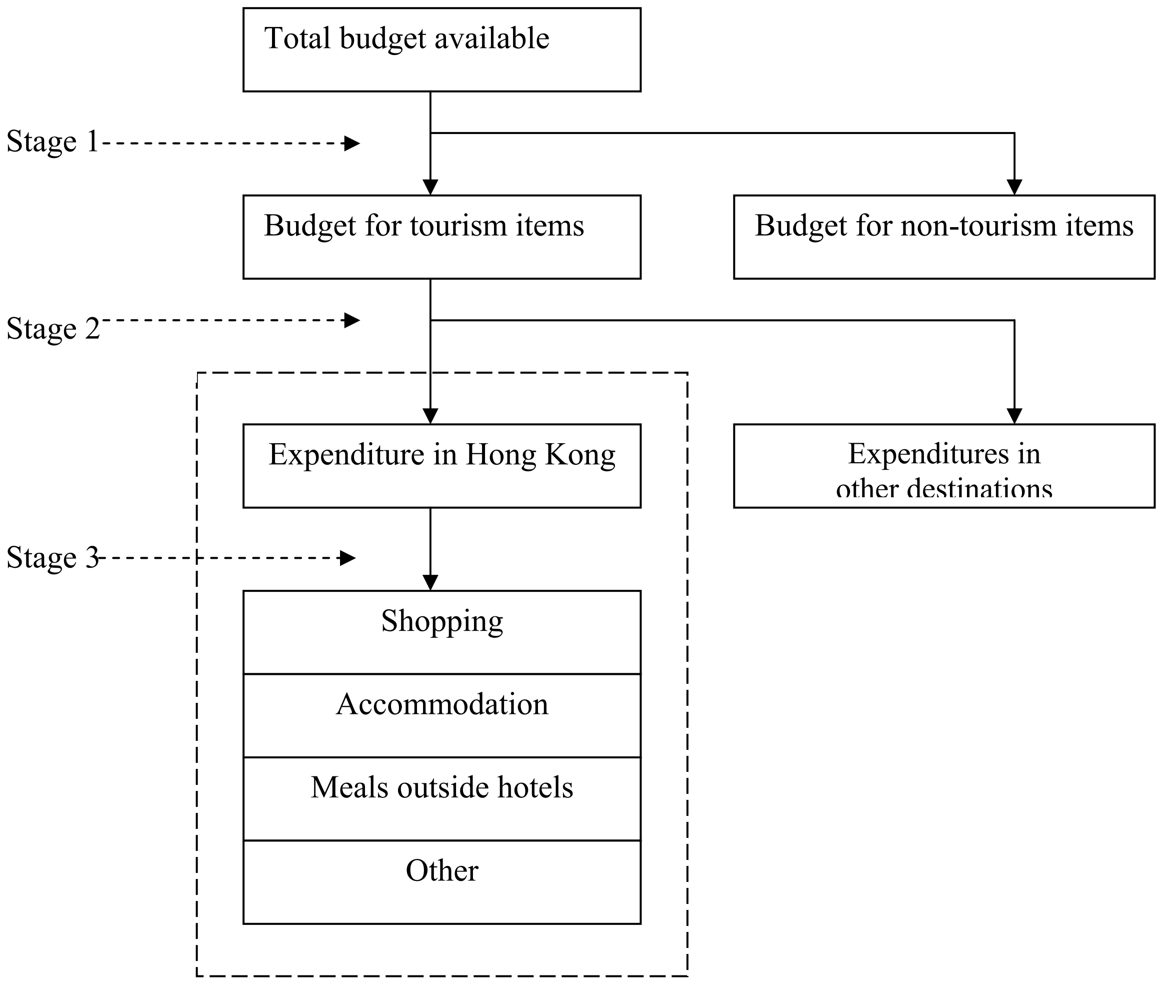

Figure 3.1 Stages of consumption budgeting

This study focuses on the third stage of budget allocation. It should be noted that it does not examine how a tourist splits his or her budget between tourism and non-tourism items or chooses a tourism destination. It is also noted that in the third stage, exchange rates between the origin and destination have no influence on the demand system as the tourist has already set a given budget for visiting a destination. For this reason, exchange rates are not included in the system modelling process. However, exchange rates do have an impact on the choice made amongst a group of destinations, which means that when the system is based on Stage 2 of the budgeting process, exchange rates must be included in the estimation. Divisekera (2003), Durbarry and Sinclair (2003) and Li et al.

(2004) took exchange rates into consideration in adjusting price variables in the system models when analysing tourist expenditure allocation in different destinations.

In addition to shopping, hotel accommodation and meals outside hotels, a fourth category, "other expenditures," must be included to form a complete system in accordance with the specification of the AIDS model. However, this study does not focus on this last category, because it covers a variety of heterogeneous goods and services and thus contributes little to theoretical explanations or practical implications. The econometric software EViews 6.0 is utilised to estimate the AIDS models proposed.

3.8 Pilot study

This pilot study applies the long-run AIDS and short-run error-correction AIDS models to analyse inbound tourist consumption behaviour concerning a number of tourism goods and services in one tourism destination. The two models have been introduced in detail in Sections 3.2 and 3.3, respectively. As mentioned in Chapter 2, studies of tourist expenditures on different tourism goods and services in a particular destination using the AIDS model are very few and include those of Divisekera (2009a, 2009b) and Fujii et al. (1985). These three studies, however, use only the long-run AIDS model. A short-run error-correction AIDS model that examines the short-run self-adjustment of the tourism system has rarely been used in the existing research. This pilot study applies the error-correction AIDS model to analyse tourist expenditures amongst different tourist goods and services.

3.8.1 Data description

In this study, the consumption behaviour of total inbound tourists to Hong Kong is examined. Three types of tourism goods and services are addressed: shopping, hotel accommodation and meals outside hotels. All data are collected from official sources. Annual expenditure data that cover a period of 25 years (1984-2008) are used to estimate the AIDS models. Data on expenditures by all inbound tourists on shopping, hotel accommodation, meals outside hotels and other items are collected from the HKTB. With regard to price variables, the compilation of detailed categories of tourist expenditure is necessary to obtain price indices for the four categories of tourism products. In calculating the component price indices, the Tornqvist (1936) price index is used. The raw data of individual prices are collected from the Hong Kong Census and Statistics Department.

3.8.2 Theoretical restriction tests and model estimation

This pilot study applies the statistics developed by Court (1968) and Deaton (1974) for testing homogeneity and symmetry (see Section 3.5), which are presented in Table 3.1. For each model, three tests are carried out including the homogeneity and symmetry tests and joint test for homogeneity and symmetry. The results, which are shown in Table 3.1, demonstrate that the null hypothesis of the test for homogeneity cannot be rejected in either model, which means that homogeneity is satisfied in both of them. However, the null hypotheses of the homogeneity-based symmetry test and homogeneity and symmetry joint test are rejected at the 1% significance level in both models. This means that the symmetry assumption is not satisfied in either of them. A similar result can be found in past studies including those of Baldwin, Hadid, and Phillips (1983) and White (1985). To comply with the theoretical requirement, both homogeneity and symmetry are imposed on each of the systems when estimating the models and discussing the findings in this study.

Table 3.1 Homogeneity and symmetry restriction tests

	Long-run AIDS model	Short-run AIDS model
Homogeneity	0.336	-0.180
Symmetry based on homogeneity	6.924**	11.142**
Homogeneity and symmetry	3.655**	5.280**

Note: ** indicates that the statistic is significant at the 1% level.

Table 3.2 shows the ADF unit root test results for all dependent and independent variables in the AIDS models. All level variables under consideration are non-stationary, whereas their first differences are stationary at the 5% significance level. It is then concluded that all of the time series involved in the AIDS models are non-stationary with one unit root. The three error-correction time series terms, which are the residual series of the long-run AIDS models, are also stationary at the 10% significance level (see Table 3.2). These conclusions provide statistical justification for the use of the error-correction model in this study.

Table 3.2 ADF unit root tests on the variables in the AIDS models

	t-Statistic	Probability
w_hotels	-1.16	0.67
w_meals	-1.82	0.36
ln(x/P)	-1.00	0.74
ln(p_shopping)-ln(p_others)	-1.63	0.45
ln(p_hotels)-ln(p_others)	-2.20	0.21
ln(p_meals)-ln(p_others)	-1.72	0.41
Δ(w_shopping)	-5.66	0.00*
Δ(w_hotels)	-3.28	0.00**
Δ(w_meals)	-4.94	0.00**
Δ(ln_x/P)	-6.17	0.00**
Δ[ln(p_shopping)-ln(p_other)]	-3.00	0.00**
Δ[ln(p_hotels)-ln(p_other)]	-3.70	0.00**
Δ[ln(p_meals)-ln(p_other)]	-3.13	0.00**
error-correction term_shopping	-2.56	0.01**
error-correction term_hotels	-1.87	0.06*
error-correction term_meals	-2.79	0.01**

Note: * and ** denote significance at the 10% and 5% levels, respectively.

Table 3.3 shows the estimated parameters in both the long-run and short-run AIDS models with homogeneity and symmetry imposed. The error-correction term in the short-run AIDS model is significant at the 1% level with a parameter estimate of -0.326. This reflects the short-run adjustment of the demand system to the long-run equilibrium state.

Table 3.3 Estimates of the homogeneity- and symmetry-restricted AIDS models

	Equation (1): Shopping	Equation (2): Hotels	Equation (3): Meals
Long-run AIDS model			
Constant	0.878** (4.033)	-0.211 (-1.074)	0.304 (1.969)
ln(p_shopping)-ln(p_other)	0.074 (1.338)	0.017 (0.573)	0.060 (1.382)
ln(p_hotels)-ln(p_other)	0.017 (0.573)	0.029 (0.929)	-0.049* (-2.547)
ln(p_meals)-ln(p_other)	0.060 (1.382)	-0.049* (-2.547)	0.241** (3.630)
ln(x/P)	-0.044 (-1.709)	0.054* (2.366)	-0.021 (-1.133)
R squared	0.214	0.438	0.700
DW statistic	0.977	0.459	0.999
Short-run error-correction AIDS model			
Error-correction term (*t-1*)	-0.326** (-3.712)	-0.326** (-3.712)	-0.326** (-3.712)
Constant	-0.003 (-1.007)	-0.001 (-0.258)	0.002 (0.95)
Δ[ln(p_shopping)-ln(p_other)]	0.008 (0.12)	0.017 (0.814)	0.005 (0.135)
Δ[ln(p_hotels)-ln(p_other)]	0.017 (0.814)	0.017 (0.91)	-0.019 (-1.895)
Δ[ln(p_meals)-ln(p_other)]	0.005 (0.135)	-0.019 (-1.895)	0.143* (2.515)
Δln(x/P)	-0.027 (-0.984)	-0.008 (-0.306)	0.003 (0.194)
Dummy-2003	0.096** (6.408)	-0.047** (-3.426)	-0.021** (-2.913)
R squared	0.690	0.433	0.460
DW statistic	1.456	2.082	1.455

Note: * and ** indicate that the statistic is significant at the 5% and 1% levels, respectively; figures in parentheses are *t*-statistics.

3.8.3 Elasticity analysis

Different demand elasticities are calculated based on the discussion in Section 3.6. It is found that the values of all expenditure elasticities are greater than zero (see Table 3.4). This is consistent with consumer demand theory, which holds that the quantity of tourism products demanded increases when the total expenditure budget increases. In the long run, hotel accommodation is considered as a great luxury, with an expenditure elasticity greater than one, whereas shopping and meals outside hotels are considered as neccesities by tourists, with expenditure elasticities less than one. The finding that shopping is considered necessary indicates that Hong Kong is viewed by tourists as an ideal shopping destination. Regarding the short-run cases, it is found that the expenditure elasticities of the three tourism products are similar, with values around one. This indicates that in the short run, the levels of tourist expenditures on shopping, hotel accommodation and meals outside hotels will increase in parallel with an increase in the total expenditure budget.

Table 3.4 Calculated expenditure elasticities

	Long-run AIDS model	Short-run AIDS model
Shopping	0.916**	0.948**
Hotel accommodation	1.199**	0.972**
Meals outside hotels	0.825**	1.022**

Note: ** indicates that the statistic is significant at the 1% level.

The compensated price elasticity is based on the assumption that real expenditure is constant over time. Table 3.5 presents the compensated price elasticities in the long- and short-run models. The own-price elasticities of shopping and hotel accommodation are significant, with negative values in both models. This means that the expenditure on those tourism goods and services will increase when the total expenditure budget increases (the own-price elasticity of demand for meals outside hotels is positive but is not discussed because of its statistical insignificance). The own-price elasticity of demand for shopping in the short-run model is higher than that in the long-run model, with values of -0.466 and -0.341, respectively, which means that in the short run, shopping is more sensitive to a price change than in the long run (equilibrium state). It is observed that tourists are comparatively more sensitive to a price change in hotel accommodation, with own-price elasticities of 0.623 in the long-run model and -0.665 in the short-run model, respectively. This means that in the short run, when the price of shopping increases by 10%, tourist expenditure on it will decrease by 4.66%, whereas when the price of hotel accommodation increases by 10%, tourist expenditure on it will decrease by 6.65%. It is thus concluded that pricing strategies will be more effective for Hong Kong's hotel sector than its retail sector.

Considering the calculated cross-price elasticities, the substitution between shopping and hotel accommodation is significant, with positive cross-price elasticities. The cross-price elasticity of shopping for hotel accommodation is 0.305, which means that when the price of hotel accommodation increases by 10%, the demand for shopping will increase by 3.05%. It is noted that the demand for hotel accommodation is more sensitive to the price change of shopping than the other way round, with cross-price elasticities of 0.581 and 0.305, respectively. Shopping and meals outside hotels are also identified as substitutes, and the demand for meals outside hotels is more sensitive to the price change of shopping than the other way round, with cross-price elasticities of 1.021 and 0.233, respectively. This implies that restaurants whose revenues rely largely on tourists should pay much attention to the price change of hotels.

In the short run only, a substitution relationship between shopping and hotel accommodation is identified. It is found that significant long-run cross-price elasticities are similar to their short-run counterparts.

Table 3.5 Compensated price elasticities in the long-run and short-run AIDS models

	Shopping	Hotel accommodation	Meals outside hotels
Long-run AIDS model			
Shopping	-0.341**	0.305**	0.233*
Hotel accommodation	0.581**	-0.623**	-0.064
Meals outside hotels	1.021*	-0.147	1.161
Short-run error-correction AIDS model			
Shopping	-0.466**	0.304**	0.128
Hotel accommodation	0.579**	-0.665**	0.049
Meals outside hotels	0.561	0.113	0.328

Note: * and ** indicate that the statistic is significant at the 5% and 1% levels, respectively.

3.8.4 Conclusion

In this pilot study, the consumption patterns of Hong Kong inbound tourists are modelled. The long-run and short-run AIDS models are employed to reflect respectively the long-run equilibrium and short-run adjustment of the tourism demand system. Three major tourist expenditure categories are studied: shopping, hotel accommodation and meals outside hotels. In both the long-run and short-run models, homogeneity and symmetry are imposed, consistent with demand theory. With regard to the restricted models, the error-correction term in the short-run AIDS model is significant at the 1% level, with an estimated self-adjustment parameter of -0.326.

The calculated expenditure elasticities indicate that hotel accommodation is viewed by Hong Kong inbound tourists as a luxury in the long run. This implies that compared with shopping and meals outside hotels, the demand for hotel accommodation is relatively more expenditure elastic. Therefore, a diversified marketing strategy for different tourism products would be appropriate. With respect to the compensated price elasticities, tourists are more sensitive to the price change of hotel accommodation than that of shopping in both the long and the short run. As for the cross-price elasticities, shopping is identified as a substitute for hotel accommodation and meals outside hotels in the long-run model. The demands for hotel accommodation and meals outside hotels are more sensitive to the price change of shopping than the other way round. Therefore, the hotel and restaurant sectors would benefit from paying more attention to price changes in the retail sector. In the short-run model only, a substitution relationship is identified between shopping and hotel accommodation. The cross-price elasticities are similar to the long-run ones, which indicates that the short-run system is currently in equilibrium.

3.9 Chapter summary

Because of the disadvantages of single-equation approaches and other system models, the AIDS model combined with the TVP technique is advanced for tourist consumption behaviour analysis. In this chapter, different forms of the

AIDS model are discussed in detail. The basic AIDS model, which is capable of reflecting the long-run equilibrium of the tourism demand system, is introduced first in terms of its specification, theoretical restrictions and advantages. As the basic AIDS model cannot capture the short-run characteristics of consumer behaviour, error-correction terms are imposed and variables are differenced in the model. Most of the existing AIDS models have been estimated using constant-parameter methods, the underlying assumption being that the model parameters are constant over time. However, this assumption does not correspond to the real-life behaviour of consumers. As a result, both the long-run and short-run AIDS models are combined with the TVP technique to account for changes of tourist consumption patterns over time. The tests for theoretical restrictions are also discussed, including the homogeneity and symmetry tests and joint test of homogeneity and symmetry. Consistent with consumer demand theory, the homogenous and symmetric versions of the long-run and short-run error-correction TVP-AIDS models are estimated, and will be applied in the analysis of tourist expenditure on a number of tourism goods and services in Chapter 6. This will help fill the gap in the existing literature from both the methodological and empirical perspectives.

The relative demand elasticities, including the expenditure, own-price and cross-price elasticities, are calculated with the developed models. The expenditure elasticity reflects the sensitivity of tourism demand (measured by expenditure allocation amongst different tourism products) to changes in consumer expenditure. Specifically, an expenditure elasticity greater than unity indicates that the product is a luxury one, whereas an expenditure elasticity less than unity means that the product is a necessity. The uncompensated price elasticity explains how a change in the price of one tourism product affects the demand for this product and other products in the system holding total expenditure and the prices of all other goods and services constant. The compensated price elasticity assumes that real expenditure is constant. A negative compensated cross-price elasticity indicates that the two tourism products considered are complementary whereas a positive one implies that the two products are substitutes for each other.

A pilot study, which is presented at the end of the chapter, employs a long-run AIDS model and a short-run error-correction AIDS model to examine tourist expenditure patterns in Hong Kong. Three expenditure categories, including shopping, hotel accommodation and meals outside hotels, are analysed. The homogeneity and symmetry restrictions are tested, and it is found that the homogeneity assumption is satisfied in both models, but that the symmetry and joint homogeneity and symmetry assumptions are not satisfied. Consistent with demand theory, homogeneity and symmetry are imposed on the models for estimation. The calculated expenditure elasticities indicate that hotel accommodation is considered a greater luxury amongst inbound tourists than either shopping or meals outside hotels. Shopping is identified as a substitute for hotel accommodation and meals outside hotels in the long-run model. Different cross-price elasticities imply that a flexible pricing policy for these tourism products should be adopted to enhance Hong Kong's competitiveness as an international tourist destination.

The pilot study focuses on overall inbound tourism expenditure in Hong Kong. However, tourists from different origins may demonstrate different consumption patterns. Therefore, applying the AIDS model to different source markets would provide useful information for decision makers. The main empirical study, which is presented in Chapters 5 and 6, conducts expenditure analysis of the top eight tourist origins, including Australia, mainland China, Japan, South Korea, Singapore, Taiwan, the UK and the US. For each system, both the long-run AIDS and the short-run error-correction AIDS models are studied using both the constant-parameter and TVP approaches, which enables the examination of the evolution of tourist consumption behaviour over time.

CHAPTER 4 HONG KONG INBOUND TOURISM DEMAND: OVERVIEW AND DESCRIPTION OF THE DATA

4.1 Introduction

As discussed in Section 2.2, tourism has become a global phenomenon and will continue to have a profound impact on the world economy in general and domestic economies in particular. Hong Kong, as a popular international tourism destination, hugely benefits from its tourism industry. In this chapter, demand for international tourism in Hong Kong by major source markets is discussed. The properties of tourism demand and various explanatory variables employed in the empirical study are examined from a statistical perspective. Unit root tests are then conducted for all of the time series used. The results provide statistical evidence for the specification of the dynamic AIDS models in the following two chapters.

4.2 Hong Kong’s major inbound tourism source markets

Visitor arrivals and tourist expenditure are the two most frequently used measures of tourism demand for a destination. Figure 4.1 shows the historical trend in total visitor arrivals to Hong Kong from 1985 to 2008. An increasing trend is observed over this period, apart from the time of the Asian financial crisis (1997-1998) and SARS epidemic (2003). An average annual growth rate of 9.1% is recorded over the whole sample period.

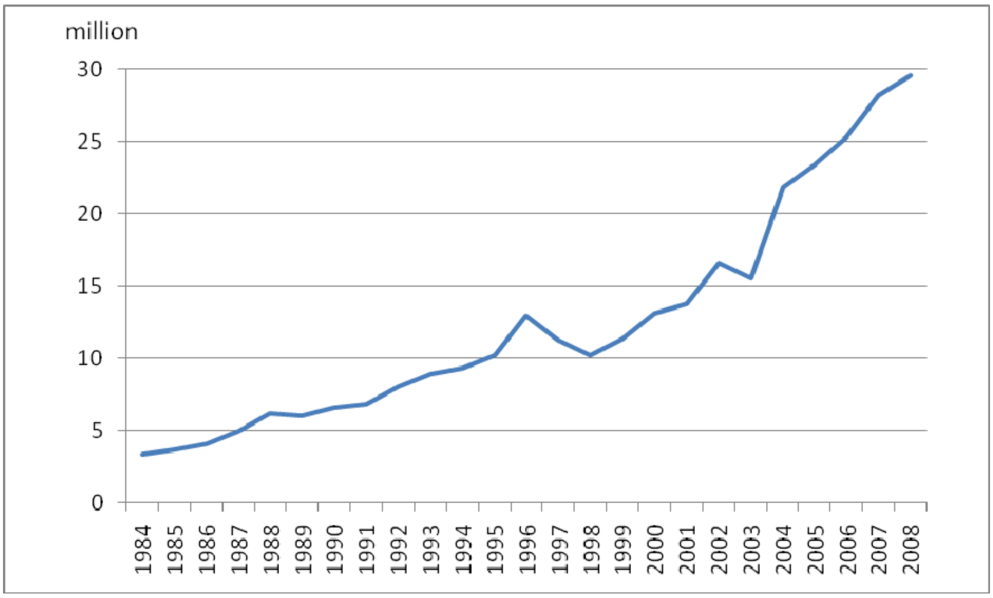

Figure 4.1 Total visitor arrivals to Hong Kong

In 2008, total tourist expenditure in Hong Kong is HKD 94.21 billion (HKTB, 2009). Figure 4.2 depicts the distribution of tourist expenditure by source market based on 2008 data. It shows that mainland China is the largest market, with a share of 56.5% of total expenditure. Other top markets include Australia, Japan, South Korea, Singapore, Taiwan, the UK and the US, which together account for 24.4% of the overall tourist expenditure in Hong Kong.

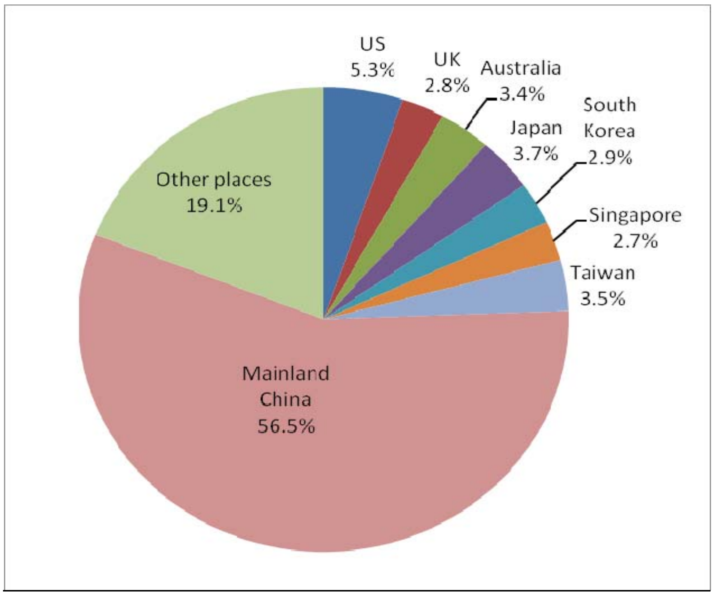

Figure 4.2 Distribution of Hong Kong tourism expenditure in 2008

4.2.1 Mainland China

Mainland China is currently Hong Kong's largest tourist source market. Since the handover of Hong Kong from the UK to China in 1997, increasing numbers of Chinese tourists have visited Hong Kong. The launch of an outbound travel policy in 2003 by the Chinese government, namely, the individual visit scheme (IVS), allowed mainland Chinese individuals from certain cities and regions to visit Hong Kong and Macau. Previously, mainland Chinese could not visit Hong Kong as individuals but had to join tour groups organised by authorised Chinese travel agencies. The IVS resulted in an immediate surge in the number of mainland Chinese visitors to Hong Kong. By 2008, the IVS had been extended to 49 mainland Chinese cities. In that year, visitor arrivals from mainland China reach 16.86 million, accounting for 57.1% of total arrivals in Hong Kong. They spent HKD 53.24 billion, equivalent to 56.5% of total tourist expenditure in Hong Kong. This market continues to grow. Given its great contribution to Hong

Kong's tourism industry, this market should be examined in detail to gain a better understanding of the unique consumption behaviour of these tourists.

Figure 4.3 indicates the distribution of spending in Hong Kong by mainland Chinese tourists. They spend a considerably large proportion of their budget on shopping, but relatively small proportions on hotel accommodation and meals outside hotels. The figure shows that this gap continues to widen slightly. In 2008, Chinese tourist expenditure on shopping reaches 71.46% of the total, which is much greater than that of either hotel accommodation (11.61%) or meals outside hotels (9.51%). It is therefore concluded that shopping is the main reason that mainland Chinese tourists visit Hong Kong. Therefore, the Hong Kong retail industry should develop marketing strategies targeting these tourists.

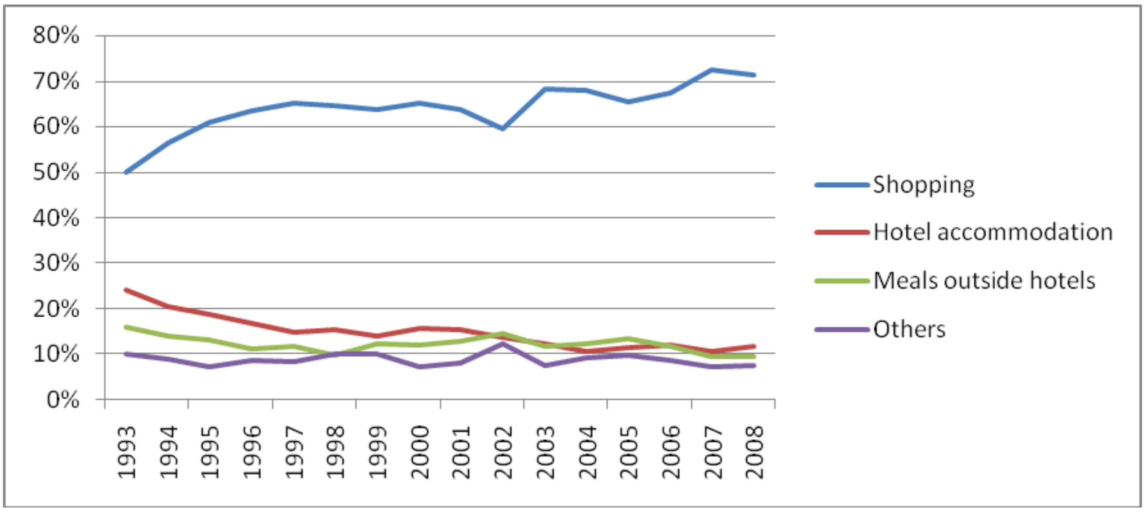

Figure 4.3 Expenditure allocation of mainland Chinese tourists

4.2.2 Australia

In 2008, Australian tourist expenditure is HKD 3.22 billion, accounting for 3.42% of total tourist expenditure in Hong Kong. Australia represents the fifth largest market and the second largest non-Asian source market (following the US) of Hong Kong inbound tourism. Figure 4.4 presents the composition of Australian tourist expenditure on different categories of goods and services. Before 1993, Australian tourists spend more on shopping than on hotel accommodation, whereas from 1994 to 2002, the situation is reversed. From 2003, the situation changes again, and Australian tourists spend more on shopping. However, in 2008, Australian tourists spend almost equal amounts on shopping and hotel accommodation (38.4% and 38.1%, respectively). Expenditure on meals outside hotels is consistently low, representing about 13.0% of total expenditure in 2008.

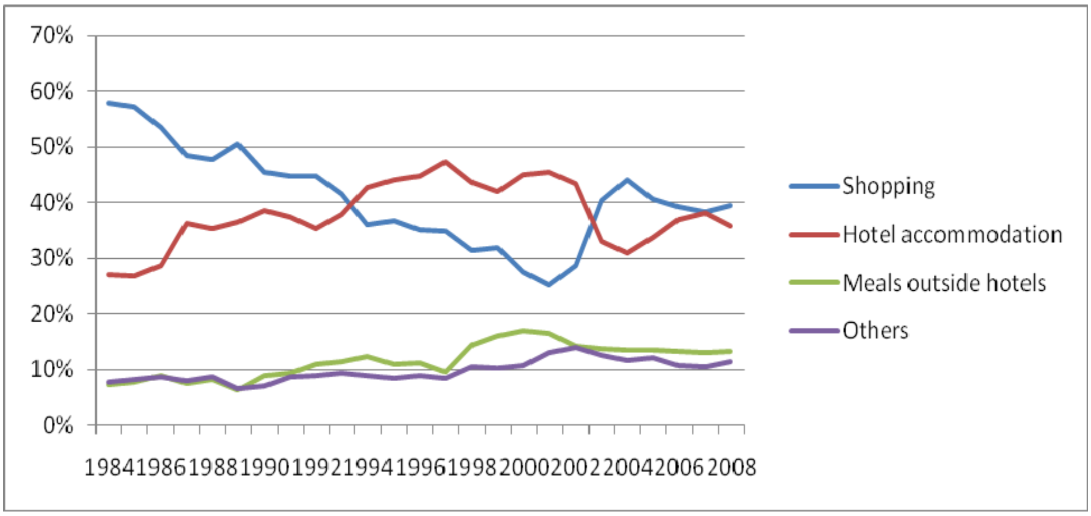

Figure 4.4 Expenditure allocation of Australian tourists

4.2.3 United Kingdom

In 2008, UK tourist expenditure is HKD 2.67 billion, accounting for 2.83% of total tourist expenditure in Hong Kong. Figure 4.5 shows that over the study period, expenditure on hotel accommodation is consistently higher than that on shopping, which is different from the spending behaviour of Australian tourists. Expenditure on meals outside hotels is also consistently lower than that of either shopping or hotel accommodation over the whole sample period. In 2008, UK tourists spend HKD 629.25 million on shopping, HKD 1224.46 million on hotel accommodation and HKD 472.11 million on meals outside hotels, which account for 23.56%, 45.85% and 17.68% of total expenditure, respectively.

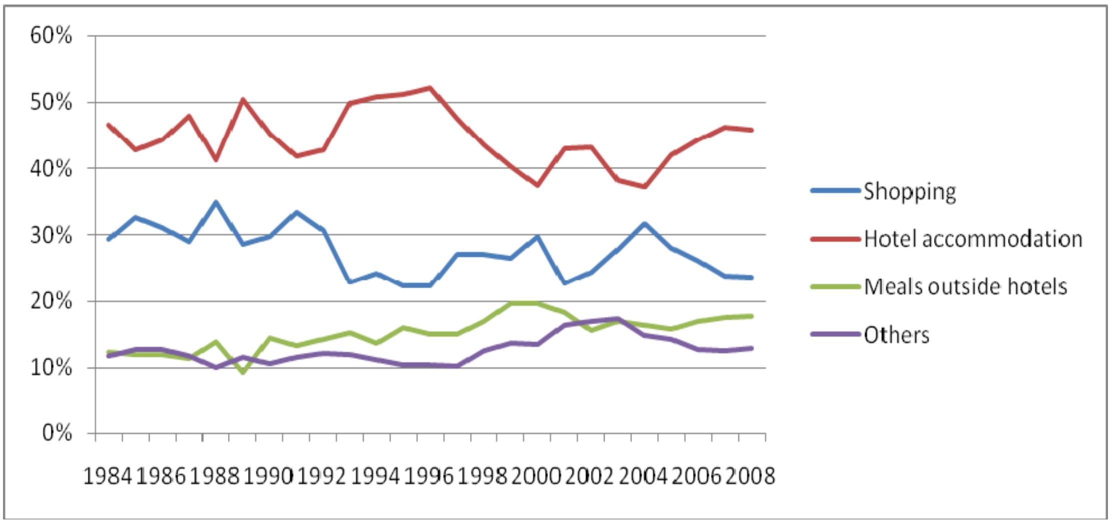

Figure 4.5 Expenditure allocation of UK tourists

4.2.4 United States

According to tourist expenditure data for 2008, the US is Hong Kong's second biggest source market, second only to mainland China. American tourist expenditure in 2008 is HKD 4.95 billion, accounting for 5.26% of total tourist expenditure in Hong Kong. Figure 4.6 presents the composition of tourist expenditure on different categories of goods and services by American tourists. Since 1989, American tourists have consistently spent the most on hotel accommodation, followed by shopping and meals outside hotels. Expenditure on shopping by American tourists shows a decreasing trend over the sample period. More recently, the gap between shopping and hotel accommodation expenditures has been widening. This can be explained by the economic crisis during 2008-2009, which has been described as the worst economic crisis since the Great Depression. The impact of this crisis on the US has been enormous. Shopping, which is normally treated by these tourists as a luxury, decreases substantially in this period. Figure 4.6 also shows that over the sample period, expenditure on meals outside hotels is less than expenditures on shopping and hotel accommodation, but increases slightly. In 2008, the shares of total expenditure of shopping, hotel accommodation and meals outside hotels are 21.25%, 51.64% and 16.15%, respectively.

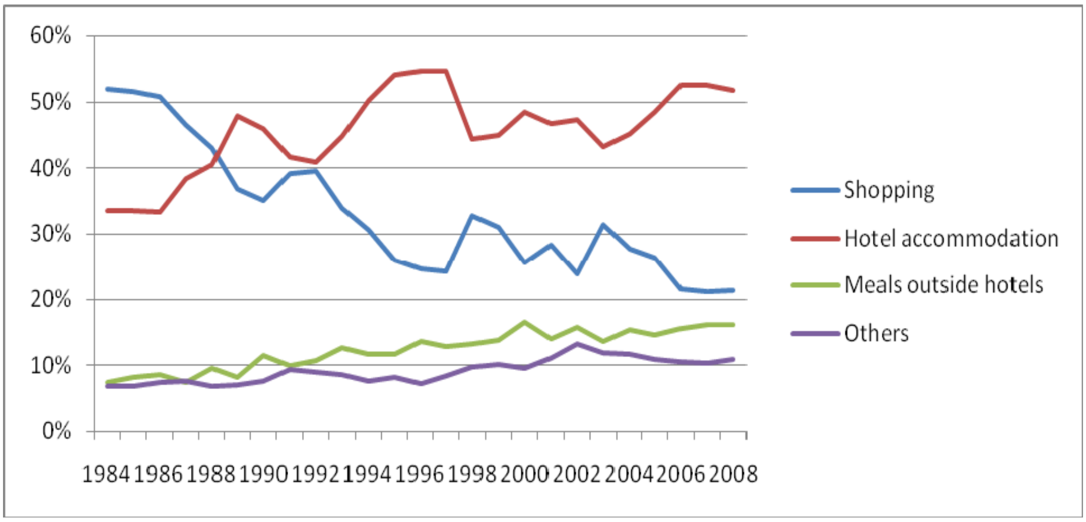

Figure 4.6 Expenditure allocation of American tourists

4.2.5 Japan

Tourism data for 2008 show that, following mainland China, Japan is the second biggest Asian source market of Hong Kong inbound tourism. Japanese tourist expenditure is HKD 3.50 billon in 2008, with a market share of 3.72%. Figure 4.7 shows that over the study period, the greatest expenditure is on shopping, followed by hotel accommodation and meals outside hotels. The share of expenditure on shopping decreases over time whereas that on hotel accommodation increases. Therefore, the gap between the expenditures on these two categories is narrowing. The expenditure shares of these two categories in 2008 are 37.83% and 35.72%, respectively. Similar to the other markets, expenditure on meals outside hotels holds the lowest share.

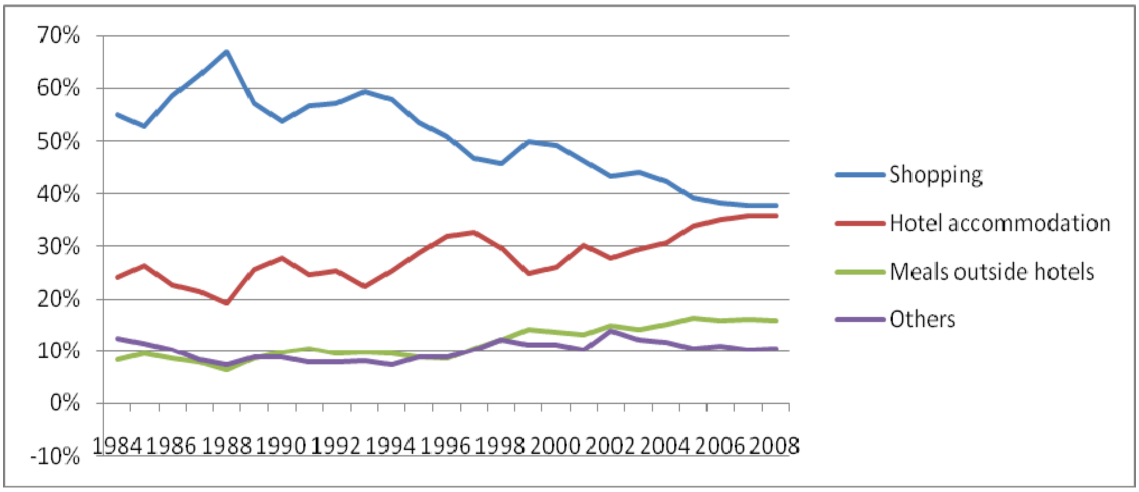

Figure 4.7 Expenditure allocation of Japanese tourists

4.2.6 South Korea

South Korea is the sixth biggest source market of Hong Kong inbound tourism, with a total tourist expenditure of HKD 2.76 billion in 2008, which represents 2.93% of the total tourism demand. The expenditure of South Korean tourists on shopping in Hong Kong is consistently higher than that on hotel accommodation, with only one exception (1998), which is mainly due to the Asian financial crisis. During the economic downturn, South Korean tourists cut their budget on shopping, which is generally regarded as a luxury. In contrast to Japan, no clear trends in consumption behaviour are observed over the study period. In 2008, of their total expenditure, South Korean tourists spend 50.85%, 23.87% and 13.39% on shopping, hotel accommodation and meals outside hotels, respectively.

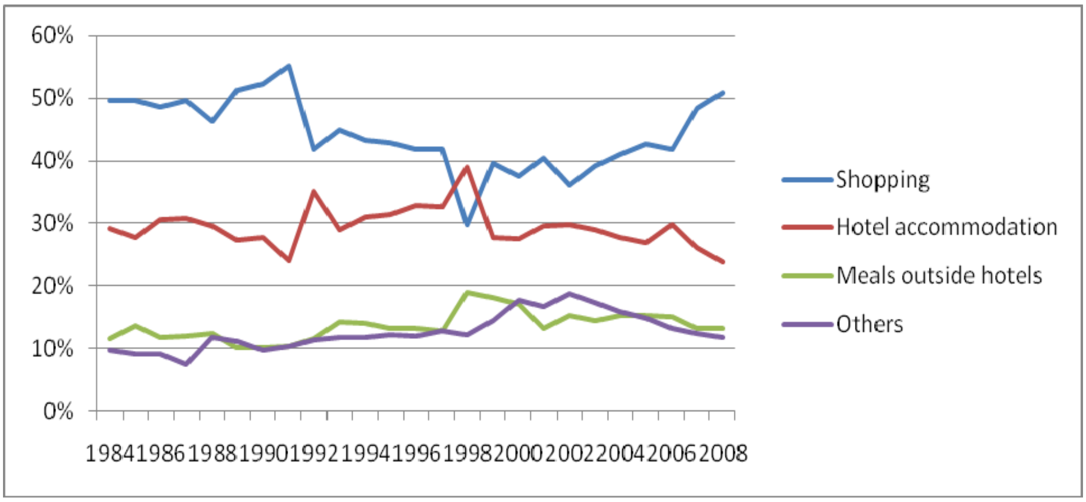

Figure 4.8 Expenditure allocation of South Korean tourists

4.2.7 Singapore

Singapore is Hong Kong's eighth biggest inbound tourism source market (HKD 2.57 billion), with a share of 2.73% of total tourist expenditure in 2008. In contrast to their Japanese and South Korean counterparts, Singaporean tourists spend relatively equal amounts on shopping and hotel accommodation, with no obvious trend in expenditures on these products (see Figure 4.9). In 2008, South Korean tourists spent 41.08%, 33.78% and 14.71% of their total expenditure on shopping, hotel accommodation and meals outside hotels, respectively.

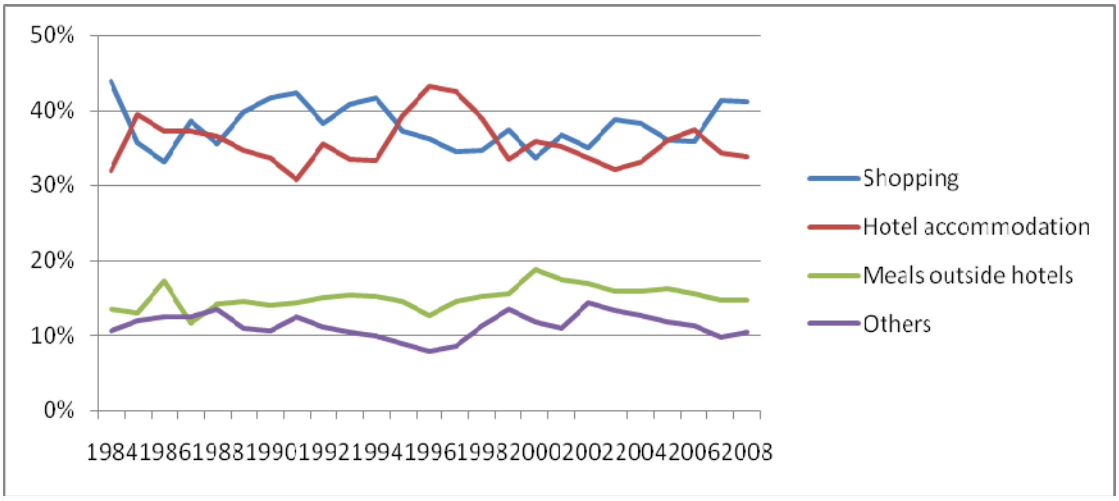

Figure 4.9 Expenditure allocation of Singaporean tourists

4.2.8 Taiwan

Based on tourist expenditure data for 2008, Taiwan is the fourth biggest source market of Hong Kong's inbound tourism industry, behind mainland China, the US and Japan. Figure 4.10 indicates that Taiwanese tourists spend a large portion on shopping, similar to mainland Chinese tourists but in contrast to the other short-haul tourists discussed above. Taiwanese tourists spend slightly more on hotel accommodation than on meals outside hotels, like their mainland Chinese counterparts. In 2008, Taiwanese tourists spent 54.51%, 22.22% and 12.99% of their total expenditure on shopping, hotel accommodation and meals outside hotels, respectively.

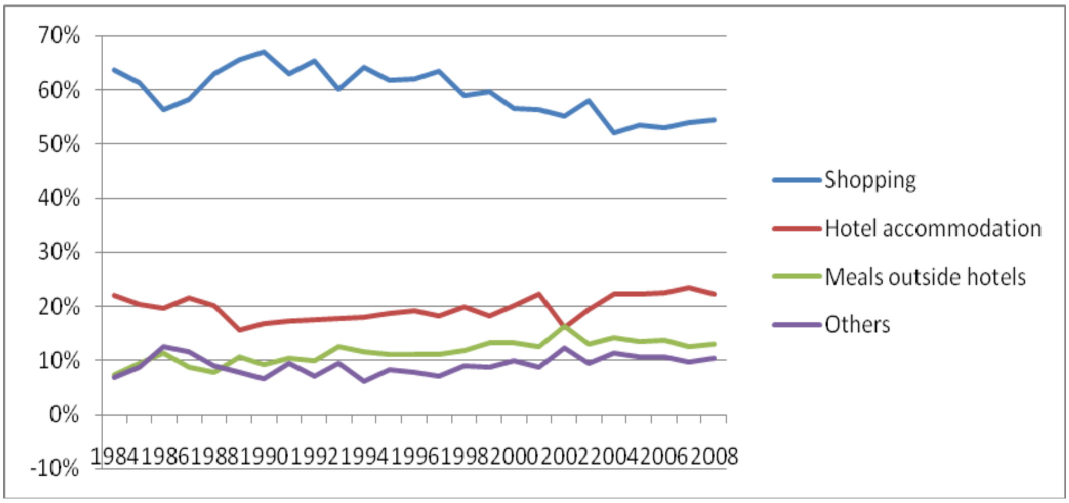

Figure 4.10 Expenditure allocation of Taiwanese tourists

4.2.9 Common consumption patterns

The common patterns of tourist consumption are summarised across the key source markets discussed above. The expenditure shares of shopping and hotel accommodation, which are regarded more as luxuries, are subject to more frequent and greater fluctuations, which are linked to the economic situation in the source market. The expenditure shares of meals outside hotels, which are more likely to be regarded as necessities, are much more stable over time, regardless of the economic performance of the source markets.

4.3 Determinants in tourism demand systems

The AIDS model is a system-of-equations model in which the dependent variables are the tourist expenditure shares of all tourism goods and services considered in the system. As the AIDS model is derived based on economic demand theory, the inclusion of the determinant variables in the system strictly follows the theory. As discussed in Chapter 3, the determinant variables in the AIDS model include real expenditure per capita, the prices of all tourism products and dummy variables, if necessary.

4.3.1 Real expenditure per capita

All expenditure data are transferred into the per capita form as suggested by Deaton and Muellbauer (1980) for model estimation. The HKTB releases the annual per capita expenditure data on the following categories of goods and services: shopping, hotel accommodation, meals outside hotels, entertainment, tours and other. However, as the price indices on entertainment and tours are unavailable, these two categories are incorporated into the "other expenditures" group. Therefore, a total of four categories of tourism goods and services are discussed in this study: shopping, hotel accommodation, meals outside hotels and other expenditures.

The real expenditure per capita in the AIDS model is defined by Deaton and Muellbauer (1980) as $log\frac{x}{P}$ where x is the total expenditure per capita and P is the aggregate price index. As discussed in Chapter 3, although the Stone price index is the most frequently used method to approximate the aggregate price index P in the AIDS model, the Tornqvist price index is applied in this study given its superiority over the former one. Figure 4.11 describes the real expenditure per capita for each of the eight source markets. In general, slight decreasing trends are identified. This may be attributable to the reduction in the length of stay of tourists in Hong Kong, due to the development of new transport technologies and the decrease in travel costs. It could also be explained by the fact that Hong Kong increasingly plays the role of transition destination.

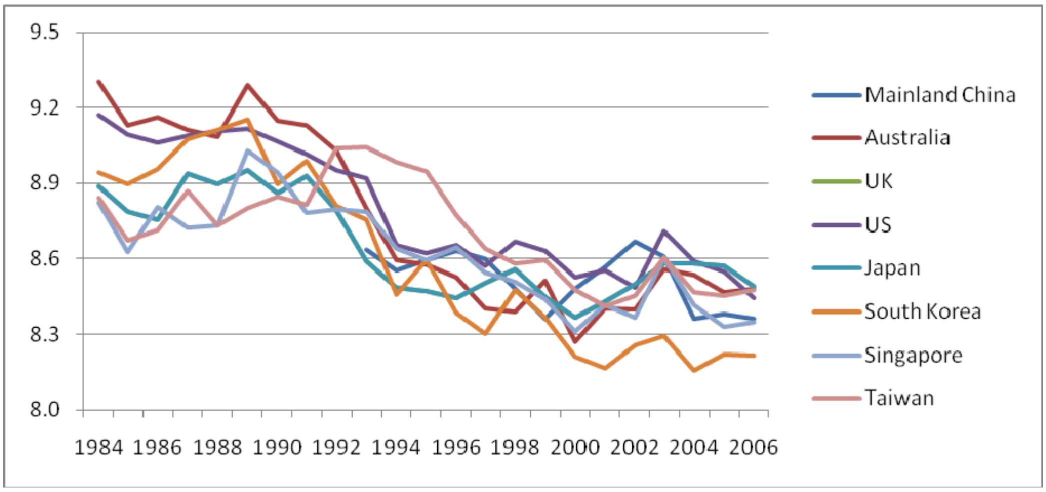

Figure 4.11 Real expenditure per capita for all source markets

4.3.2 Tourism price index for shopping

Shopping is the largest inbound tourist spending category. In 2008, of tourist expenditure of HKD 94.21 billion, shopping accounts for 53.96 billion, or 57.3% of total expenditure. On average, tourist spending per capita on shopping during 2008 in Hong Kong is HKD 3,116. Figure 4.12 presents the tourist expenditure per capita on shopping in 2008 by source market. Mainland Chinese tourists spend the most on shopping (HKD 4,056 per capita). Two long-haul source markets, the UK and the US, spend the least on shopping per capita (HKD 1,347 and HKD 1,257, respectively), followed by Japanese tourists (HKD 1,622 per capita). The remaining four source markets spend between HKD 2,000 and HKD 3,000 per capita on shopping.

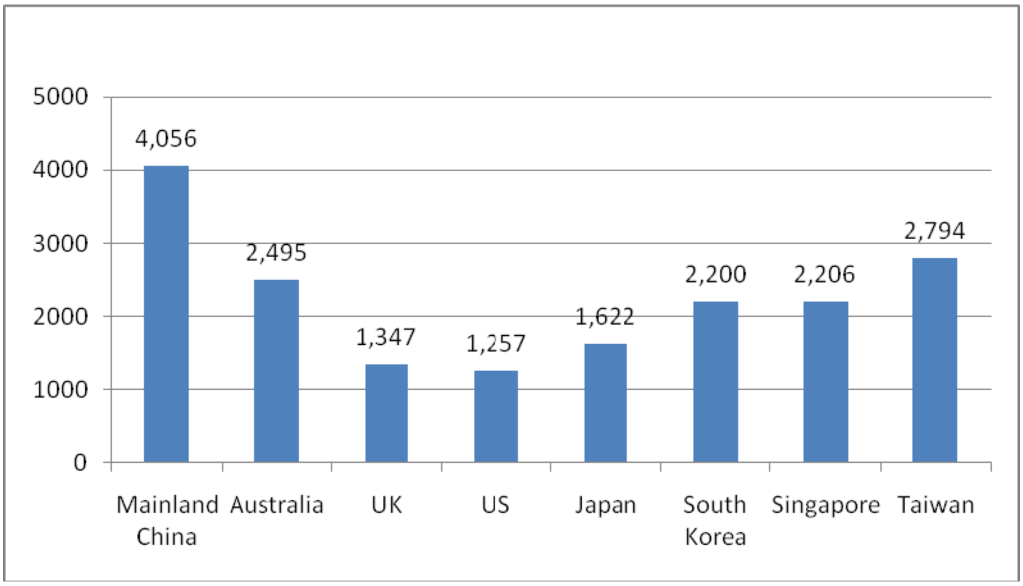

Figure 4.12 Per capita spending on shopping for all source markets in 2008

Unit: HKD

The direct price index of shopping by tourists in Hong Kong is not available. Hence, it is constructed by aggregating the prices of relevant sub-categories reported by the Hong Kong Census and Statistic Department when compiling the Hong Kong consumer price index.

The HKTB (2009) gives details of the main products and their shares of tourist spending in Hong Kong. The four main products that inbound tourists purchase include: (1) clothing and footwear, (2) jewellery, (3) watches, cameras and optical, and (4) cosmetics and personal care products. Therefore, the prices for these four products are identified from the sub-categories of the Hong Kong consumer price index. The tourism price index of shopping is then constructed as

$$P_{shopping} = \sum_{i} (price_i \times weight_i), \tag{4.1}$$

where $i = 1,...,5$ refers to the price indices for five categories: clothing and footwear; jewellery; watches, cameras and optical; cosmetics and personal care products; and all other retail items. The price index for other retail items is approximated using the retail price index published annually by the Hong Kong Census and Statistics Department. $weight$ is calculated using the expenditure shares of these five categories based on total retail expenditure by Hong Kong inbound tourists. Although the shopping behaviours of the tourists from the eight source markets differ, because of data unavailability, the same tourism price index for shopping is employed for the eight demand systems.

4.3.3 Tourism price index for hotel accommodation

The room rate is traditionally employed as a proxy of the price index for hotel accommodation. Four types of hotel accommodation are identified in Hong Kong: high tariff A hotels, high tariff B hotels, medium hotels and tourist guesthouses. This classification is based on a composite score for each hotel by weighting the scores of a list of indicators, such as facilities, location and achieved room rate. The room rates for these four types of accommodation are reported by the Hong Kong Hotels Association from 1984 to 2002 and by the HKTB from 2004 to 2008. Figure 4.13 presents the achieved hotel room rates for these four hotel categories. As seen from the figure, the root rates reach a peak in 1996-1997 and then stay relatively low from 1998 to 2003. Then, a slight increasing trend can be observed. In 2008, the achieved room rates in Hong Kong dollars are \$2,106, \$974, \$586 and \$352, respectively.

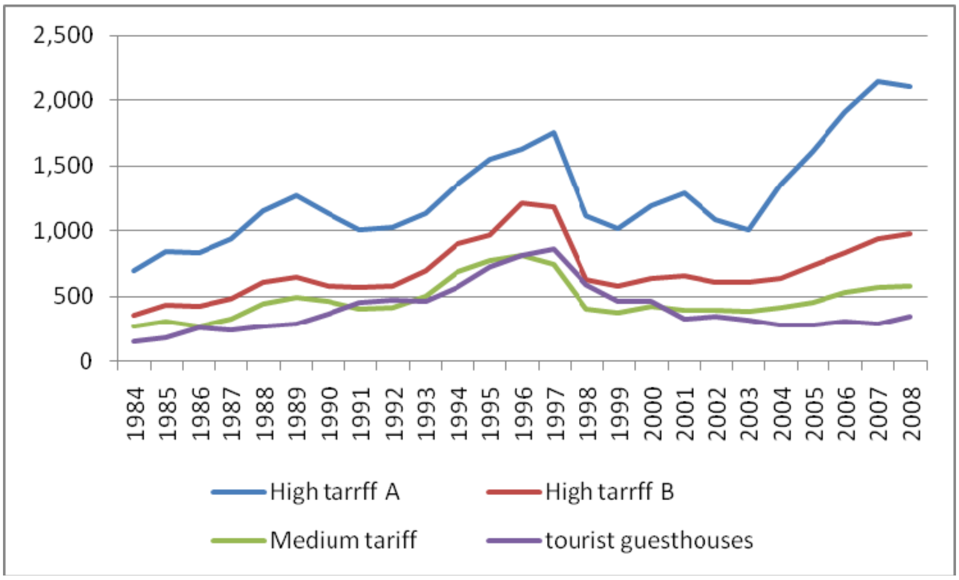

Figure 4.13 Achieved hotel room rates for the four categories of hotels

Unit: HKD

The overall room rate for the Hong Kong hotel industry is calculated using the weighted average of the room rates of the four tourist accommodation types. The numbers of rooms occupied by tourists from different source markets are used for the weighting. The calculation is specified as follows:

$$P_{hotel_i} = \frac{\sum_j (room\ rate_j \times room\ number_j \times occupancy\ rate_j \times toruist\ share_{ij})}{\sum_j (room\ number_j \times occupancy\ rate_j \times toruist\ share_{ij})}, \quad (4.2)$$

where i refers to the i th tourist source market; j denotes the jth hotel accommodation type and $j = 1,...,4$; *room rate* is the number of rooms available in Hong Kong for each hotel type; the *occupancy rate* is the corresponding occupancy rate for each hotel type; and $tourist\ share_{ij}$ indicates the weight of tourists from the ith source market amongst all tourists staying in the jth hotel category. Consequently, for each tourist source market, the relative overall price index for hotel accommodation is constructed. It is noted from Equation 4.2 that the price index for hotel accommodation for a given source market is a composite index weighted by the number of rooms occupied by tourists from this source market. This reflects the real price change of one room of the hotels considered, but not that of one tourist. By using a hotel room as the calculation unit, the definition of the price index is consistent.

It is reported by the HKTB that tourists from different markets prefer different types of hotels. Figure 4.14 shows hotel preference by source market using data from 2006. For example, mainland Chinese tourists are most likely to choose medium-tariff hotels and least likely to choose high-tariff A hotels. American, Japanese and Singaporean tourists choose high-tariff A hotels the most often and guesthouses the least. It is interesting to see that relatively large portions of Australian and South Korean tourists choose tourist guesthouses when travelling to Hong Kong. This is probably because of the relatively high proportion of young travellers from these countries, who are faced with tight budget constraints and tend to choose cheaper accommodation.

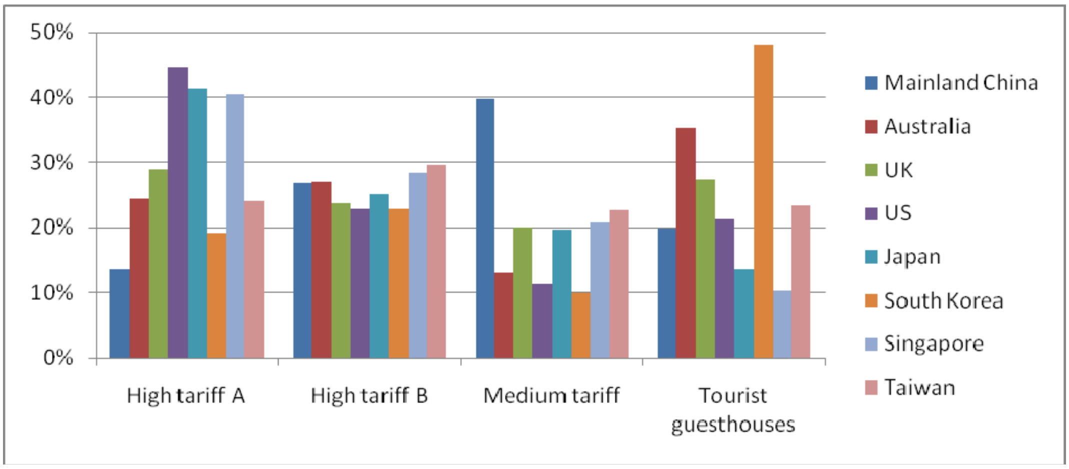

Figure 4.14 Tourist preferences for different hotel types using data from 2006

Given the limited data availability, the weighted price indices of hotel accommodation are calculated separately for each source market. Figure 4.15 presents these indices in the sample period for model estimation, which are first computed based on data from 2000 and then transformed into logarithm form. Although slightly different across the eight source markets, the calculated price indices show similar trends over the sample period. Before 1997, there is an increasing price trend in hotel accommodation. From 1998 to 2003, the hotel industry in Hong Kong experiences a tough period and the price decreases considerably. This reflects the postponed impact on the Hong Kong hotel industry of the Asian financial crisis in 1997-1998. The SARS outbreak in 2003 also badly affects the industry.

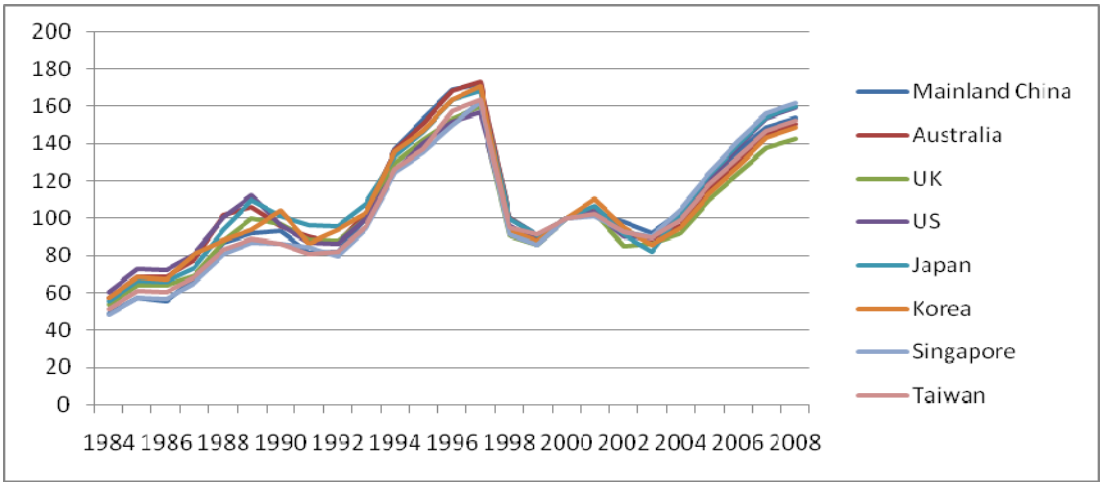

Figure 4.15 Tourism price indices of hotel accommodation for the eight source markets

Year 2000 = 100

4.3.4 Tourism price index for meals outside hotels

No formal data are available on tourist meal expenditure in Hong Kong. To overcome this problem, an appropriate proxy has to be identified to represent the price index for meals outside hotels. The Hong Kong Census and Statistics Department compiles a sub-category, namely, the price index of meals outside taken by Hong Kong residents, when compiling the Hong Kong consumer price index. This is used to represent the price index for meals outside hotels taken by Hong Kong inbound tourists following the suggestion of Martin and Witt (1987), who argued that in the absence of price indices for tourists, domestic price indices could be used as proxies. Also, tourists from different source markets may have unique preferences regarding different types of restaurants, and hence the price indices for different tourists may not be the same. In this study, however, the same price series for meals outside hotels are used in the eight systems in model estimation because of data unavailability.

4.3.5 Tourism price index for other expenditures

According to the specification of the AIDS model, a complete system is analysed and all tourism products in this system are included in the modelling process. Therefore, in addition to shopping, hotel accommodation and meals outside hotels, expenditure on other items and the relative price index are required for model estimation. In this study, the consumer price index in Hong Kong is employed as the proxy for the price index of other items with October 1999-September 2000 as the base year, where the price index is equal to 100.

Figure 4.16 illustrates the historical changes in the price indices of shopping, meals outside hotels and other items. Consistent with the model estimation requirements, these indices are all in logarithmic form. They demonstrate similar trends over the sample period, but that of shopping is relatively smoother than the other two.

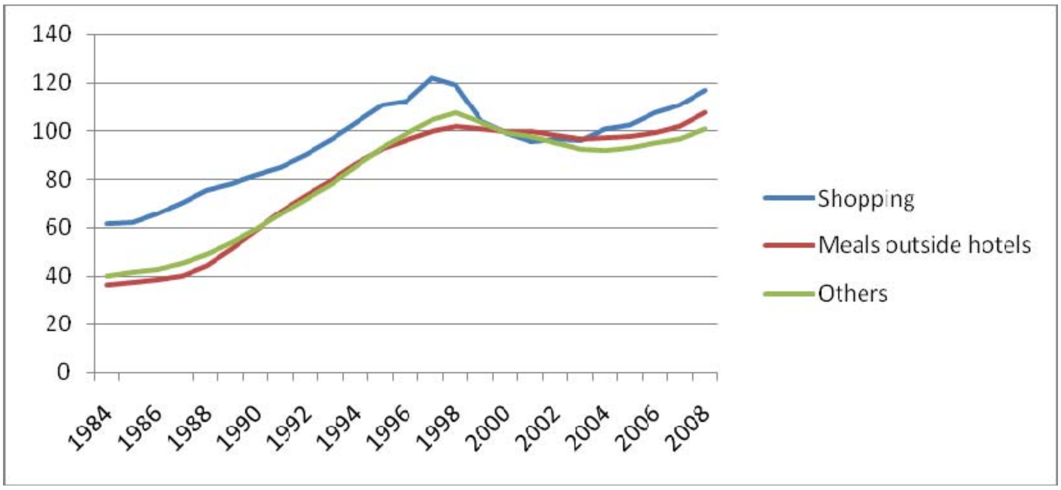

Figure 4.16 Price indices of shopping, meals outside hotels and other expenditures

Oct 1999 - Sep 2000 = 100

4.4 Stationarity tests for variables in the system models

The stationarity of time series is an important issue in econometric modelling. It reflects the property of a time series and hence determines the way that it is modelled. If some time series are not stationary, then the estimation of an econometric model that includes these time series may lead to the problem of spurious regression. Therefore, before the modelling process, stationarity tests need to be conducted. In this study, ADF method of the unit root test is performed for all of the variables included in the AIDS models. Both level variables and first-order differenced variables are tested.

Table 4.1 shows the stationarity test results. In the level form, some variables are non-stationary, whereas others are stationary. For the time series, in the difference level, all of them are stationary at the 5% significance level. In conclusion, amongst all of the time series under consideration, some are stationary without any unit root whereas others are non-stationary with one unit root.

Table 4.1 ADF unit root tests on the variables in the AIDS models

	Mainland China	Australia	The UK	The US	Japan	South Korea	Singapore	Taiwan
w_shopping	1.36	-1.41	-0.62	-2.07*	-1.54	-0.12	-0.4	-0.77
Δ(w_shopping)	-3.54*	-3.44*	-6.11*	-4.64*	-3.96*	-7.42*	-6.78*	-6.65*
w_hotels	-3.09*	0.17	-0.26	0.72	0.65	-0.45	-0.1	0.37
Δ(w_hotels)	-3.29*	-3.91*	-4.15*	-3.85*	-4.46*	-8.08*	-5.41*	-5.86*
w_meals	-1.33	0.38	0.81	2.27	1.23	-0.16	-0.17	0.55
Δ(w_meals)	-4.44*	-5.20*	-8.14*	-9.98*	-4.23*	-4.28*	-8.46*	-7.97*
ln(x/P)	-0.49	-1.41	-1.07	-1.83	-1.14	-1.51	-0.8	-0.98
Δ(ln_x/P)	-3.42*	-5.21*	-4.07*	-5.20*	-3.65*	-5.85*	-6.65*	-5.04*
ln(p_shopping)-ln(p_others)	-1.39	-2.30*	-2.30*	-2.30*	-2.30*	-2.30*	-2.30*	-2.30*
Δ[ln(p_shopping)-ln(p_other)]	-2.87*	-3.00*	-3.00*	-3.00*	-3.00*	-3.00*	-3.00*	-3.00*
ln(p_hotels)-ln(p_others)	-0.72	-0.97	-1.09	-1.56	-0.81	-1.07	-0.88	-0.93
Δ[ln(p_hotels)-ln(p_other)]	-3.06*	-3.70*	-4.11*	-3.57*	-3.79*	-4.38*	-4.12*	-4.02*
ln(p_meals)-ln(p_others)	-0.31	-2.10*	-2.10*	-2.10*	-2.10*	-2.10*	-2.10*	-2.10*
Δ[ln(p_meals)-ln(p_other)]	-2.40*	-3.13*	-3.13*	-3.13*	-3.13*	-3.13*	-3.13*	-3.13*

Note: * denotes significance at the 5% level.

4.5 Chapter summary

It is observed that tourists from the eight source markets exhibit different consumption behaviour patterns in Hong Kong. Amongst Japanese, Taiwanese and mainland Chinese tourists, expenditure on shopping dominates the spending budget over the sample period. For Japanese tourists, the difference in expenditure between shopping and hotel accommodation has been decreasing since the 1980s, but for Taiwanese and Chinese tourists, this difference has not changed significantly. In contrast to the other markets, UK tourists consistently spend the most on hotel accommodation. For Australian, American, South Korean and Singaporean tourists, the largest spending share varies between shopping and hotel accommodation over the period concerned. Meanwhile, meals outside hotels take the smallest share of total expenditures in all cases apart from mainland China, where the gap between meals and hotel accommodation expenditure has been narrowing recently.

The construction of various price indices is discussed, including those for shopping, hotel accommodation, meals outside hotels and other expenditures, which are included in the AIDS models in this study. As tourist price indices are not available in Hong Kong, the relative domestic price indices are employed as a substitute for the tourist ones. Real total expenditure per capita is one determinant variable in the AIDS model. It is constructed using the total expenditure per capita for each source market divided by an aggregate price index, namely, the Tornqvist price index.

Finally, stationarity tests are carried out on all dependent and independent variables in the AIDS models using the ADF test. The results show that amongst the dependent and independent variables, three variables are stationary whereas the remainder have one unit root. These conclusions provide statistical evidence for econometric modelling using the error-correction approach in the following two chapters.

CHAPTER 5 HONG KONG TOURIST CONSUMPTION ANALYSIS: A SYSTEM-OF-EQUATIONS MODEL WITH CONSTANT PARAMETERS

5.1 Introduction

Understanding tourist consumption behaviour is important amongst tourism goods and services providers and policy makers in relation to destination planning and development. This chapter seeks to provide new insights into this area through the use of long-run and short-run AIDS models with constant parameters. The error-correction version of the short-run AIDS model is employed to analyse tourist expenditure allocation amongst different goods and services in Hong Kong. Based on the estimates of eight complete demand systems, the interactions amongst the demands for these goods and services and the demand elasticities are examined.

The research scope is introduced, followed by illustrations of the long-run AIDS models for the eight source markets considered. Stationarity tests are then carried out to test the residuals generated from the long-run AIDS models. The results provide supportive evidence for the establishment of the error-correction AIDS model. Based on the estimation of the error-correction AIDS models, the tourist consumption patterns of the different source markets under study are separately examined and then compared across the markets. The theoretical assumptions of homogeneity and symmetry are also tested for both the long-run and short-run AIDS models.

5.2 Research scope

The long-run AIDS and short-run error-correction AIDS models that are specified in Sections 3.2 and 3.3, respectively, are estimated to analyse tourist budget allocation amongst different tourism goods and services in Hong Kong. Hence, this study is confined to the third stage of the tourist budget allocation process as described in Figure 3.1.

In addition to shopping, hotel accommodation and meals outside hotels, a fourth category, "other expenditures," has to be included to create a complete system, according to the specification of the AIDS model.

As discussed in Chapter 3, Engle and Granger's (1987) two-step modelling procedure is adopted to specify the error-correction AIDS model. This permits gradual adjustments to the equilibrium state in the long run and therefore the short-run consumption behaviour of tourists to be captured.

Eight major source markets are covered in the empirical study, which include five short-haul markets – mainland China, Japan, South Korea, Singapore and Taiwan, and three long-haul markets – Australia, the UK and the US. In each AIDS system, four categories of tourist consumption are examined: shopping, hotel accommodation, meals outside hotels, and other expenditures. The Tornqvist price index, which is introduced in Chapter 3, is used to approximate the aggregate price index P. Annual data from 1984 to 2008 are used to estimate the AIDS models.

5.3 Tourist consumption behaviour in the long run

As discussed in Section 3.2, the long-run AIDS model reflects the long-run equilibrium of tourism demand. The linear specification of the AIDS model takes the form of

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log \frac{x_i}{P} + \sum_k \varphi_{ik} dum_k + \varepsilon_i , \tag{5.1}$$

where w_i (i = 1, 2, 3) is the tourist expenditure shares of shopping, hotel accommodation and meals outside hotels, respectively; p_j (j = 1, 2, 3, 4) is the price index of the product category j; x is the total expenditure on all goods and services in the system; P is the Tornqvist aggregate price index used here to linearise the AIDS model; x/P is the real total expenditure per capita; dum_k is the kth dummy variable, which captures the effect of a one-off event; α_i, β_i, φ_{ik} and γ_{ij} are the parameters to be estimated; and ε_i is a disturbance term. In total, three equations are included in the system estimation process, corresponding to the three main product categories. The fourth equation, which concerns other consumption items, is removed from the model estimation to avoid singularity of the residuals variance-covariance matrix. Equation 5.1 is an unrestricted AIDS model, in which neither the homogeneity nor the symmetry assumption is imposed.

Homogeneity and symmetry are two basic assumptions of demand theory. Consistent with the theoretical requirements, the tourism demand systems examined in this study are subjected to statistical tests of these two assumptions.

Once homogeneity and symmetry are imposed, the long-run AIDS model can be rewritten as

$$\begin{aligned} w_1 = \alpha_1 + \gamma_{11}(\log p_1 - \log p_4) + \gamma_{12}(\log p_2 - \log p_4) + \gamma_{13}(\log p_3 - \log p_4) \\ + \beta_1 \log \frac{x_1}{P} + \sum_k \varphi_{1k} dum_k + \varepsilon_1 \end{aligned} \qquad (5.2a)$$

$$\begin{aligned} w_2 = \alpha_2 + \gamma_{12}(\log p_1 - \log p_4) + \gamma_{22}(\log p_2 - \log p_4) + \gamma_{23}(\log p_3 - \log p_4) \\ + \beta_2 \log \frac{x_2}{P} + \sum_k \varphi_{2k} dum_k + \varepsilon_2 \end{aligned} \qquad (5.2b)$$

$$\begin{aligned} w_3 = \alpha_3 + \gamma_{13}(\log p_1 - \log p_4) + \gamma_{23}(\log p_2 - \log p_4) + \gamma_{33}(\log p_3 - \log p_4) \\ + \beta_3 \log \frac{x_3}{P} + \sum_k \varphi_{3k} dum_k + \varepsilon_3 . \end{aligned} \qquad (5.2c)$$

In the specification of Equations 5.2(a) to (c), the homogeneity restriction is indicated by $\sum_j \gamma_{ij} = 0$ and the symmetry restriction by $\gamma_{ij} = \gamma_{ji}$. Once the long-run AIDS models with and without theoretical restrictions are specified, standard statistical tests (see below) can be applied to test for the two assumptions.

5.3.1 Theoretical restriction tests

An advantage of the system model is that the theoretical assumptions can be formally tested. The method discussed in Section 3.6 is employed for these theoretical tests. The estimation of each system starts with the unrestricted long-run AIDS model. The model is then re-estimated with the homogeneity restriction imposed, and subsequently under both the homogeneity and symmetry restrictions. By comparing the variance-covariance matrices of residuals with and without restrictions, three tests can be carried out for each system. These tests include the homogeneity and homogeneity-based symmetry tests and the joint test for homogeneity and symmetry. The results are provided in Table 5.1. It is found that in the long-run AIDS models, homogeneity cannot be rejected at the 1% significance level, whereas it is found to be rejected in two cases (the UK and the US) at the 5% significance level. Symmetry based on homogeneity is not rejected in most cases, with only one exception (mainland China) at the 5% significance level. Similarly, most models pass the joint test of symmetry and homogeneity, except Australia, the US and mainland China, at the 5% significance level. Theoretically, the assumptions of homogeneity and symmetry are satisfied, but these assumptions do not always hold in empirical studies. This may be because the data used for estimating the system models do not reflect tourist consumption behaviour well, or because of sampling bias when the number of observations for variables is small. Another possible reason for the rejection of this restriction may be the irrational behaviour of tourists in expenditure allocation on overseas travel as a result of information asymmetry. Homogeneity and symmetry are not rejected in the majority of cases. Therefore, both are imposed on each of the systems to be consistent with the theoretical requirement when estimating the models and discussing the findings.

Table 5.1 Homogeneity and symmetry restriction tests for the long-run AIDS models

	Mainland China	Australia	The UK	The US	Japan	South Korea	Singapore	Taiwan
Homogeneity	2.438	2.562	2.677	3.670*	1.013	2.454	1.032	0.004
Symmetry based on homogeneity	1.259	3.681*	0.416	3.001*	1.346	2.143	3.916*	0.183
Homogeneity and symmetry	2.126	3.229*	1.567	3.493**	1.190	2.180	2.533*	0.089

Note: * and ** denote significance at the 5% and 1% levels, respectively.

5.3.2 Summary of the estimation of the long-run AIDS models

Table 5.2 summarises the estimation results of the long-run AIDS models, with both the homogeneity and symmetry restrictions imposed on the systems. The three equations for shopping, hotel accommodation and meals outside hotels are included in the system based on the adding-up assumption. One dummy variable is included in the mainland China model to account for the effect of SARS in 2003. This dummy variable was initially introduced into the other demand systems too, but was deleted because of its statistical insignificance.

Table 5.2 Estimates of the homogeneity- and symmetry-restricted long-run AIDS models

	Mainland China	Australia	The UK	The US	Japan	South Korea	Singapore	Taiwan
Equation (1): shopping								
Constant	3.850**	-0.960**	-0.662*	-1.311**	-1.586**	-0.235	-0.429	-0.718**
	(5.644)	(-2.822)	(-2.072)	(-3.461)	(-10.046)	(-0.81)	(-1.574)	(-2.800)
ln(p_shopping)-ln(p_other)	-0.376*	0.234*	0.085	0.438**	-0.001	-0.015	-0.065	-0.011
	(-2.455)	(2.001)	(1.457)	(4.494)	(-0.014)	(-0.158)	(-1.421)	(-0.220)
ln(p_hotels)-ln(p_other)	0.177**	-0.029	-0.060	-0.188**	-0.046	0.124**	0.031	0.027
	(3.255)	(-0.653)	(-1.901)	(-4.66)	(-1.722)	(2.812)	(1.152)	(0.970)
ln(p_meals)-ln(p_other)	0.023	0.064	-0.040	-0.147**	0.005	0.120*	0.062	-0.067**
	(0.350)	(0.957)	(-0.999)	(-3.662)	(0.204)	(2.057)	(1.593)	(-3.836)
ln(x/P)	-0.378**	0.153**	0.108**	0.184**	0.242**	0.075*	0.095**	0.151**
	(-4.700)	(3.767)	(2.882)	(4.143)	(13.041)	(2.151)	(2.942)	(5.034)
Dummy2003	0.103**							
	(2.938)							
R-squared	0.638	0.827	0.555	0.925	0.913	0.615	0.271	0.628
DW statistic	1.078	0.602	2.322	1.242	1.639	1.439	1.420	1.164
Equation (2): hotel accommodation								
Constant	-1.923**	1.562**	0.826**	1.866**	1.405**	0.628**	0.791**	0.815**
	(-4.011)	(6.738)	(2.766)	(7.766)	(13.91)	(3.637)	(3.148)	(5.142)
ln(p_shopping)-ln(p_other)	0.177**	-0.029	-0.060	-0.188**	-0.046	0.124**	0.031	0.027

	(3.255)	(-0.653)	(-1.901)	(-4.66)	(-1.722)	(2.812)	(1.152)	(0.97)
ln(p_hotels)-ln(p_other)	-0.061	0.076	0.153**	0.159**	0.102**	-0.040	0.047	0.011
	(-1.807)	(1.616)	(4.182)	(4.661)	(4.953)	(-1.065)	(1.497)	(0.483)
ln(p_meals)-ln(p_other)	-0.039	-0.064**	-0.028	0.029	-0.015	-0.079**	-0.049**	-0.009
	(-1.664)	(-3.340)	(-1.794)	(1.92)	(-1.242)	(-3.690)	(-2.688)	(-0.89)
ln(x/P)	0.243**	-0.138**	-0.047	-0.162**	-0.132**	-0.040	-0.053	-0.072**
	(4.308)	(-5.114)	(-1.353)	(-5.84)	(-11.211)	(-1.987)	(-1.790)	(-3.912)
Dummy2003	-0.054*							
	(-2.185)							
R-squared	0.612	0.479	0.461	0.760	0.853	0.018	0.176	0.371
DW statistic	1.029	0.433	1.910	0.517	1.464	1.420	0.949	1.589
Equation (3): meals outside hotels								
Constant	-0.786*	0.691**	0.726**	0.451**	0.650**	0.703**	0.375	0.338**
	(-2.643)	(4.066)	(3.941)	(2.836)	(7.942)	(4.137)	(1.987)	(3.352)
ln(p_shopping)-ln(p_other)	0.023	0.064	-0.040	-0.147**	0.005	0.120*	0.062	-0.067**
	(0.350)	(0.957)	(-0.999)	(-3.662)	(0.204)	(2.057)	(1.593)	(-3.836)
ln(p_hotels)-ln(p_other)	-0.039	-0.064**	-0.028	0.029	-0.015	-0.079**	-0.049**	-0.009
	(-1.664)	(-3.34)	(-1.794)	(1.92)	(-1.242)	(-3.69)	(-2.688)	(-0.89)
ln(p_meals)-ln(p_other)	0.129*	0.111	0.009	0.046	0.152**	-0.068	0.192**	0.074**
	(2.451)	(1.581)	(0.191)	(1.443)	(4.801)	(-0.873)	(2.969)	(3.287)
ln(x/P)	0.107**	-0.065**	-0.065**	-0.035	-0.061**	-0.066**	-0.026	-0.024
	(3.063)	(-3.186)	(-2.972)	(-1.876)	(-6.252)	(-3.212)	(-1.152)	(-1.998)

Dummy2003	-0.027 (-1.794)							
R-squared	0.336	0.898	0.796	0.886	0.883	0.671	0.339	0.754
DW statistic	1.205	1.675	2.133	2.584	1.247	1.431	2.255	2.305

Note: * and ** denote significance at the 5% and 1% levels, respectively; figures in parentheses are *t*-statistics.

5.3.3 Elasticity analysis

Based on the model estimation results, the demand elasticities, including expenditure and price elasticities, are computed. Elasticity analysis of the long-run AIDS model enables the identification of the responsiveness of tourist expenditures to changes in tourism prices or total expenditure in the long run. The long-run elasticities are discussed only briefly here as the focus of the study is on short-run elasticity analysis, which can be found in Section 5.4.3. The rationale for this is that the short-run error-correction AIDS model, which integrates an error-correction mechanism into the modelling process, can reflect tourist consumption behaviour more accurately than can the long-run model, as tourists always self-adjust their tourism expenditure towards the equilibrium state. The long-run and short-run demand elasticities are compared in Section 5.5.

As discussed in Chapter 3, the expenditure elasticity value is used to identify whether the tourism product is a luxury or necessity. Table 5.3 shows the calculated long-run expenditure elasticities for the eight source markets under consideration. It is concluded that mainland Chinese tourists treat shopping as a necessity (expenditure elasticity of 0.410), whereas the remaining seven source markets treat shopping as a luxury (expenditure elasticities greater than one). An explanation of these findings is given in Section 5.4.3.3.

As for expenditure on hotel accommodation and meals outside hotels, the opposite situation is observed. These two tourism product categories are regarded more as luxuries by mainland Chinese tourists (expenditure elasticities greater than one) but more as necessities by the other source markets (expenditure elasticities less than one), as shown in Table 5.3.

Table 5.3 Long-run expenditure elasticities

	Mainland China	Australia	The UK	The US	Japan	South Korea	Singapore	Taiwan
Shopping	0.410**	1.373**	1.393**	1.557**	1.478**	1.170**	1.250**	1.253**
Hotels	2.638**	0.636**	0.895**	0.644**	0.525**	0.863**	0.853**	0.634**
Meals	1.880**	0.436*	0.570**	0.717**	0.475**	0.516**	0.829**	0.798**

Note: * and ** denote significance at the 5% and 1% levels, respectively.

Table 5.4 presents the calculated long-run price elasticities. As mentioned, the main focus of this study is short-run elasticities. The long-run elasticities are presented mainly for comparison purposes.

Table 5.4 Long-run compensated price elasticities

	Mainland China			Australia			The UK			The US		
	Shopping	Hotels	Meals	Shopping	Hotels	Meals	Shopping	Hotels	Meals	Shopping	Hotels	Meals
Shopping	-0.945**	0.424**	0.159	-0.018	0.307*	0.271	-0.417	0.228	0.007	0.657*	-0.114	-0.323*
Hotels	1.831**	-1.264**	-0.138	0.332*	-0.421**	-0.053	0.141	-0.210*	0.088*	-0.082	-0.195*	0.187**
Meals	0.833	-0.168	0.183	0.96	-0.176	0.075	0.013	0.261*	-0.787*	-0.860*	0.69**	-0.506
	Japan			South Korea			Singapore			Taiwan		
	Shopping	Hotels	Meals	Shopping	Hotels	Meals	Shopping	Hotels	Meals	Shopping	Hotels	Meals
Shopping	-0.495**	0.186**	0.125*	-0.593*	0.574**	0.408**	-0.792**	0.44**	0.315**	-0.423**	0.243**	0.004
Hotels	0.339**	-0.353**	0.063	0.862**	-0.843**	-0.133	0.466**	-0.512**	0.014	0.731**	-0.747**	0.071
Meals	0.549*	0.151	0.430	1.317**	-0.285	-1.358*	0.791**	0.033	0.421	0.021	0.120	-0.253

Note: * and ** denote significance at the 5% and 1% levels, respectively.

5.3.4 Stationarity tests of the residuals of the long-run AIDS models

The presence of unit roots in the variables that are included in the AIDS model may lead to spurious relationships amongst these variables. If this is the case, then the use of the error-correction model can prevent this problem (Engle & Granger, 1987). According to Engle and Granger (1987), when more than two variables are included in the model, the resulting residuals of the estimated model should be stationary before the error-correction model can be applied to eliminate spurious correlation between these variables. As there are three equations in each system, the unit root test (ADF) is performed on each of the three residual series from each system. For each of the series to be tested, the null hypothesis of the ADF test is that there exists one unit root. Table 5.5 provides the test results and shows that the ADF test statistics for all residuals series are significant at the 1% or 5% level with only two exceptions, which, however, are significant at the 10% level. Therefore, it can be concluded that all of the residuals series in the long-run AIDS models are stationary at the 10% significance level. The unit root test results in Chapter 4 also show that all variables in the level form are either non-stationary with one unit root or stationary. It is therefore concluded that the long-run AIDS model can be transformed into the error-correction AIDS model.

Table 5.5 ADF unit root tests on the residual time series of the long-run AIDS models

	Mainland China	Australia	The UK	The US	Japan	South Korea	Singapore	Taiwan
Shopping	-2.418*	-2.289*	-4.265**	-3.669**	-4.560**	-3.059**	-2.659*	-3.71**
Hotels	-2.767*	-1.741	-3.14**	-1.607	-2.817**	-3.13**	-2.041*	-4.029**
Meals	-2.249*	-4.316**	-4.204**	-5.53**	-2.865**	-2.847**	-3.58**	-5.701**

Note: * and ** denote significance at the 5% and 1% levels, respectively.

5.4 Tourist consumption behaviour in the short run

Section 5.3.4 explains that the purpose of estimating the error-correction AIDS models is to examine tourist consumption behaviour in the short run. As discussed in Section 3.4, the error-correction AIDS model with the homogeneity and symmetry assumptions imposed can be written as

$$\Delta w_1 = \alpha_1 + \lambda\mu_{1,t-1} + \gamma_{11}(\Delta\ln p_1 - \Delta\ln p_4) + \gamma_{12}(\Delta\ln p_2 - \Delta\ln p_4) + \gamma_{13}(\Delta\ln p_3 - \Delta\ln p_4) + \beta_1\Delta\ln\frac{x_1}{P} + \sum_k \varphi_{1k} dum_k + \varepsilon_1 \quad (5.3a)$$

$$\Delta w_2 = \alpha_2 + \lambda\mu_{2,t-1} + \gamma_{12}(\Delta\ln p_1 - \Delta\ln p_4) + \gamma_{22}(\Delta\ln p_2 - \Delta\ln p_4) + \gamma_{23}(\Delta\ln p_3 - \Delta\ln p_4) + \beta_2\Delta\ln\frac{x_2}{P} + \sum_k \varphi_{2k} dum_k + \varepsilon_2 \quad (5.3b)$$

$$\Delta w_3 = \alpha_3 + \lambda\mu_{3,t-1} + \gamma_{13}(\Delta\ln p_1 - \Delta\ln p_4) + \gamma_{23}(\Delta\ln p_2 - \Delta\ln p_4) + \gamma_{33}(\Delta\ln p_3 - \Delta\ln p_4) + \beta_3\Delta\ln\frac{x_3}{P} + \sum_k \varphi_{3k} dum_k + \varepsilon_3, \quad (5.3c)$$

where Δ is the first difference operator, and $\lambda\mu_{i,t-1}$ (i = 1, 2, 3) is the error-correction term, which is the estimated residual term from the long-run AIDS model of Equations 5.2(a) to (c). The coefficients of $\mu_{i,t-1}$ are set to be equal (denoted as λ in Equations 5.3(a) to (c)) in the three equations within the system to be consistent with the homogeneity assumption. λ indicates the speed of adjustment of tourist expenditure towards the disequilibrium of the budget allocation related to each tourism product category at time *t*-1. Equations 5.3(a) to (c) are the model specifications employed in this study to examine tourist consumption behaviour in the short run.

5.4.1 Theoretical restriction tests

In line with the long-run AIDS models, homogeneity and symmetry restrictions are tested under three scenarios for the error-correction AIDS models. Table 5.6 presents the restriction test results. Similar to the long-run models, in the majority of cases these two theoretical restrictions cannot be statistically rejected. Homogeneity cannot be rejected at the 1% significance level, whereas it is rejected in the US and mainland China cases at the 5% significance level. Symmetry based on homogeneity is not rejected in most cases, with only one exception at the 5% significance level (Singapore) and one at the 1% level (the US). The results show that most models pass the symmetry and homogeneity joint test, except Singapore and mainland China. Again, for the purpose of consistency regarding theoretical requirement, both homogeneity and symmetry restrictions are imposed on each system when estimating the models and discussing the findings.

Table 5.6 Homogeneity and symmetry restriction tests for the short-run AIDS models

	Mainland China	Australia	The UK	The US	Japan	South Korea	Singapore	Taiwan
Homogeneity	3.597*	4.753**	2.006	2.67	n.a.	1.242	n.a.	0.394
Symmetry based on homogeneity	5.263**	n.a.	1.548	1.747	2.327	n.a.	7.620**	1.903
Homogeneity and symmetry	6.079**	2.698	1.469	2.422	0.763	1.144	3.590**	1.074

Note: * and ** denote significance at the 5% and 1% levels, respectively; n.a. refers to non-positive statistics.

5.4.2 Summary of the estimation of the error-correction AIDS models

Table 5.7 summarises the estimation results for the eight system models, all with homogeneity and symmetry restrictions being imposed. The results show that error-correction terms in all of the eight systems are statistically significant at the 1% level with correct signs (i.e., negative). Some variables are statistically insignificant but they are kept in the final models in accordance with the requirement of the AIDS model specification.

Table 5.7 Estimates of the homogeneity- and symmetry-restricted short-run AIDS models

	Mainland China	Australia	The UK	The US	Japan	Korea	Singapore	Taiwan
Equation (1): shopping								
Constant	0.003 (0.772)	0.001 (0.152)	0.001 (0.220)	-0.004 (-0.835)	-0.003 (-0.618)	-0.001 (-0.1)	-0.004 (-0.969)	-0.006 (-1.338)
Δ[ln(p_shopping)-ln(p_other)]	-0.252* (-2.38)	0.168 (1.669)	0.042 (0.510)	0.137 (1.669)	-0.046 (-0.547)	-0.175 (-1.513)	-0.140 (-1.623)	-0.286** (-2.926)
Δ[ln(p_hotels)-ln(p_other)]	0.006 (0.233)	0.015 (0.454)	-0.024 (-0.757)	-0.105** (-3.057)	0.005 (0.166)	0.193** (3.764)	0.045 (1.522)	-0.011 (-0.355)
Δ[ln(p_meals)-ln(p_other)]	-0.001 (-0.027)	-0.118* (-2.452)	-0.110 (-1.751)	-0.095 (-1.559)	-0.021 (-0.564)	-0.053 (-0.729)	0.074 (1.151)	0.076 (1.564)
Δln(x/P)	-0.064 (-1.519)	0.192** (4.372)	0.098 (1.703)	0.195** (3.468)	0.199** (5.257)	0.110 (1.629)	0.049 (1.390)	0.091* (2.250)
Error-correction term (t-1)	-0.800** (-7.102)	-0.484** (-4.807)	-1.075** (-8.158)	-0.547** (-4.64)	-0.786** (-7.795)	-0.911** (-7.684)	-0.913** (-7.690)	-1.052** (-8.408)
Dummy2003	0.105** (6.686)							
R squared	0.826	0.524	0.599	0.631	0.625	0.476	0.602	0.526
DW statistic	1.336	1.246	2.070	1.724	1.772	1.434	1.360	2.016
Equation (2): hotel accomodation								
Constant	-0.004 (-1.22)	0.000 (0.010)	-0.002 (-0.268)	0.002 (0.349)	0.001 (0.295)	-0.001 (-0.096)	0.002 (0.368)	-0.002 (-0.603)
Δ[ln(p_shopping)-ln(p_other)]	0.006 (0.233)	0.015 (0.454)	-0.024 (-0.757)	-0.105** (-3.057)	0.005 (0.166)	0.193** (3.764)	0.045 (1.522)	-0.011 (-0.355)
Δ[ln(p_hotels)-ln(p_other)]	0.013 (0.700)	0.017 (0.455)	0.073 (1.911)	0.124** (3.623)	0.046* (2.337)	-0.135** (-3.167)	0.004 (0.104)	0.048* (2.020)
Δ[ln(p_meals)-ln(p_other)]	0.028* (2.201)	-0.034** (-2.779)	-0.022 (-1.361)	0.010 (0.549)	-0.006 (-0.635)	-0.072** (-3.733)	-0.033 (-1.921)	-0.013 (-0.951)
Δln(x/P)	0.076* (2.415)	-0.155** (-3.250)	-0.079 (-1.107)	-0.156** (-2.785)	-0.155** (-6.025)	-0.110 (-1.956)	-0.050 (-1.211)	-0.079* (-2.343)
Error-correction term (t-1)	-0.8** (-7.102)	-0.484** (-4.807)	-1.075** (-8.158)	-0.547** (-4.640)	-0.786** (-7.795)	-0.911** (-7.684)	-0.913** (-7.690)	-1.052** (-8.408)
Dummy2003	-0.045** (-3.503)							

R squared	0.368	0.342	0.534	0.600	0.738	0.505	0.295	0.411
DW statistic	2.519	1.184	1.718	1.072	2.117	1.680	0.894	1.855
Equation (3): meals outside hotels								
Constant	-0.002 (-0.750)	-0.002 (-0.759)	-0.002 (-0.711)	0.001 (0.300)	0.001 (0.742)	0.001 (0.183)	0.001 (0.229)	0.003 (1.403)
Δ[ln(p_shopping)-ln(p_other)]	-0.001 (-0.027)	-0.118* (-2.452)	-0.110 (-1.751)	-0.095 (-1.559)	-0.021 (-0.564)	-0.053 (-0.729)	0.074 (1.151)	0.076 (1.564)
Δ[ln(p_hotels)-ln(p_other)]	0.028* (2.201)	-0.034** (-2.779)	-0.022 (-1.361)	0.010 (0.549)	-0.006 (-0.635)	-0.072** (-3.733)	-0.033 (-1.921)	-0.013 (-0.951)
Δ[ln(p_meals)-ln(p_other)]	0.059 (0.749)	0.144 (1.856)	0.071 (0.598)	-0.014 (-0.179)	0.243** (3.922)	-0.236* (-2.160)	0.250* (2.396)	0.036 (0.612)
Δln(x/P)	-0.003 (-0.132)	-0.05** (-3.075)	-0.087** (-3.007)	-0.046 (-1.592)	-0.006 (-0.519)	-0.053* (-2.067)	0.010 (0.483)	-0.002 (-0.087)
Error-correction term (t-1)	-0.800** (-7.102)	-0.484** (-4.807)	-1.075** (-8.158)	-0.547** (-4.64)	-0.786** (-7.795)	-0.911** (-7.684)	-0.913** (-7.690)	-1.052** (-8.408)
Dummy2003	-0.028** (-3.290)							
R squared	0.732	0.685	0.667	0.418	0.590	0.720	0.608	0.706
DW statistic	1.576	2.800	2.003	3.137	1.176	2.156	2.375	2.585

Note: * and ** denote significance at the 5% and 1% levels, respectively; figures in parentheses are *t*-statistics.

5.4.3 Elasticity analysis

Based on the estimates of the eight system models, the expenditure and price elasticities are calculated to evaluate the responsiveness of demand to expenditure budget and price changes. In the AIDS model, the expenditure elasticity reflects the responsiveness of demand for tourism product i to changes in the spending budget. According to demand theory, if the expenditure elasticity is greater than one, then the good or service is considered a luxury, whereas a value between zero and one indicates that it is considered a necessity.

Price elasticity measures the sensitivity of demand to price changes. The calculation of the uncompensated and compensated price elasticities within the AIDS framework has been discussed in Section 3.6. Here, only the compensated price elasticities are reported (Table 5.9), because they hold the assumption that real expenditure is constant, and hence can reflect the effects of price changes more accurately than can the uncompensated price elasticities.

5.4.3.1 Long-haul markets – Australia, the UK and the US

The calculated expenditure elasticities in Table 5.8 suggest that the retail products purchased by tourists from these three long-haul markets are consistently regarded as luxuries (the expenditure elasticities of shopping are greater than one), and that hotel accommodation and meals outside hotels are commonly perceived to be necessities (the expenditure elasticities are less than one). For example, the expenditure elasticity of demand for shopping in the US case is 1.593. This means that a 10% increase (decrease) in the budget of American tourists on tourism in Hong Kong would lead to a 15.93% increase (decrease) in their spending on shopping, and 6.57% and 6.28% increases (decreases) in their spending on hotel accommodation and meals outside hotels, respectively.

Table 5.8 Short-run expenditure elasticities

	Mainland China	Australia	The UK	The US	Japan	Korea	Singapore	Taiwan
Shopping	0.900**	1.470**	1.354**	1.593**	1.394**	1.249**	1.130**	1.154**
Hotels	1.513**	0.590**	0.824**	0.657**	0.441**	0.628**	0.860**	0.602**
Meals	0.975**	0.565**	0.422*	0.628*	0.946**	0.609**	1.066**	0.984**

Note: * and ** denote significance at the 5% and 1% levels, respectively.

The values on the diagonal of each market's sub-matrix in Table 5.9 refer to the compensated own-price elasticities, which show that all statistically significant ones are negative. This result is consistent with demand theory; namely, relative expenditure decreases as price increases.

With respect to cross-price elasticities (off-diagonal values in Table 5.9), two substitution relationships are identified, which are indicated by positive cross-price elasticities. First, shopping and hotel accommodation are regarded as substitutes by two long-haul source markets: Australia and the UK. Second, hotel accommodation and meals outside hotels exhibit significant substitution effects across two long-haul markets: the UK and the US. However, the degree of the substitution effect differs between each pair of consumption categories. For instance, the shopping demand of UK tourists is more sensitive to the price change of hotel accommodation than their demand for hotel accommodation in response to the price change of shopping. The cross-price elasticities are 0.361 and 0.223, respectively. This means that if the average hotel room rate increases by 10%, then UK tourists will tend to spend 3.61% more on shopping. However, if the average price of shopping increases by 10%, then these tourists will spend only 2.23% more on accommodation. In the case of Australia, the degree of the substitution effect between shopping and hotel accommodation varies less. The related cross-price elasticities are 0.416 and 0.449, respectively. With regard to two long-haul source markets – the UK and the US – the demand for meals outside hotels is much more sensitive to the price change of hotel accommodation than is the demand for hotel accommodation in response to the price change of meals outside hotels. The cross-price elasticities are 0.304 and 0.103 for the UK, and 0.534 and 0.145 for the US, respectively.

It is interesting to note that neither a substitution nor a complementary relationship is identified between the expenditures on shopping and meals outside hotels, as suggested by the insignificant cross-price elasticities, for any of the three long-haul source markets under consideration. This finding is helpful for market practitioners in related sectors when planning pricing strategies.

Table 5.9 Short-run compensated price elasticities

	Mainland China			Australia			The UK			The US		
	Shopping	Hotels	Meals	Shopping	Hotels	Meals	Shopping	Hotels	Meals	Shopping	Hotels	Meals
Shopping	-0.751**	0.158**	0.12	-0.181	0.416**	-0.172	-0.573	0.361**	-0.247	-0.254	0.138	-0.165
Hotels	0.68**	-0.765**	0.31**	0.449**	-0.577**	0.025	0.223**	-0.39**	0.103**	0.100	-0.273	0.145**
Meals	0.629	0.377**	-0.391	-0.611	0.081	0.367	-0.452	0.304**	-0.377	-0.441	0.534**	-0.993**

	Japan			South Korea			Singapore			Taiwan		
	Shopping	Hotels	Meals	Shopping	Hotels	Meals	Shopping	Hotels	Meals	Shopping	Hotels	Meals
Shopping	-0.586**	0.287**	0.073	-0.954**	0.73**	0.018	-0.990**	0.476**	0.347	-0.886**	0.179**	0.245**
Hotels	0.523**	-0.555**	0.094*	1.097**	-1.165**	-0.107	0.505**	-0.633**	0.058	0.539**	-0.558**	0.049
Meals	0.321	0.227*	1.223*	0.058	-0.230	-2.586**	0.870	0.137	0.805	1.25**	0.083	-0.577

Note: * and ** denote significance at the 5% and 1% levels, respectively.

5.4.3.2 Short-haul markets – Japan, South Korea, Singapore and Taiwan

Apart from mainland China, Japan, South Korea, Singapore and Taiwan are the main short-haul Hong Kong inbound tourism markets. In 2008, their expenditure in Hong Kong varied from HKD 2.57 billion to HKD 3.50 billion (HKTB, 2009), with market shares ranging from 2.73% to 3.72%. In contrast to their long-haul counterparts, these short-haul tourists spend more on shopping than on hotel accommodation.

Table 5.8 shows that tourists from these four short-haul origins demonstrate spending patterns similar to those of their long-haul counterparts. The expenditure elasticities are always greater than zero, indicating that tourists from these source markets tend to spend more on each of the three main consumption categories as the total budget increases. The products that they purchase are generally regarded as luxuries, whereas hotel accommodation and meals outside hotels are regarded as necessities with only one inconclusive case (meals outside hotels consumed by Singaporean tourists; the value of 1.066 is only slightly greater than one).

The demand for shopping is more expenditure elastic amongst Japanese tourists (value of 1.394) than that amongst the other short-haul tourists (values of 1.249, 1.130 and 1.154, respectively), as shown in Table 5.8, whereas demand for hotel accommodation is more expenditure inelastic amongst them (value of 0.441) compared to the others (values of 0.628, 0.860 and 0.602, respectively). It is interesting to observe that for meals outside hotels, the expenditure elasticities in the short-haul markets are consistently higher than those in the long-haul ones. This means that meals outside hotels are regarded more as a necessity amongst non-Asian tourists, while the demand of Asian tourists for meals outside hotels is more sensitive to total expenditure budget changes.

As for shopping, the absolute values of own-price elasticities are relatively higher amongst the South Korean, Singaporean and Taiwanese tourists than amongst the Japanese tourists. The relatively low sensitivity of the latter to retail price changes can be explained by the relatively high income level of these tourists. However, pricing strategies in the retail sector are likely to be more effective in terms of increasing spending by South Korean, Taiwanese and Singaporean tourists. As for hotel accommodation, the own-price elasticity of South Korean tourists is distinctly higher than that of tourists from the other three short-haul markets. Therefore, for those hotels targeting the South Korean market, appropriate promotion campaigns (in collaboration with Korean tour operators or travel agencies) could be considered to boost revenues.

The calculated cross-price elasticities support the substitution between shopping and hotel accommodation for all short-haul source markets. A substitution relationship is identified between hotel accommodation and meals outside hotels in the case of Japan, and between shopping and meals outside hotels in the case of Taiwan. In addition, different degrees of substitution effects are identified in these pairs of tourism categories. For example, the demand of short-haul tourists for hotel accommodation is more sensitive to the price change of shopping than is the demand for shopping in response to the price change of hotel accommodation. The cross-price elasticities are 0.523 and 0.287 for Japan, 1.097 and 0.018 for South Korea, 0.505 and 0.476 for Singapore, and 0.539 and 0.179 for Taiwan, respectively.

5.4.3.3 Mainland China

Although mainland China is also a short-haul tourist source market, it is analysed separately because of its special role in Hong Kong tourism development, as discussed in Chapter 4. In 2008, visitor arrivals from mainland China reached 16.86 million, accounting for 57.1% of total arrivals in Hong Kong. Meanwhile, mainland Chinese tourist expenditure in 2008 reached HKD 53.24 billion, or 56.5% of total tourist expenditure in Hong Kong (HKTB, 2009).

The calculated demand elasticities also differentiate the mainland Chinese market from the others. Using shopping as an example, the expenditure elasticity of mainland Chinese tourists is the lowest, with a value of 0.900 (see Table 5.8), in comparison to the other markets, for which the expenditure elasticities are all above one. This implies that mainland Chinese tourists generally regard their purchased products in Hong Kong as necessities rather than luxuries. This can be explained by the fact that tourists who can afford to travel to Hong Kong are normally middle-class and wealthy people, and shopping (for example, for gold, designer clothes and handbags) is their major motivation for visiting Hong Kong. Given this inelastic feature of their demand for shopping, Hong Kong has a competitive advantage as a shopping paradise for mainland Chinese visitors.

Therefore, to increase spending by mainland Chinese tourists, Hong Kong's retail shops must offer high-quality products and high-quality service.

Compared to tourists from the other source markets, mainland Chinese tourists demonstrate different spending patterns on hotel accommodation, with a considerably higher expenditure elasticity of 1.513. This implies that mainland Chinese tourists regard hotel accommodation in Hong Kong as a luxury rather than a necessity, in contrast to tourists from the other markets. With regard to meals outside hotels, the expenditure elasticity of mainland Chinese tourists (0.975) is similar to that of Japanese, Singaporean and Taiwanese tourists, but higher than that of the long-haul tourists.

Table 5.9 shows that mainland Chinese tourists are highly sensitive to the price change of hotel accommodation, with an own-price elasticity of -0.765, the second highest amongst all of the markets under study. Overall, mainland Chinese tourists behave differently from the tourists from the other source markets, perhaps because of the special relationship between mainland China and Hong Kong. From the geographical perspective, travelling to Hong Kong incurs the lowest transportation cost for mainland Chinese tourists in comparison to other international destinations. From the political and economic perspectives, since the handover of Hong Kong to China in 1997, the Chinese government has been encouraging mainland Chinese citizens to visit Hong Kong to enhance the economic competitiveness of Hong Kong. From the cultural perspective, mainland China and Hong Kong share the same root culture. These factors may lead to the unique consumption behaviour of mainland Chinese tourists in Hong Kong.

5.5 Comparison between the long-run and short-run demand elasticities

Given that the short-run error-correction AIDS model corresponds more to reality and may produce more accurate estimates than the long-run AIDS one, more attention is paid to analysing the short-run demand elasticities. However, comparing the long-run and short-run demand elasticities may bring new insights into tourist consumption behaviour from different perspectives. Below is a summary of comparisons based on the results shown in Tables 5.3 and 5.8 for expenditure elasticities, and in Tables 5.4 and 5.9 for price elasticities.

Although shopping is considered a necessity by mainland Chinese tourists, in the long run, this is less so. The long-run expenditure elasticity is 0.410 whereas the short-run expenditure elasticity is 0.900 for this group (see Tables 5.3 and 5.8, respectively). This finding suggests that mainland Chinese tourists are likely to purchase retail products in Hong Kong and thus the retail industry has a distinct competitive advantage. Hong Kong's tourism-related sectors should encourage mainland Chinese tourists to spend more in Hong Kong by further improving professional customer services and shopping facilities.

The expenditure elasticity of demand for hotel accommodation is remarkably higher in the long run than in the short run for mainland Chinese tourists. The values are 2.638 and 1.513, respectively. This implies that in the long run, spending on hotel accommodation may be treated more as a luxury than it is in the short run for this group. The shorter travel distance for visitors from the southern provinces of China may explain this finding. The rapid development of the transportation systems between Hong Kong and major Chinese cities also makes it easier and more convenient for mainland Chinese tourists to travel to Hong Kong and hence stay for shorter visits. As a result, the tourism-related sectors in Hong Kong may consider some strategic responses to this phenomenon, such as promoting shorter-stay tour packages or advertising less luxurious hotels in the mainland Chinese market.

Mainland Chinese tourists also treat meals outside hotels as a luxury more in the long than in the short run, with expenditure elasticities of 1.880 and 0.975, respectively (see Tables 5.3 and 5.8, respectively). It is also observed that Japanese tourists are more expenditure inelastic regarding their restaurant meals in the long than in the short run, with expenditure elasticities of 0.475 and 0.946 respectively. In the long run, the demand by Japanese tourists for meals outside hotels is the most expenditure inelastic amongst all five short-haul source markets.

With regard to own-price elasticities, differences in consumption patterns are also identified between mainland Chinese tourists and tourists from other source markets, when the long-run elasticities are compared with the short-run ones. For example, expenditure on shopping is more price elastic in the long than in the short run amongst mainland Chinese tourists, but the opposite is true for the other seven source markets under consideration. Mainland Chinese tourists are more sensitive to the price change of shopping in the long run. This conclusion sheds new light on the consumption pattern of mainland Chinese tourists. The comparative price advantage of the retail industry in Hong Kong over that in mainland China, for example, for gold, jewellery and designer fashion products, may be the reason that mainland Chinese tourists spend a large amount of money on shopping in Hong Kong. Therefore, emphasising Hong Kong as a shopping paradise is an effective marketing strategy to attract more mainland Chinese tourists and increase the level of their spending.

At the same time, hotel accommodation is found to be more price elastic in the long than in the short run in two cases: mainland China and Taiwan. The absolute values of the short-run own-price elasticities are greater than those of the long-run ones in the other markets. This implies that amongst the tourists from mainland China and Taiwan, the effect of price changes on hotel accommodation is greater in the long than in the short run.

5.6 Chapter summary

The long-run and short-run AIDS models are employed in this chapter to analyse Hong Kong inbound tourism demand. The long-run AIDS models are first estimated for all eight source markets. The unit root tests for all of the residual series of the long-run AIDS models suggest that long-run cointegration relationships exist amongst the variables that are included in each of the demand systems. This provides the rationale for the adoption of the error-correction AIDS model in the empirical study.

From a methodological perspective, in contrast to most previous studies, this study employs the Tornqvist price index to produce the aggregate price index that is used in the AIDS models. From the empirical perspective, this chapter has bridged a gap in the literature by employing the short-run error-correction AIDS model to analyse tourism expenditure allocation amongst groups of tourism products. This study provides insights into tourist consumption patterns related to different tourism goods and services in response to expenditure budget and price changes using a system demand approach.

The empirical results of this study reveal different consumption behaviours amongst tourists from eight source markets. For example, demand for meals outside hotels is more expenditure elastic in short-haul than in long-haul markets. Also, substitution relationships are identified between shopping and hotel accommodation for all source markets except the US, between shopping and meals outside hotels for Taiwan only, and between hotel accommodation and meals outside hotels for mainland China, Japan, the UK and the US.

Mainland Chinese tourists demonstrate unique consumption characteristics. For example, in contrast to other tourists, they regard shopping in Hong Kong as a necessity but hotel accommodation as a luxury. There are a number of reasons for the differences in consumption behaviour amongst tourists from different source markets, including differences in cultural background, income level, perceived image of Hong Kong as a tourist destination and geographic distance between the source market and Hong Kong.

The understanding of the different tourist consumption patterns of the key source markets provides important implications for the tourism-related sectors in Hong Kong with regard to such strategic issues as pricing, market segmentation and service quality. With regard to the distinct consumption behaviour of mainland Chinese tourists and their significant contribution to the Hong Kong tourism industry, tourism practitioners in Hong Kong face challenges in sustaining continuous growth in this market whilst maintaining a healthy balance amongst various key source markets. Meanwhile, increasingly fierce competition from neighbouring countries forces the Hong Kong tourism industry to enhance its competitive advantage by adopting differentiated marketing and pricing strategies. The empirical results also provide useful information for public agencies in Hong Kong for the evaluation of the effectiveness of taxation and promotion policies.

CHAPTER 6 ECONOMETRIC ANALYSIS OF TOURIST DEMAND SYSTEMS: A TIME-VARYING PARAMETER PERSPECTIVE

6.1 Introduction

The time-varying parameter (TVP) model is superior to its constant-parameter counterpart when the aim is to examine the evolution of consumer behaviour over a specific period. In reality, the consumption patterns of tourists change over time because of changes in social conditions, political or economic policies and consumer taste or preference. These changes are reflected in the data generating process as structural changes. Constant-parameter models, however, are not capable of capturing such structural changes. The TVP approach overcomes this limitation by relaxing the restriction of the constant effects of determinants on the demand for tourism (i.e., dependent variables). This means that in a TVP model, the coefficients to be estimated can vary over the study period. Therefore, specifying a demand system using time-varying parameters enables it to reflect the evolution of consumer behaviour over time. Because of the distinct advantage of the TVP technique, this approach is incorporated into the tourism demand modelling process with the aim of examining tourist consumption behaviour from a time-varying perspective.

Although a large number of studies have applied the TVP approach in tourism demand modelling and forecasting, to the best knowledge of the author, none of them has incorporated the TVP technique into an error-correction AIDS model with theoretical restrictions imposed. This chapter therefore presents the first attempt to employ a restricted error-correction TVP-AIDS model to analyse tourist expenditure allocation on a bundle of tourism goods and services (i.e., shopping, hotel accommodation, meals outside hotels and other expenditures). Eight source markets of Hong Kong inbound tourism are examined separately. Eight complete demand systems are specified and estimated, from which expenditure and price elasticities are computed on a time-varying basis. The empirical results shed new light on the evolution of tourist consumption behaviour over time, which provides relevant stakeholders in both the public and private sectors with dynamic information to facilitate strategic decision making regarding tourism planning, development and marketing.

In this chapter, the specification of the long-run TVP-AIDS and short-run error-correction TVP-AIDS models is discussed, followed by the model estimation of the eight tourism demand systems. Based on the estimation results, the tourist consumption patterns of the eight source markets are investigated from a time-varying perspective, and the corresponding managerial implications are discussed.

6.2 Specification of the TVP-AIDS models

Although error-correction models can capture momentary disequilibrium in an economic system, they cannot solve the problem of structural change if the models are specified in constant-parameter form. Constant-parameter models generally assume that the effects of determinant variables on demand remain constant over time. Once the model is estimated, the average impact of each determinant on tourism demand in the time span of the data sample can be evaluated. However, this assumption is quite strict and does not reflect the reality of the evolution of consumer behaviour over time. The relationships between tourism demand and its determinants, including tourism price and tourist income, are not expected to remain constant over time because of important social, political and economic policy changes (Song & Witt, 2000, p.123). The consumption habits or preferences of tourists may also change over time because of socioeconomic changes. An effective solution to this problem is to use the TVP approach to simulate changes in the demand relationship, as it allows the coefficients of the independent variables in the model to vary over time.

Although the use of dummy variables is the conventional way to capture ongoing known structural changes in an economic system, this approach is only appropriate when the one-off shocks to the system are known, and the effects of these shocks do not continue once the shocks are over. Compared with the TVP specification, the dummy variable method has limitations in capturing continuous structural changes in the demand system.

The TVP technique enables the identification of changes in tourist consumption behaviour over time, especially when the structural changes are gradual and long lasting.

6.2.1 Long-run TVP-AIDS model

As discussed in Chapter 3, incorporating the TVP technique into a demand system model is usually realised by a state space specification. The state space representation of a system is derived from the modern control engineering field. The state of a system is defined as a minimum set of information from the present and past, with the future behaviour of the system completely described by the knowledge of the present state and the future input. Therefore, given the present state, the future of a system is independent of its past (Wei, 2006, p.463).

In the state space specification, two types of equations are included: the measurement or signal equation, which measures the observed variables, and the transition or state equation, which describes the evolution of unobserved variables. The unobserved variables are usually specified in a random walk process (Song & Witt, 2000, p.131). In this empirical study, the long-run TVP-AIDS model with homogeneity and symmetry restrictions is described by the following system of equations:

$$w_1 = \alpha_1 + \gamma_{11}(\log p_1 - \log p_4) + \gamma_{12}(\log p_2 - \log p_4) + \gamma_{13}(\log p_3 - \log p_4) + \beta_1 \log\frac{x_1}{P} + \sum_k \varphi_{1k} dum_k + \varepsilon_1 \tag{6.1a}$$

$$w_2 = \alpha_2 + \gamma_{12}(\log p_1 - \log p_4) + \gamma_{22}(\log p_2 - \log p_4) + \gamma_{23}(\log p_3 - \log p_4) + \beta_2 \log\frac{x_2}{P} + \sum_k \varphi_{2k} dum_k + \varepsilon_2 \tag{6.1b}$$

$$w_3 = \alpha_3 + \gamma_{13}(\log p_1 - \log p_4) + \gamma_{23}(\log p_2 - \log p_4) + \gamma_{33}(\log p_3 - \log p_4) + \beta_3 \log\frac{x_3}{P} + \sum_k \varphi_{3k} dum_k + \varepsilon_3 \tag{6.1c}$$

$$\alpha_{1,t} = \alpha_{1,t-1} + \phi_{1,t} \tag{6.1d}$$

$$\alpha_{2,t} = \alpha_{2,t\text{-}1} + \phi_{2,t} \tag{6.1e}$$

$$\alpha_{3,t} = \alpha_{3,t\text{-}1} + \phi_{3,t} \tag{6.1f}$$

$$\gamma_{11,t} = \gamma_{11,t\text{-}1} + \pi_{11,t} \tag{6.1g}$$

$$\gamma_{12,t} = \gamma_{12,t\text{-}1} + \pi_{12,t} \tag{6.1h}$$

$$\gamma_{13,t} = \gamma_{13,t\text{-}1} + \pi_{13,t} \tag{6.1i}$$

$$\gamma_{22,t} = \gamma_{22,t\text{-}1} + \pi_{22,t} \tag{6.1j}$$

$$\gamma_{23,t} = \gamma_{23,t\text{-}1} + \pi_{23,t} \tag{6.1k}$$

$$\gamma_{33,t} = \gamma_{33,t\text{-}1} + \pi_{33,t} \tag{6.1j}$$

$$\beta_{1,t} = \beta_{1,t\text{-}1} + \upsilon_{1,t} \tag{6.1m}$$

$$\beta_{2,t} = \beta_{2,t\text{-}1} + \upsilon_{2,t} \tag{6.1n}$$

$$\beta_{3,t} = \beta_{3,t\text{-}1} + \upsilon_{3,t}\,. \tag{6.1o}$$

Equations 6.1(a) to (c) are measurement equations in which all independent variables are included, which are the same as the constant-parameter static AIDS model discussed in Section 5.3. Equations 6.1(d) to (o) are transition equations in which all coefficients in the measurement equations are specified as random walks, which measure the time-varying properties of the coefficients in the system model. $\phi_{i,t}$, $\pi_{ij,t}$ and $\upsilon_{i,t}$ are the error terms in the measurement equations. The definitions of the variables are given following Equations 5.2(a) to (c) in Chapter 5. The Kalman filter algorithm is employed to calculate this state space model. It recursively estimates the parameters and allows them to vary over time. As a result, the dynamic change of the economic regime can be readily accommodated. Details of the Kalman filter algorithm are discussed by Durbin and Koopman (2001) and Harvey (1989).

The long-run TVP-AIDS model reflects the long-run equilibrium of the system over the sample period. Although in reality equilibrium amongst the variables in the system may not always be reached, there is an invisible hand within the system pushing the variables of the system towards equilibrium at all times. Therefore, the long-run TVP-AIDS model helps us to understand tourist consumption behaviour from the long-run equilibrium perspective. As discussed in Chapter 3, consistent with consumer demand theory, both homogeneity and symmetry are imposed on the long-run TVP-AIDS models for estimation, as specified in Equations 6.1(a) to (o).

In estimating the eight long-run system models with the TVP technique, Marquardt's maximum likelihood is employed to identify the optimal iterations. Finally, all eight models converge, and the estimation results of the final states are reported in Table 6.1. As the estimation algorithm differs from the constant-parameter model, the estimation results shown in Table 6.1 are different from their constant-parameter counterparts in Table 5.2.

Table 6.1 Final state estimates of the homogeneity- and symmetry-restricted long-run TVP-AIDS models

	Mainland China	Australia	The UK	The US	Japan	South Korea	Singapore	Taiwan
Equation (1): Shopping								
Constant	2.171**	-1.362**	0.006	-1.398	-0.904*	-0.429	-0.551	-0.226
	(2.932)	(-2.937)	(0.007)	(-1.711)	(-1.967)	(-0.627)	(-1.200)	(-0.469)
ln(p_shopping)-ln(p_other)	-0.037	0.237	0.199	0.204	0.031	-0.189	-0.057	-0.100
	(-0.168)	(1.386)	(0.920)	(0.834)	(0.189)	(-0.860)	(-0.313)	(-0.652)
ln(p_hotels)-ln(p_other)	0.087	-0.007	-0.013	-0.122	-0.004	0.152**	-0.001	0.070
	(1.857)	(-0.178)	(-0.257)	(-1.053)	(-0.107)	(2.744)	(-0.017)	(1.768)
ln(p_meals)-ln(p_other)	0.086	-0.146*	-0.028	0.017	-0.033	0.106	0.128	0.027
	(1.234)	(-2.572)	(-0.434)	(0.235)	(-0.472)	(1.159)	(0.950)	(0.269)
ln(x/P)	-0.176*	0.204**	0.025	0.194*	0.158**	0.107	0.115*	0.090
	(-2.005)	(3.748)	(0.245)	(2.031)	(2.793)	(1.268)	(2.098)	(1.570)
Equation (2): Hotel accommodation								
Constant	-0.537	1.499**	0.401	1.401*	1.517**	0.694	0.763	0.274
	(-1.441)	(3.436)	(0.441)	(2.322)	(4.361)	(1.697)	(1.933)	(0.750)
ln(p_shopping)-ln(p_other)	0.087	-0.007	-0.013	-0.122	-0.004	0.152**	-0.001	0.070
	(1.857)	(-0.178)	(-0.257)	(-1.053)	(-0.107)	(2.744)	(-0.017)	(1.768)
ln(p_hotels)-ln(p_other)	-0.040	0.060	0.078	0.175**	0.025	-0.050	0.061	-0.009

	(-1.643)	(1.642)	(1.374)	(4.275)	(0.353)	(-1.386)	(1.668)	(-0.313)
ln(p_meals)-ln(p_other)	-0.018	0.003	-0.029	-0.011	-0.016	-0.095*	-0.022	-0.026
	(-0.793)	(0.086)	(-1.448)	(-0.599)	(-1.047)	(-2.114)	(-0.713)	(-1.045)
ln(x/P)	0.078	-0.137**	0.004	-0.112	-0.144**	-0.052	-0.054	-0.007
	(1.753)	(-2.683)	(0.038)	(-1.585)	(-3.466)	(-1.051)	(-1.159)	(-0.155)
Equation (3): Meals outside hotels								
Constant	-0.417	0.448**	0.729**	0.640*	0.162	0.543*	0.144	0.506
	(-1.173)	(3.048)	(2.845)	(2.575)	(0.938)	(2.007)	(0.454)	(1.659)
ln(p_shopping)-ln(p_other)	0.086	-0.146*	-0.028	0.017	-0.033	0.106	0.128	0.027
	(1.234)	(-2.572)	(-0.434)	(0.235)	(-0.472)	(1.159)	(0.95)	(0.269)
ln(p_hotels)-ln(p_other)	-0.018	0.003	-0.029	-0.011	-0.016	-0.095*	-0.022	-0.026
	(-0.793)	(0.086)	(-1.448)	(-0.599)	(-1.047)	(-2.114)	(-0.713)	(-1.045)
ln(p_meals)-ln(p_other)	-0.443	0.015	0.049	0.159	0.153	-0.136	0.252	0.198
	(-1.092)	(0.127)	(0.651)	(1.135)	(1.188)	(-0.763)	(0.952)	(1.005)
ln(x/P)	0.063	-0.035*	-0.065*	-0.058*	0.000	-0.046	-0.003	-0.046
	(1.507)	(-1.987)	(-2.143)	(-1.977)	(0.002)	(-1.402)	(-0.068)	(-1.243)
The whole system								
Log likelihood	8.123	66.213	49.644	59.997	74.178	50.287	53.226	66.083
AIC	1.235	-4.097	-2.772	-3.600	-4.734	-2.823	-3.058	-4.087

Note: * and ** denote significance at the 5% and 1% levels, respectively; figures in parentheses are *z*-statistics.

Figure 6.1 illustrates the evolution of the coefficients of the long-run AIDS model over time in the case of the UK. Both homogeneity and symmetry are imposed on the system. The figure shows that some of the estimated coefficients demonstrate specific trends over time when the TVP technique is applied. Similar conclusions are also obtained for the other seven systems (the results of the remaining seven source markets are reported in the Appendix). It is therefore verified that tourism demand systems have time-varying properties.

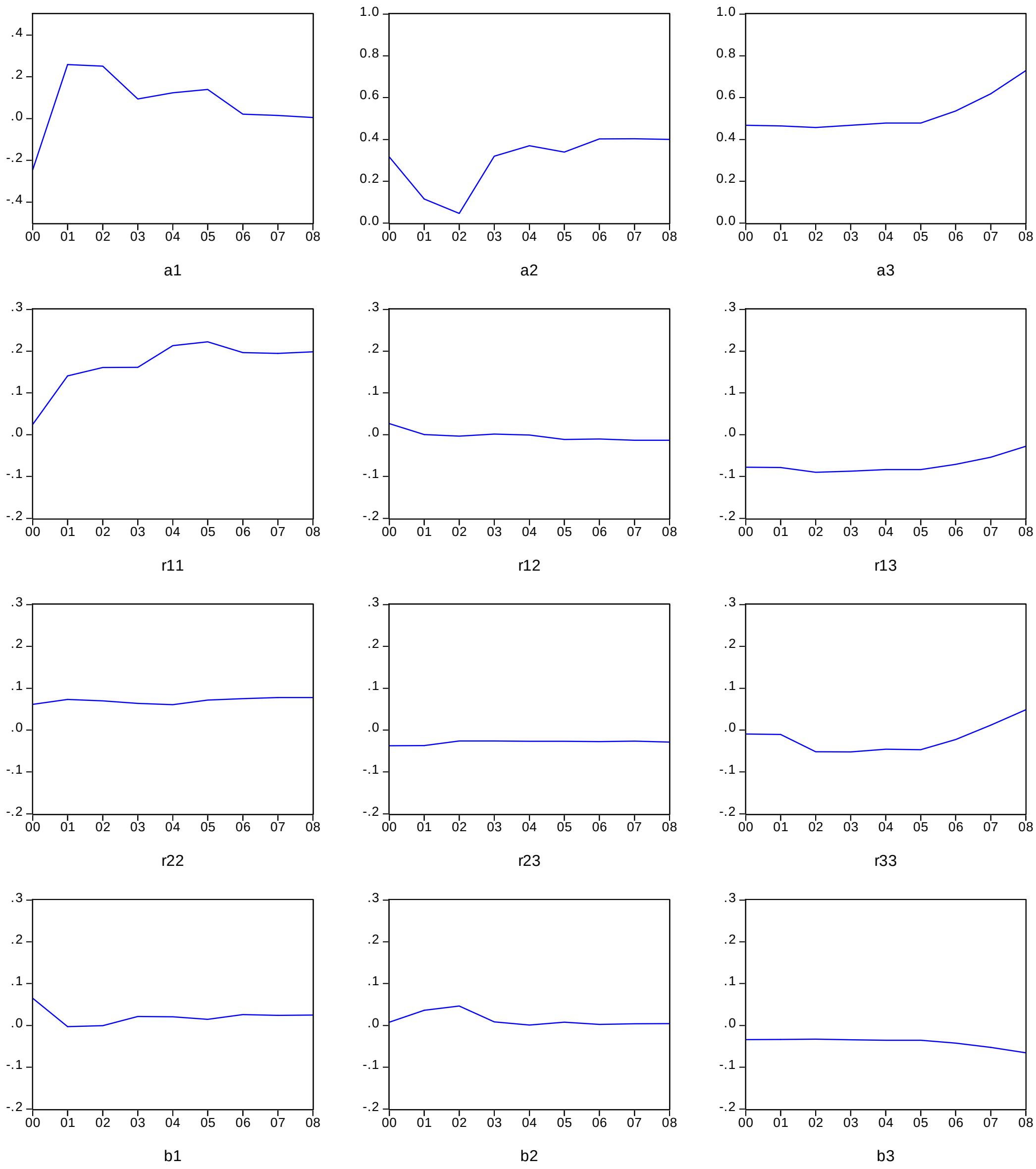

Figure 6.1 Evolution of the coefficients in the long-run AIDS model for the UK

6.2.2 Short-run error-correction TVP-AIDS model

Based on the specification of the long-run TVP-AIDS model, this section further develops the error-correction TV-AIDS model to capture the short-run dynamics of tourist spending behaviour. As discussed, in reality, a tourism system tends to stay away from equilibrium but is always pulled towards it. The error-correction TVP-AIDS model attempts to describe this self-adjusting mechanism in a tourism system to identify short-run tourist spending patterns.

The specification of the short-run error-correction TVP-AIDS model for a tourism demand system is shown in Equations 6.2(a) to (p). The TVP model is described by specifying the coefficients of the determinants as a random walk process.

$$\begin{aligned}\Delta w_1 = \alpha_1 + \lambda\mu_{1,t-1} + \gamma_{11}(\Delta\ln p_1 - \Delta\ln p_4) + \gamma_{12}(\Delta\ln p_2 - \Delta\ln p_4) \\ + \gamma_{13}(\Delta\ln p_3 - \Delta\ln p_4) + \beta_1\Delta\ln\frac{x_1}{P} + \sum_k \varphi_{1k}dum_k + \varepsilon_1\end{aligned} \tag{6.2a}$$

$$\begin{aligned}\Delta w_2 = \alpha_2 + \lambda\mu_{2,t-1} + \gamma_{12}(\Delta\ln p_1 - \Delta\ln p_4) + \gamma_{22}(\Delta\ln p_2 - \Delta\ln p_4) \\ + \gamma_{23}(\Delta\ln p_3 - \Delta\ln p_4) + \beta_2\Delta\ln\frac{x_2}{P} + \sum_k \varphi_{2k}dum_k + \varepsilon_2\end{aligned} \tag{6.2b}$$

$$\begin{aligned}\Delta w_3 = \alpha_3 + \lambda\mu_{3,t-1} + \gamma_{13}(\Delta\ln p_1 - \Delta\ln p_4) + \gamma_{23}(\Delta\ln p_2 - \Delta\ln p_4) \\ + \gamma_{33}(\Delta\ln p_3 - \Delta\ln p_4) + \beta_3\Delta\ln\frac{x_3}{P} + \sum_k \varphi_{3k}dum_k + \varepsilon_3\end{aligned} \tag{6.2c}$$

$$\alpha_{1,t} = \alpha_{1,t-1} + \phi_{1,t} \tag{6.2d}$$

$$\alpha_{2,t} = \alpha_{2,t-1} + \phi_{2,t} \tag{6.2e}$$

$$\alpha_{3,t} = \alpha_{3,t-1} + \phi_{3,t} \tag{6.2f}$$

$$\gamma_{11,t} = \gamma_{11,t-1} + \pi_{11,t} \tag{6.2g}$$

$$\gamma_{12,t} = \gamma_{12,t-1} + \pi_{12,t} \qquad (6.2h)$$

$$\gamma_{13,t} = \gamma_{13,t-1} + \pi_{13,t} \qquad (6.2i)$$

$$\gamma_{22,t} = \gamma_{22,t-1} + \pi_{22,t} \qquad (6.2j)$$

$$\gamma_{23,t} = \gamma_{23,t-1} + \pi_{23,t} \qquad (6.2k)$$

$$\gamma_{33,t} = \gamma_{33,t-1} + \pi_{33,t} \qquad (6.2j)$$

$$\beta_{1,t} = \beta_{1,t-1} + \upsilon_{1,t} \qquad (6.2m)$$

$$\beta_{2,t} = \beta_{2,t-1} + \upsilon_{2,t} \qquad (6.2n)$$

$$\beta_{3,t} = \beta_{3,t-1} + \upsilon_{3,t} \qquad (6.2o)$$

$$\lambda_t = \lambda_{t-1} + \upsilon\eta_t , \qquad (6.2p)$$

where Equations 6.2(a) to (c) are the measurement equations and Equations 6.2(d) to (p) are the transition equations. It should be noted that the coefficients of $\mu_{i,t-1}$ are set to be equal in three equations (6.2(a) to (c)), and specified as a random walk process (Equation 6.2(p)). This allows the examination of the evolution of the adjustment in the system in response to disequilibrium in the previous time period. All other variables have been explained in Sections 5.3 and 6.2.1. The difference between Equations 6.2(a) to (p) and Equations 5.3(a) to (c) is that the former allow the coefficients of the independent variables to change over time as a random walk process. This helps the model to capture any structural change as a result of changes in tourist consumption behaviour.

Table 6.2 presents the estimates of the final state for the error-correction TVP-AIDS models with homogeneity and symmetry imposed. All models converge after a certain number of iterations.

Table 6.2 Final state estimates of the homogeneity- and symmetry-restricted error-correction TVP-AIDS models

	Mainland China	Australia	The UK	The US	Japan	South Korea	Singapore	Taiwan
Equation (1): Shopping								
Constant	0.021	0.007	0.004	0.007	0.000	-0.002	0.048*	-0.006
	(1.203)	(0.644)	(0.834)	(0.436)	(-0.007)	(-0.172)	(2.468)	(-1.275)
ln(p_shopping)-ln(p_other)	-0.159	0.445**	0.289	0.021	0.054	-0.093	-0.425**	-0.301*
	(-1.502)	(2.742)	(1.921)	(0.033)	(0.441)	(-0.372)	(-4.215)	(-2.480)
ln(p_hotels)-ln(p_other)	0.038	-0.012	-0.046	-0.123**	-0.023	0.201**	0.050*	0.000
	(1.829)	(-0.363)	(-1.364)	(-3.079)	(-0.251)	(3.628)	(2.513)	(0.001)
ln(p_meals)-ln(p_other)	0.022	0.107	0.857	-0.052	0.019	0.064	0.161*	-0.108
	(0.313)	(0.347)	(1.917)	(-0.875)	(0.538)	(0.860)	(2.133)	(-0.645)
ln(x/P)	-0.092*	0.222	0.203	0.186**	0.193**	0.110	0.011	0.092*
	(-2.427)	(0.791)	(0.853)	(2.821)	(5.181)	(1.373)	(0.515)	(2.234)
Error-correction term (t-1)	-0.729**	-0.470**	-1.157**	-0.348	-0.380	-1.230**	-1.277**	-0.902**
	(-6.409)	(-5.307)	(-11.496)	(-0.528)	(-0.720)	(-11.425)	(-13.64)	(-5.830)
Equation (2): Hotel accommodation								
Constant	-0.007	0.000	-0.012	0.006	0.000	-0.048*	-0.045	0.001
	(-0.384)	(-0.081)	(-0.741)	(0.804)	(0.011)	(-2.291)	(-1.778)	(0.354)

ln(p_shopping)-ln(p_other)	0.038	-0.012	-0.046	-0.123**	-0.023	0.201**	0.050*	0.000
	(1.829)	(-0.363)	(-1.364)	(-3.079)	(-0.251)	(3.628)	(2.513)	(0.001)
ln(p_hotels)-ln(p_other)	-0.013	0.008	0.082*	0.061	0.024	-0.052	0.018	0.040
	(-0.550)	(0.222)	(2.126)	(1.429)	(1.117)	(-0.423)	(0.720)	(1.811)
ln(p_meals)-ln(p_other)	0.022	-0.038	0.015	0.016	0.096*	-0.079**	-0.036**	0.053
	(1.315)	(-0.313)	(0.162)	(1.112)	(2.310)	(-4.531)	(-2.647)	(0.046)
ln(x/P)	0.081*	-0.161**	-0.053	-0.184	-0.178**	0.168	-0.018	-0.056
	(1.991)	(-3.103)	(-0.728)	(-1.539)	(-5.883)	(0.784)	(-0.656)	(-1.697)
Error-correction term (t-1)	-0.729**	-0.470**	-1.157**	-0.348	-0.380	-1.230**	-1.277**	-0.902*
	(-6.409)	(-5.307)	(-11.496)	(-0.528)	(-0.720)	(-11.425)	(-13.640)	*(-5.830)
Equation (3): Meals outside hotels								
Constant	-0.002	-0.004	-0.001	0.000	-0.006	-0.012	-0.011	-0.001
	(-0.683)	(-0.949)	(-0.283)	(0.071)	(-1.366)	(-0.819)	(-1.372)	(-0.229)
ln(p_shopping)-ln(p_other)	0.022	0.107	0.857	-0.052	0.019	0.064	0.161*	-0.108
	(0.313)	(0.347)	(1.917)	(-0.875)	(0.538)	(0.860)	(2.133)	(-0.645)
ln(p_hotels)-ln(p_other)	0.022	-0.038	0.015	0.016	0.096*	-0.079**	-0.036**	0.053
	(1.315)	(-0.313)	(0.162)	(1.112)	(2.310)	(-4.531)	(-2.647)	(0.046)
ln(p_meals)-ln(p_other)	0.151	0.448**	0.366*	0.216	0.502**	0.078	0.320*	0.013
	(0.880)	(3.646)	(2.475)	(1.918)	(6.562)	(0.344)	(2.148)	(0.109)

ln(x/P)	-0.004	-0.043**	-0.086**	-0.072	0.025*	-0.055**	-0.003	-0.042
	(-0.153)	(-3.152)	(-5.870)	(-1.389)	(2.439)	(-2.658)	(-0.069)	(-0.891)
Error-correction term (t-1)	-0.729**	-0.470**	-1.157**	-0.348	-0.380	-1.23**	-1.277**	-0.902**
	(-6.409)	(-5.307)	(-11.496)	(-0.528)	(-0.720)	(-11.425)	(-13.640)	(-5.830)
The whole system								
Log likelihood	-1.208	47.047	47.198	54.648	76.604	38.580	58.541	38.956
AIC	2.694	-2.587	-2.600	-3.221	-5.050	-1.882	-3.545	-1.913

Note: * and ** denote significance at the 5% and 1% levels, respectively; figures in parentheses are *z*-statistics.

6.3 Elasticity analysis from the TVP perspective

In the previous chapter, tourism demand elasticities are examined from a constant-parameter perspective. This means that the demand elasticities calculated are constant over time. Such elasticities can be understood as the average level of demand elasticities over the time span under consideration. In this chapter, as the TVP technique is employed to examine tourist consumption behaviour, the coefficients in the TVP-AIDS models can vary over time. Therefore, the corresponding demand elasticities calculated are produced on a time-varying basis. That is, specific demand elasticities are generated in response to each time point, and the evolution of tourist demand elasticities can be examined. This is more consistent with reality, as the spending patterns of tourists are likely to evolve over time.

6.3.1 Calculation of the demand elasticities

As the coefficients in the TVP-AIDS models change over time, the calculated demand elasticities also vary over time. As discussed in Chapter 3, the expenditure elasticity is calculated as $\varepsilon_{ix} = \frac{\beta_i}{w_i} - 1$, where ε_{ix} is the expenditure elasticity for tourism product *i*, β_i is the coefficient estimated for the logarithm of real expenditure per capita in the equation of tourism product *i* within the demand system and w_i is the expenditure share for product *i*. In the TVP version of the AIDS models, the coefficient β_i is estimated to generate different values at each time point, and w_i also contains values that vary over the time span considered. Therefore, the calculated TVP-based expenditure elasticities allow the analysis of the evolution of demand elasticities at the respective points in time.

Similarly, as discussed in Chapter 3, the calculation of the compensated own-price and cross-price elasticities is based on these formulae: $\varepsilon_{ii} = \frac{\gamma_{ii}}{w_i} + w_i - 1$ and $\varepsilon_{ij} = \frac{\gamma_{ij}}{w_i} + w_j$, respectively. When the TVP approach is employed, the estimates of coefficients γ_{ii} and γ_{ij} are two time series instead of two specific values. In contrast to the constant-parameter models, where the averages of w_i (or w_j) are used for elasticity calculation, here, the whole time series of w_i (or w_j) is employed to generate time-varying price elasticities.

Based on the calculation results, various kinds of consumption behaviour in both the long and the short run are identified regarding the eight source markets. For each source market, the consumption pattern also changes over time. Tables 6.3 to 6.10 show the demand elasticities of the eight source markets in both the long run and the short run, respectively (see the following sections). The long-run and short-run demand elasticities reported in these tables are calculated based on the estimates of the long-run TVP-AIDS and error-correction TVP-AIDS models, respectively. The reported demand elasticity series start from 1992 (from 2001 in the case of mainland China). The elasticities calculated for earlier years are unstable and inaccurate because of the initialisation of the Kalman filter, and thus are omitted. The statistical significance of the calculated demand elasticities is also reported. To ensure the robustness of the findings, only the statistically significant elasticities are discussed in detail in the following sections.

Table 6.3 Long-run and short-run tourism demand elasticities for mainland China

	Price elasticities									Expenditure elasticities		
	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Long-run												
2001	-0.584	0.292*	0.29	1.207*	-1.197**	0.006	1.442	0.007	2.781	0.832*	1.865*	1.334
2002	-0.708	0.285*	0.316	1.243*	-1.165**	0.006	1.301	0.006	2.238	0.774*	1.526*	1.306*
2003	-0.529	0.25*	0.255	1.388**	-1.213**	-0.027	1.475	-0.028	1.074	0.779*	1.615**	1.452*
2004	-0.441	0.243*	0.246	1.552**	-1.313**	-0.042	1.369	-0.037	-0.3	0.705**	1.803**	1.539**
2005	-0.451	0.236*	0.254	1.359**	-1.233**	-0.003	1.239	-0.003	1.575	0.689**	1.759**	1.498**
2006	-0.411	0.244*	0.228	1.368**	-1.188**	-0.013	1.319*	-0.014	-0.61	0.695**	1.702**	1.613**
2007	-0.32	0.224*	0.216	1.533**	-1.264**	-0.071	1.628*	-0.078	-6.031**	0.76**	1.707**	1.651**
2008	-0.338	0.238**	0.215	1.463**	-1.226**	-0.056	1.616*	-0.068	-5.568**	0.753**	1.669**	1.665**
Short-run												
2001	-0.459	0.215	0.165	0.889	-1.053	0.256	0.818	0.308	0.517	0.758	2.276	1.005
2002	-0.587	0.2*	0.252	0.875*	-1.07*	0.26	1.038	0.245	0.777	0.766*	2.396*	1.027
2003	-0.497	0.18*	0.193	0.996**	-1.056**	0.25	1.119	0.261	0.776	0.795**	2.232*	1.104
2004	-0.487	0.161**	0.2	1.027**	-1.048**	0.251	1.112	0.219	1.173	0.845**	1.963**	1.069**
2005	-0.527*	0.171**	0.215	0.986**	-1.032**	0.289*	1.049	0.245	0.923	0.849**	1.799**	1.076**
2006	-0.505*	0.175**	0.183	0.978**	-1.002**	0.268*	1.056	0.276	1.094	0.842**	1.744**	1.096**
2007	-0.474*	0.155**	0.152	1.062**	-1.018**	0.26*	1.147	0.287	1.336	0.875**	1.769**	1.011**
2008	-0.507*	0.17**	0.126	1.043**	-0.995**	0.281*	0.945	0.343*	0.68	0.872**	1.701**	0.955**

Note:

S-S:	The own-price elasticity of demand for shopping;
S-H:	The cross-price elasticity of demand for shopping in response to the price change of hotels;
S-M:	The cross-price elasticity of demand for shopping in response to the price change of meals outside hotels;
H-S	The cross-price elasticity of demand for hotel accommodation in response to the price change of shopping;
H-H:	The own-price elasticity of demand for hotel accommodation;
H-M:	The cross-price elasticity of demand for hotel accommodation in response to the price change of meals outside hotels;
M-S:	The cross-price elasticity of demand for meals outside hotels in response to the price change of shopping;
M-H:	The cross-price elasticity of demand for meals outside hotels in response to the price change of hotel accommodation; and
M-M:	The own-price elasticity of demand for meals outside hotels.

Table 6.4 Long-run and short-run tourism demand elasticities for Australia

	Price elasticities									Expenditure elasticities		
	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Long-run												
1992	-0.689	0.479	0.433	0.607	-0.64*	-0.032	1.788	-0.104	1.278	1.313**	0.989*	0.121
1993	-0.677	0.492*	0.471	0.539	-0.592*	-0.057	1.718	-0.19	1.281	1.365**	0.897*	0.328
1994	-0.579	0.456*	0.48	0.383	-0.463	0.022	1.402	0.076	0.858	1.476**	0.844**	0.364
1995	-0.581	0.475*	0.6	0.397	-0.456	-0.006	2.022	-0.023	1.933	1.466**	0.847**	0.24
1996	-0.651	0.469*	0.354	0.369	-0.447	0.021	1.114	0.084	0.571	1.492**	0.851**	0.341
1997	-0.566	0.471*	0.18	0.347	-0.439*	0.002	0.659	0.011	1.309	1.459**	0.832**	0.493
1998	-0.624	0.55**	0.122	0.395*	-0.439**	-0.045	0.266	-0.137	0.004	1.551**	0.826**	0.605
1999	-0.551	0.523**	-0.069	0.397**	-0.45**	-0.036	-0.138	-0.095	-0.156	1.526**	0.821**	0.727*
2000	-0.543	0.564**	-0.065	0.344*	-0.428**	-0.003	-0.105	-0.007	0.183	1.63**	0.821**	0.69**
2001	-0.361	0.518**	-0.126	0.287*	-0.414**	0.012	-0.194	0.032	0.192	1.556**	0.844**	0.705**
2002	-0.237	0.444**	-0.498**	0.292*	-0.42**	0.113	-1.004	0.346	-1.106	1.499**	0.835**	0.713**
2003	-0.104	0.339**	-0.287	0.413**	-0.5**	0.089	-0.84	0.212	-0.986	1.507**	0.599**	0.739**
2004	0.002	0.31**	-0.207	0.443**	-0.523**	0.12	-0.684	0.277	-0.814	1.47**	0.554**	0.731**
2005	0.03	0.326**	-0.236	0.392**	-0.5**	0.11	-0.715	0.278	-0.815	1.514**	0.591**	0.732**
2006	-0.005	0.351**	-0.247	0.375**	-0.469**	0.128	-0.739	0.358	-0.833	1.519**	0.642**	0.73**
2007	-0.001	0.364**	-0.258	0.366**	-0.461**	0.124	-0.758	0.364	-0.838	1.531**	0.654**	0.729**
2008	-0.004	0.34**	-0.236	0.375**	-0.474**	0.142	-0.703	0.384	-0.755	1.515**	0.619**	0.738**

	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Short-run												
1992	0.449	0.277	0.603	0.351	-0.881	-0.055	2.491	-0.18	3.288	1.252	0.877	0.277
1993	0.446	0.307	0.778	0.336	-0.796*	-0.111	2.837	-0.369	3.269	1.225*	0.789	0.378
1994	0.553	0.322	0.908	0.271	-0.638*	0.109	2.652	0.379	2.851	1.392**	0.754*	0.464
1995	0.537	0.343	0.559	0.287	-0.63*	0.087	1.884	0.351	2.794	1.421*	0.761*	0.427
1996	0.44	0.358	-0.278	0.282	-0.617*	0.229	-0.873	0.913	3.162	1.317*	0.767*	0.438
1997	0.424	0.39*	-0.614	0.287	-0.593*	0.202	-2.246	1.002	4.315	1.329*	0.771**	0.38
1998	0.415	0.427**	-0.867	0.306*	-0.507**	0.047	-1.885	0.142	2.741	1.353*	0.788**	0.571
1999	0.322	0.419**	-0.121	0.318*	-0.521**	0.072	-0.244	0.191	2.093	1.623**	0.79**	0.61*
2000	0.407	0.452**	-0.161	0.276*	-0.488**	0.094	-0.262	0.251	1.924	1.698**	0.782**	0.633*
2001	0.146	0.429**	-0.638	0.237*	-0.466**	0.266	-0.982	0.74	1.974	1.032**	0.82**	0.723**
2002	0.254	0.392**	-0.512	0.258*	-0.484**	0.248	-1.033	0.76	2.415	1.012	0.804**	0.689**
2003	0.282	0.281**	-0.431	0.343**	-0.607**	0.206	-1.264	0.494	2.499	2.224**	0.556**	0.673**
2004	0.528	0.27**	-0.231	0.386**	-0.643**	0.238	-0.761	0.551	2.67*	2.047**	0.5**	0.667**
2005	0.53	0.316**	-0.134	0.381**	-0.63**	0.08	-0.405	0.201	2.608*	1.717**	0.552**	0.673**
2006	0.53	0.341**	0.203	0.364**	-0.605**	0.218	0.608	0.612	2.532*	1.639*	0.587**	0.672**
2007	0.544	0.354**	0.246	0.356**	-0.598**	0.101	0.725	0.296	2.463*	1.579*	0.601**	0.677**
2008	0.52	0.329**	0.403	0.363**	-0.618**	0.027	1.202	0.072	2.509*	1.561*	0.551**	0.674**

Note: See the note for Table 6.3.

Table 6.5 Long-run and short-run tourism demand elasticities for the UK

	Price elasticities									Expenditure elasticities		
	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Long-run												
1992	-0.284	0.576	0.92	0.413	-0.571	0.054	2.004	0.165	2.241	0.714	1.48*	0.389
1993	0.308	0.524	1.381	0.24	-0.443	0.069	2.087	0.228	2.408	1.254*	1.003*	0.409
1994	0.189	0.635	1.45	0.302	-0.413	0.035	2.565	0.132	3.049	1.2*	0.973*	0.424
1995	-0.244	0.634	0.351	0.275	-0.403	0.106	0.492	0.343	0.149	1.23*	0.974**	0.644
1996	-0.418	0.64	0.14	0.274	-0.393	0.102	0.209	0.356	-0.223	1.235*	0.972**	0.674
1997	-0.195	0.539	0.045	0.306	-0.43	0.1	0.081	0.317	-0.473	1.255*	0.925**	0.711*
1998	-0.218	0.439	0.009	0.272	-0.411*	0.099	0.014	0.258	-0.643	1.25**	0.926**	0.766*
1999	-0.505	0.441	-0.075	0.289*	-0.409*	0.106	-0.101	0.219	-0.836	1.259**	0.979**	0.836**
2000	-0.62	0.463*	-0.066	0.367*	-0.461**	0.094	-0.101	0.182	-0.853	1.219**	1.021**	0.826**
2001	-0.151	0.432*	-0.165	0.228	-0.4**	0.095	-0.206	0.226	-0.878	0.986*	1.084**	0.815**
2002	-0.097	0.419*	-0.211	0.237	-0.406**	0.095	-0.334	0.265	-1.179	0.997*	1.107**	0.787**
2003	-0.142	0.386	-0.147	0.281*	-0.451**	0.1*	-0.243	0.227	-1.142	1.076*	1.023**	0.796**
2004	-0.01	0.372	-0.101	0.315*	-0.465**	0.091	-0.195	0.207	-1.117	1.065*	1.002**	0.783**
2005	0.074	0.382	-0.141	0.253*	-0.408**	0.093	-0.25	0.249	-1.138	1.052*	1.019**	0.774**
2006	0.014	0.405*	-0.103	0.238	-0.387**	0.106*	-0.16	0.28	-0.966	1.1**	1.006**	0.747**
2007	0.055	0.408*	-0.053	0.21	-0.369**	0.116*	-0.072	0.31*	-0.758	1.101**	1.008**	0.698**
2008	0.078	0.402*	0.06	0.207	-0.372**	0.113*	0.08	0.294*	-0.548	1.104**	1.009**	0.63**

	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Short-run												
1992	-0.017	-0.026	-1.573	-0.019	-0.259	0.202	-3.426	0.613	2.11	1.182	1.076*	0.546
1993	0.306	-0.174	-1.682	-0.08	-0.135	0.149	-2.543	0.49	2.363	1.995**	0.863*	0.583*
1994	0.445	-0.134	-1.097	-0.064	-0.032	-0.048	-1.94	-0.178	3.108	2.038*	0.891*	0.516*
1995	0.332	-0.137	-1.454	-0.06	-0.037	-0.062	-2.038	-0.2	1.911	2.153*	0.92**	0.542*
1996	0.624	-0.135	-0.595	-0.058	-0.04	-0.083	-0.885	-0.29	1.984	2.253*	0.936**	0.492**
1997	0.291	-0.061	0.072	-0.035	-0.046	-0.109	0.13	-0.344	1.614	1.94*	0.905**	0.473**
1998	0.279	0.143	0.503	0.089	-0.209	0.071	0.811	0.184	1.608	1.777	0.878**	0.526**
1999	0.15	0.099	-0.045	0.065	-0.214	0.107	-0.061	0.221	1.207	1.453	0.877**	0.587**
2000	0.565	0.104	0.759	0.083	-0.335**	0.196	1.16	0.377	1.509	0.615	0.877**	0.579**
2001	0.838	0.119	-0.22	0.063	-0.341**	0.184	-0.275	0.435	1.629	0.677	0.862**	0.555**
2002	0.238	0.209	-1.363	0.118	-0.35**	0.235	-2.154	0.657	1.337	0.476	0.876**	0.477**
2003	0.14	0.2	-1.823	0.146	-0.382**	0.164	-3.012	0.372	1.104	0.816	0.837**	0.515**
2004	0.402	0.199	-0.117	0.169	-0.407**	0.196	-0.226	0.447	0.839	0.758	0.847**	0.5**
2005	0.535	0.232	-0.043	0.154	-0.385**	0.072	-0.076	0.193	0.899	0.622	0.865**	0.485**
2006	0.442	0.256	1.173	0.15	-0.372**	0.111	1.824	0.293	0.721	1.015	0.866**	0.51**
2007	0.514	0.245	2.1	0.126	-0.36**	0.341*	2.882	0.912*	0.978	1.131	0.876**	0.531**
2008	0.463	0.262*	3.813**	0.135	-0.364**	0.208	5.082*	0.541	1.245	1.861*	0.884**	0.512**

Note: See the note for Table 6.3.

Table 6.6 Long-run and short-run tourism demand elasticities for the US

	Price elasticities									Expenditure elasticities		
	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Long-run												
1992	2.722	-0.19	1.538	-0.184	-0.298	0.154	5.655	0.587	7.098	-0.128	1.648	-1.788
1993	3.244*	-0.351	1.665*	-0.266	-0.221	0.201	4.466	0.712	5.672	-0.024	1.361	-1.601
1994	2.419	-0.475	0.764	-0.29	-0.122	0.12	1.99	0.512	3.144	0.721	0.893*	0.816
1995	2.871*	-0.708	0.547	-0.341	-0.1	0.119	1.223	0.551	1.953	0.717	0.869**	0.884
1996	2.131	-0.629	-0.35	-0.283	-0.1	0.15	-0.63	0.599	-0.663	0.925*	0.863**	1.195*
1997	1.852	-0.648	-0.351	-0.288	-0.101	0.143	-0.658	0.603	-0.608	1.094*	0.855**	1.21*
1998	1.364	-0.225	-0.192	-0.165	-0.1	0.152*	-0.474	0.509*	-0.519	1.15**	0.836**	1.196*
1999	0.914	-0.276	-0.155	-0.191	-0.1	0.155**	-0.35	0.504*	-0.54	1.206**	0.832**	1.185*
2000	1.118	-0.367	-0.137	-0.194	-0.104	0.194**	-0.212	0.569*	0.105	1.253**	0.865**	1.071*
2001	0.468	-0.073	-0.034	-0.044	-0.123	0.15**	-0.068	0.499*	-0.003	1.355**	0.836**	0.934*
2002	0.208	0.114	0.117	0.057	-0.14	0.149**	0.176	0.447*	0.28	1.708**	0.81**	0.859*
2003	0.033	0.133	0.087	0.097	-0.153	0.118*	0.198	0.371*	0.151	1.6**	0.734**	0.641*
2004	0.033	0.019	0.188	0.012	-0.157	0.135**	0.339	0.397*	0.238	1.681**	0.757**	0.64*
2005	0.09	0.12	0.198	0.065	-0.155	0.12*	0.36	0.4*	0.301	1.708**	0.776**	0.619*
2006	0.114	-0.029	0.243	-0.012	-0.138	0.134**	0.336	0.449**	0.203	1.913**	0.781**	0.626*
2007	0.147	-0.049	0.258	-0.02	-0.143	0.14**	0.338	0.455**	0.204	1.926**	0.783**	0.64*
2008	0.171	-0.056	0.243	-0.023	-0.145	0.14**	0.32	0.448**	0.144	1.915**	0.782**	0.641*

	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Short-run												
1992	0.661	0.461	0.643	0.446	-0.745	0.154	2.364	0.587	3.773	-0.044	1.828	-0.507
1993	0.956	0.428	0.626	0.325	-0.637	0.181	1.68	0.641	2.473	-0.051	1.624	-0.278
1994	0.936	0.327	0.145	0.199	-0.509*	0.138	0.376	0.588	0.754	1.237*	0.578	0.964
1995	0.902	0.353	0.322	0.17	-0.448	0.13	0.719	0.606	1.439	1.067*	0.737	1.061
1996	-0.34	0.4	0.055	0.18	-0.451*	0.153*	0.1	0.614*	0.399	1.201**	0.76*	1.162*
1997	0.39	0.337	-0.119	0.15	-0.453*	0.157*	-0.223	0.665*	0.533	1.198**	0.766*	1.261*
1998	-0.57	0.083	0.049	0.061	-0.356*	0.176**	0.12	0.592**	1.041	1.217**	0.576	1.151*
1999	0.236	0.027	0.004	0.019	-0.347*	0.182**	0.008	0.593**	0.885	1.266**	0.572	1.137*
2000	0.572	-0.024	0.044	-0.013	-0.346*	0.211**	0.069	0.62**	0.949	1.355**	0.608	0.981
2001	0.264	0.082	-0.023	0.049	-0.411**	0.181**	-0.046	0.602**	1.062	1.641**	0.415	0.811
2002	-0.246	-0.033	-0.107	-0.017	-0.353**	0.195**	-0.162	0.583**	0.626	1.668**	0.585	0.803
2003	-0.129	0.056	-0.111	0.041	-0.392**	0.176**	-0.253	0.555**	0.71	1.577**	0.454*	0.614*
2004	-0.292	0.014	-0.057	0.008	-0.395**	0.191**	-0.102	0.56**	0.605	1.66**	0.553*	0.581
2005	-0.352	0.027	-0.081	0.015	-0.389**	0.178**	-0.147	0.596**	0.688	1.689**	0.598*	0.564
2006	-0.45	-0.037	-0.111	-0.015	-0.361**	0.187**	-0.154	0.63**	0.549	1.846**	0.654**	0.557
2007	-0.574	-0.047	-0.085	-0.019	-0.366**	0.193**	-0.111	0.628**	0.526	1.876**	0.646*	0.558
2008	-0.689	-0.06	-0.083	-0.025	-0.366**	0.192**	-0.109	0.613**	0.5	1.877**	0.643*	0.555

Note: See the note for Table 6.3.

Table 6.7 Long-run and short-run tourism demand elasticities for Japan

	Price elasticities									Expenditure elasticities		
	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Long-run												
1992	0.278	0.014	-0.3	0.031	-0.326*	0.159	-1.799	0.423	-1.069	1.293**	0.582	0.975
1993	0.164	0.024	-0.279	0.063	-0.488**	0.169	-1.675	0.382	-1.069	1.309**	0.444	0.966
1994	0.171	0.061	-0.233	0.14	-0.349**	0.118	-1.416	0.311	-0.497	1.315**	0.472	1.022*
1995	0.275	0.067	-0.13	0.127	-0.287**	0.103	-0.796	0.333	1.072*	1.361**	0.494	1.111*
1996	0.208	0.104	-0.133	0.166	-0.283**	0.096	-0.79	0.357	1.34*	1.363**	0.537	1.144*
1997	0.157	0.087*	0.033	0.125	-0.311**	0.106	0.149	0.328	0.473**	1.449**	0.598*	0.757*
1998	0.252	0.159**	0.012*	0.246*	-0.456**	0.058	0.046	0.14	-0.053*	1.437**	0.53*	0.819*
1999	-0.212	0.175	-0.063*	0.354	-0.366**	0.072	-0.224	0.124	-0.131*	1.468**	0.278	0.919**
2000	-0.305	0.23*	-0.059*	0.435*	-0.497**	0.054	-0.21	0.102	-0.325**	1.409**	0.441*	0.967**
2001	-0.316	0.265*	-0.065*	0.407	-0.425**	0.058	-0.227	0.132	-0.345**	1.431**	0.482*	0.986**
2002	-0.554	0.289**	0.023*	0.45*	-0.482**	0.047	0.067	0.087	0.084**	1.374**	0.454*	1.055**
2003	-0.551	0.308**	-0.01*	0.464*	-0.629**	0.054	-0.031	0.110	-0.039**	1.369**	0.482**	1.046**
2004	-0.536*	0.317**	0.087**	0.44*	-0.706**	0.082**	0.243	0.166**	0.211**	1.381**	0.500**	1.000**
2005	-0.547*	0.326*	0.084**	0.381	-0.513**	0.115**	0.201	0.236**	0.132**	1.409**	0.567**	1.004**
2006	-0.551*	0.338*	0.075**	0.370	-0.529**	0.112**	0.180	0.246**	0.158**	1.419**	0.584**	1.005**
2007	-0.543*	0.346	0.084**	0.368	-0.565**	0.116*	0.197	0.255*	0.173**	1.417**	0.596**	1.000**
2008	-0.539	0.346	0.072**	0.367	-0.572**	0.115**	0.171	0.257**	0.114**	1.417**	0.597**	1.000**

	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Short-run												
1992	0.766	0.371	0.039	0.841	-0.934	-0.037	0.235	-0.099	4.077	1.234*	0.331	1.271*
1993	0.706	0.329	0.028	0.874	-0.953*	-0.107	0.171	-0.242	4.173	1.222**	0.256	1.296*
1994	0.692	0.276	-0.082	0.633	-0.799*	0.118	-0.498	0.312	3.043	1.235**	0.327	1.178**
1995	0.613	0.329	-0.048	0.619	-0.769*	0.11	-0.295	0.358	3.826*	1.303**	0.362	1.207**
1996	0.639	0.325	-0.053	0.519	-0.697*	0.084	-0.313	0.312	3.953*	1.329**	0.372	1.225**
1997	0.195	0.412*	0.207	0.593	-0.725**	0.024	0.923	0.074	4.189**	1.48**	0.373*	1.187**
1998	0.168	0.239**	0.228	0.37*	-0.589**	0.088	0.855	0.213	3.511*	1.499**	0.289	1.179**
1999	0.084	0.184	0.245*	0.373	-0.619**	0.096	0.865	0.166	2.88*	1.47**	0.178	1.141**
2000	0.075	0.254*	0.273*	0.48	-0.659**	0.102	0.981	0.194	3.095**	1.462**	0.309*	1.137**
2001	0.048	0.333*	0.261*	0.51	-0.621**	0.016	0.908	0.037	3.312**	1.481**	0.389*	1.185**
2002	-0.289	0.441**	0.194*	0.687*	-0.638**	0.126	0.561	0.234	2.542**	1.465**	0.335*	1.129**
2003	-0.366	0.512**	0.194*	0.772*	-0.636**	0.12	0.6	0.246	2.737**	1.454**	0.379**	1.14**
2004	-0.513*	0.359**	0.257**	0.498*	-0.632**	0.309**	0.717	0.621**	2.731**	1.475**	0.407**	1.165**
2005	-0.517*	0.283*	0.217**	0.331	-0.587**	0.379**	0.522	0.779**	2.269**	1.499**	0.461**	1.151**
2006	-0.544*	0.282	0.208**	0.308	-0.575**	0.365**	0.501	0.8**	2.352**	1.514**	0.479**	1.157**
2007	-0.524*	0.308	0.213**	0.328	-0.575**	0.361*	0.499	0.795*	2.299**	1.514**	0.497**	1.155**
2008	-0.479	0.297	0.209**	0.315	-0.575**	0.427**	0.495	0.954**	2.3**	1.511**	0.501**	1.157**

Note: See the note for Table 6.3.

Table 6.8 Long-run and short-run tourism demand elasticities for South Korea

	Price elasticities									Expenditure elasticities		
	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Long-run												
1992	-1.664	0.518	-0.473	0.618	-0.601	0.174	-1.694	0.522	-5.291	1.443**	0.612	0.649
1993	-1.690	0.465	-0.611	0.717	-0.654	0.247	-1.903	0.499	-5.344	1.439**	0.633	0.665
1994	-1.633	0.510	-0.482	0.714	-0.736*	0.151	-1.474	0.329	-4.249	1.399**	0.767*	0.910
1995	-1.144	0.441	-0.072	0.601	-0.696*	0.090	-0.233	0.214	-2.591	1.333**	0.782**	0.753
1996	-1.061	0.453	0.091	0.575	-0.669*	0.100	0.287	0.247	-1.575	1.340**	0.778**	0.822*
1997	-1.001	0.432	0.035	0.555	-0.668*	0.109	0.114	0.277	-1.459	1.305**	0.793**	0.865*
1998	-1.470	0.978**	0.033	0.749**	-0.865**	-0.044	0.052	-0.090	-1.812	1.458**	0.745**	0.810*
1999	-1.772*	0.746**	0.173	1.061**	-0.900**	-0.148	0.378	-0.227	-1.986	1.426**	0.703**	0.800*
2000	-1.859**	0.777**	0.178	1.056**	-0.892**	-0.156	0.390	-0.252	-1.876	1.461**	0.766**	0.773*
2001	-1.711*	0.758**	0.225	1.037**	-0.860**	-0.251	0.686	-0.560	-2.385	1.422**	0.778**	0.638*
2002	-1.876**	0.817**	0.363	0.996**	-0.858**	-0.263	0.859	-0.512	-1.717	1.470**	0.777**	0.686*
2003	-1.644*	0.74**	0.305	1.001**	-0.856**	-0.254	0.829	-0.509	-2.019	1.421**	0.779**	0.657*
2004	-1.181*	0.646**	0.435	0.950**	-0.862**	-0.259	1.162	-0.470	-1.668	1.292**	0.807**	0.612*
2005	-1.148*	0.626**	0.381	0.989**	-0.889**	-0.153	1.063	-0.271	-1.667	1.282**	0.797**	0.719**
2006	-1.188*	0.656**	0.387	0.922**	-0.830**	-0.117	1.069	-0.230	-1.690	1.288**	0.821**	0.718**
2007	-1.037	0.593**	0.337	1.093**	-0.913**	-0.219	1.227	-0.433	-1.914	1.264**	0.779**	0.656*
2008	-0.863	0.537**	0.342	1.144**	-0.970**	-0.263	1.297	-0.470	-1.880	1.210**	0.780**	0.654*

	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Short-run												
1992	-1.852	0.563	0.305	0.672	-0.489	0.006	1.094	0.018	-0.296	1.357*	0.143	0.628
1993	-1.696	0.484	0.504	0.747	-0.561	0.078	1.570	0.158	0.339	1.354*	-0.08	0.892
1994	-1.806	0.531	0.480	0.743	-0.651	0.084	1.467	0.184	0.101	1.366**	0.738	0.876
1995	-1.548	0.487	0.578	0.665	-0.513	0.061	1.867	0.144	0.648	1.238**	1.177*	0.830*
1996	-1.403	0.476	0.524	0.605	-0.558	0.046	1.643	0.114	0.089	1.293**	0.786*	0.763*
1997	-1.652	0.491	0.209	0.631	-0.584	0.043	0.680	0.109	-1.171	1.309**	0.775	0.708*
1998	-2.389*	1.094**	0.112	0.837**	-0.896**	0.008	0.176	0.017	-0.903	1.446**	1.001	0.719**
1999	-1.850*	0.849**	0.156	1.208**	-1.099**	-0.094	0.342	-0.144	-1.07	1.369**	1.412*	0.687**
2000	-1.900*	0.870**	0.195	1.183**	-1.164**	-0.105	0.428	-0.169	-0.981	1.377**	1.506*	0.675**
2001	-1.737*	0.847**	0.235	1.160**	-1.108**	-0.138	0.717	-0.308	0.111	1.352**	1.509*	0.558**
2002	-1.663*	0.861**	0.326	1.049**	-0.936*	-0.126	0.772	-0.245	0.256	1.362**	0.846	0.614**
2003	-1.424	0.801**	0.331	1.083**	-0.929*	-0.143*	0.899	-0.287	0.533	1.333**	0.886	0.596**
2004	-1.008	0.740**	0.347	1.089**	-0.989*	-0.144*	0.927	-0.262	0.451	1.262**	1.204	0.614**
2005	-1.004	0.734**	0.279	1.160**	-1.127**	-0.133*	0.777	-0.234	0.227	1.274**	0.988*	0.655**
2006	-1.030	0.776**	0.293	1.090**	-1.098**	-0.116	0.808	-0.228	0.099	1.284**	0.810	0.632**
2007	-0.857	0.694**	0.255	1.280**	-1.249**	-0.172*	0.929	-0.340*	-0.131	1.266**	0.679	0.565**
2008	-0.674	0.634**	0.259	1.350**	-0.979*	-0.197**	0.983	-0.351*	-0.282	1.217**	1.704*	0.588**

Note: See the note for Table 6.3.

Table 6.9 Long-run and short-run tourism demand elasticities for Singapore

	Price elasticities									Expenditure elasticities		
	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Long-run												
1992	-0.158	0.137	0.899	0.147	-0.423	-0.017	2.284	-0.040	1.321	1.145**	0.777*	1.301*
1993	-0.583	0.253	0.541	0.309	-0.521	0.031	1.433	0.068	0.264	1.181**	0.749**	1.367*
1994	-0.789	0.346	0.375	0.431	-0.614*	0.100	1.021	0.219	-0.138	1.174**	0.768**	1.358*
1995	-0.544	0.375	0.648	0.356	-0.574*	0.080	1.658	0.216	0.670	1.180**	0.772**	1.304*
1996	-0.406	0.351	0.769	0.294	-0.498*	0.052	2.192	0.176	1.351	1.158**	0.826**	1.298**
1997	-0.430	0.334	0.903	0.270	-0.503*	0.063	2.137	0.185	0.937	1.172**	0.838**	1.198**
1998	-0.423	0.328*	0.905	0.292	-0.463**	0.053	2.050	0.136	0.820	1.178**	0.840**	1.184**
1999	-0.845	0.340*	0.672	0.380*	-0.488**	0.049	1.607	0.106	0.852	1.173**	0.858**	1.163**
2000	-0.806	0.324*	0.780	0.305*	-0.467**	0.119	1.399	0.226	1.378	1.229**	0.861**	1.038**
2001	-0.799	0.329*	0.754	0.342*	-0.471**	0.096	1.591	0.195	1.507	1.240**	0.855**	1.000**
2002	-0.941	0.321*	0.577	0.334*	-0.474**	0.111	1.189	0.221	0.888	1.263**	0.856**	1.058**
2003	-0.865	0.309*	0.513	0.374**	-0.481**	0.095	1.252	0.192	0.895	1.275**	0.840**	0.978**
2004	-0.795	0.321*	0.505	0.371**	-0.483**	0.094	1.216	0.196	0.822	1.256**	0.857**	1.000**
2005	-0.820	0.340**	0.526	0.340*	-0.459**	0.107	1.169	0.237	0.793	1.276**	0.861**	0.993**
2006	-0.828	0.355**	0.515	0.339*	-0.447**	0.099	1.188	0.239	0.884	1.277**	0.869**	0.988**
2007	-0.726	0.342**	0.466	0.412**	-0.479**	0.080	1.310	0.187	0.954	1.279**	0.838**	0.974**
2008	-0.728	0.336**	0.458	0.409**	-0.480**	0.081	1.279	0.185	0.858	1.281**	0.839**	0.982**

	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Short-run												
1992	-1.847	0.579	0.604	0.622	-0.52	-0.022	1.535	-0.053	1.763	0.977**	0.954*	1.168
1993	-1.771*	0.512*	0.556	0.624*	-0.521	-0.009	1.473	-0.019	1.570	0.973**	0.953**	1.172*
1994	-1.716*	0.514*	0.516	0.642*	-0.566	0.057	1.404	0.124	1.418	0.973**	0.956**	0.989*
1995	-1.868*	0.635**	0.514	0.602**	-0.642*	0.048	1.314	0.128	1.011	0.973**	0.949**	1.003*
1996	-1.581*	0.62**	0.707	0.519**	-0.547*	0.029	2.015	0.1	1.846	0.942**	0.989**	0.929*
1997	-1.765**	0.632**	0.819*	0.51**	-0.556*	0.041	1.939	0.119	1.609	0.947**	0.986**	0.897*
1998	-1.875**	0.536**	0.82*	0.477**	-0.472**	0.027	1.858	0.068	1.471	0.932**	1.014**	0.896*
1999	-1.745**	0.473**	0.801*	0.529**	-0.62**	0.005	1.915*	0.011	1.364	0.94**	0.981**	0.913*
2000	-1.93**	0.507**	1.059**	0.476**	-0.598**	0.057	1.898*	0.108	1.559	0.931**	0.982**	0.837
2001	-1.788**	0.48**	0.992**	0.499**	-0.6**	0.045	2.092**	0.091	1.805	0.971**	0.969**	1.009**
2002	-1.872**	0.472**	0.761**	0.491**	-0.608**	0.061	1.567*	0.12	1.311	0.968**	0.979**	1.100**
2003	-1.767**	0.459**	0.601*	0.555**	-0.631**	0.047	1.468*	0.095	1.179	1.016**	0.948**	0.667*
2004	-1.803**	0.471**	0.573*	0.544**	-0.622**	0.045	1.379*	0.095	1.320	1.03**	0.934**	0.956**
2005	-1.801**	0.502**	0.594**	0.503**	-0.596**	0.059	1.319*	0.13	1.228	1.027**	0.943**	0.942**
2006	-1.788**	0.517**	0.588*	0.494**	-0.583**	0.056	1.356*	0.134	1.302	1.032**	0.948**	0.944**
2007	-1.614**	0.467**	0.542*	0.563**	-0.609**	0.036	1.525**	0.084	1.436	1.028**	0.942**	0.905**
2008	-1.624**	0.46**	0.539*	0.559**	-0.607**	0.039	1.506**	0.091	1.323	1.028**	0.947**	0.976**

Note: See the note for Table 6.3.

Table 6.10 Long-run and short-run tourism demand elasticities for Taiwan

	Price elasticities									Expenditure elasticities		
	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Long-run												
1992	-0.919	0.527*	0.057	1.967*	-1.263*	-0.119	0.371	-0.207	-0.395	1.211**	1.104*	0.413
1993	-0.725	0.409*	-0.02	1.375*	-1.071	0.065	-0.098	0.092	-0.697	1.157**	1.155*	0.635
1994	-0.659	0.406*	0.036	1.437*	-0.948*	-0.05	0.198	-0.078	-0.482	1.143**	1.173*	0.565
1995	-0.580	0.414*	0.131	1.357*	-0.945*	-0.051	0.719	-0.085	0.319	1.158**	1.148*	0.547
1996	-0.559	0.404*	0.16	1.301*	-0.935*	-0.057	0.891	-0.099	0.569	1.147**	1.057*	0.558
1997	-0.450	0.344*	0.143	1.2*	-0.89*	-0.044	0.807	-0.072	0.562	1.081**	1.139**	0.598
1998	-0.502	0.343**	0.158	1.011**	-0.965**	0.035	0.779	0.058	0.643	1.07**	1.077**	0.656
1999	-0.53	0.331**	0.104	1.08**	-0.999**	0.059	0.468	0.081	0.481	1.076**	1.08**	0.711
2000	-0.527	0.34**	0.047	0.952**	-0.933**	0.077	0.197	0.117	-0.045	1.116**	1.006**	0.769
2001	-0.52	0.358**	0.037	0.904**	-0.894**	0.074	0.165	0.131	-0.201	1.119**	0.975**	0.786
2002	-0.462	0.28**	0.275	0.947**	-0.943**	0.006	0.922	0.006	0.82	1.102**	0.914**	0.824*
2003	-0.433	0.308**	0.209	0.917**	-0.883**	-0.006	0.917	-0.008	0.983	1.12**	1.045**	0.587
2004	-0.679*	0.361**	0.199	0.838**	-0.827**	0.032	0.727	0.05	0.788	1.19**	0.978**	0.618
2005	-0.659*	0.357**	0.193	0.851**	-0.824**	0.019	0.761	0.031	0.867	1.185**	0.978**	0.594
2006	-0.673*	0.356**	0.203	0.838**	-0.821**	0.028	0.779	0.046	0.798	1.184**	0.979**	0.620
2007	-0.654*	0.366**	0.175	0.842**	-0.807**	0.018	0.742	0.034	0.71	1.171**	0.965**	0.640
2008	-0.639*	0.35**	0.179	0.859**	-0.82**	0.013	0.75	0.023	0.654	1.166**	0.97**	0.648

	S-S	S-H	S-M	H-S	H-H	H-M	M-S	M-H	M-M	Shopping	Hotels	Meals
Short-run												
1992	-1.036	0.301	1.249	1.125	-0.337	-0.544	8.099	-0.946	6.601	1.153**	1.001	0.488
1993	-1.175	0.19	1.386	0.639	-0.109	1.839	6.604	2.605	4.563	1.132**	0.99*	0.811
1994	-1.167	0.236	1.23	0.836	-0.227	0.361	6.828	0.567	4.627	1.132**	0.967*	0.889
1995	-1.308	0.253	1.086	0.83	-0.261	-2.605	5.95	-4.36	2.533	1.144**	0.969*	0.295
1996	-1.298*	0.25	1.075	0.805	-0.268	0.101	5.99	0.175	2.725	1.141**	0.924**	0.055
1997	-0.686	0.116	0.532	0.404	-0.315	3.915	3.01	6.362	-0.309	1.036**	0.898**	1.421
1998	-0.661	0.235**	0.638	0.693**	-0.737**	-0.001	3.144	-0.002	0.173	1.062**	0.827**	1.402
1999	-0.744*	0.232**	0.254	0.755**	-0.756**	-1.449	1.139	-1.994	1.192	1.078**	0.822**	1.018
2000	-0.85*	0.239**	0.235	0.669**	-0.711**	-0.367	0.989	-0.552	0.783	1.092**	0.802**	1.085
2001	-0.862*	0.26**	0.211	0.656**	-0.688**	-2.111*	0.94	-3.729*	0.568	1.091**	0.807**	1.157
2002	-0.841**	0.155*	0.148	0.524*	-0.652**	-1.251	0.497	-1.24	-0.308	1.1**	0.643**	1.141
2003	-0.769**	0.186**	0.019	0.553**	-0.644**	1.649	0.084	2.429	-0.274	1.137**	0.723**	0.641
2004	-1.035**	0.217**	-0.011	0.505**	-0.61**	0.282	-0.039	0.443	-0.512	1.181**	0.713**	0.686
2005	-1.005**	0.217**	-0.017	0.518**	-0.602**	0.094	-0.068	0.156	-0.419	1.174**	0.732**	0.631
2006	-1.043**	0.225**	0.001	0.528**	-0.598**	0.483	0.003	0.788	-0.346	1.171**	0.759**	0.597
2007	-1.022**	0.238**	-0.014	0.546**	-0.593**	-0.357	-0.059	-0.66	-0.316	1.169**	0.752**	0.563
2008	-1.008**	0.222**	-0.068	0.545**	-0.596**	0.367	-0.284	0.628	-0.772	1.169**	0.749**	0.674

Note: See the note for Table 6.3.

6.3.2 Mainland China

Table 6.3 shows that amongst mainland Chinese tourists, the expenditure elasticities of demand for shopping always fall between zero and one over the period examined, suggesting that mainland Chinese tourists consistently treat shopping as a necessity. The expenditure elasticities of demand for hotel accommodation are found to be greater than one during the period examined, suggesting that mainland Chinese tourists always treat hotel accommodation in Hong Kong as a luxury. These results confirm the findings in Chapter 5 based on constant-parameter AIDS model estimations. It is thus concluded that Hong Kong has a comparative advantage as a shopping destination for mainland Chinese tourists.

In terms of the evolution of the expenditure elasticity of demand for shopping by this group, the same pattern is exhibited in the long and the short run in recent years, namely, an upwards trend over the past two years (see Table 6.3 and Figure 6.2). As total expenditure per capita by mainland Chinese tourists decreases over the last two years of the study period (see Figure 4.11), the increase in the expenditure elasticity is explained by the recent economic downturn, which has created greater challenges for Hong Kong's retail sector in encouraging mainland Chinese tourists to visit Hong Kong for shopping.

Regarding hotel accommodation, which is regarded as a luxury by mainland Chinese tourists, the expenditure elasticity shows a generally decreasing trend in both the long and the short run since 2004, with the short-run elasticity declining more sharply. This decrease indicates that hotel accommodation is viewed by mainland Chinese tourists less as a luxury than before. This can be explained by the rapid growth in personal income of mainland Chinese in recent years and the concomitant continuous appreciation of the currency of mainland China.

Despite the rapid growth of the Chinese economy and increase in the personal income level, meals outside hotels are still treated as a luxury by mainland Chinese tourists. It is interesting to observe that the expenditure elasticity of the demand for meals outside hotels shows an upwards trend in the long run. It is thus concluded that meals outside hotels are still expensive compared with meals in mainland China. However, compared with hotel accommodation, meals outside hotels have become less a luxury amongst these tourists (see Table 6.3).

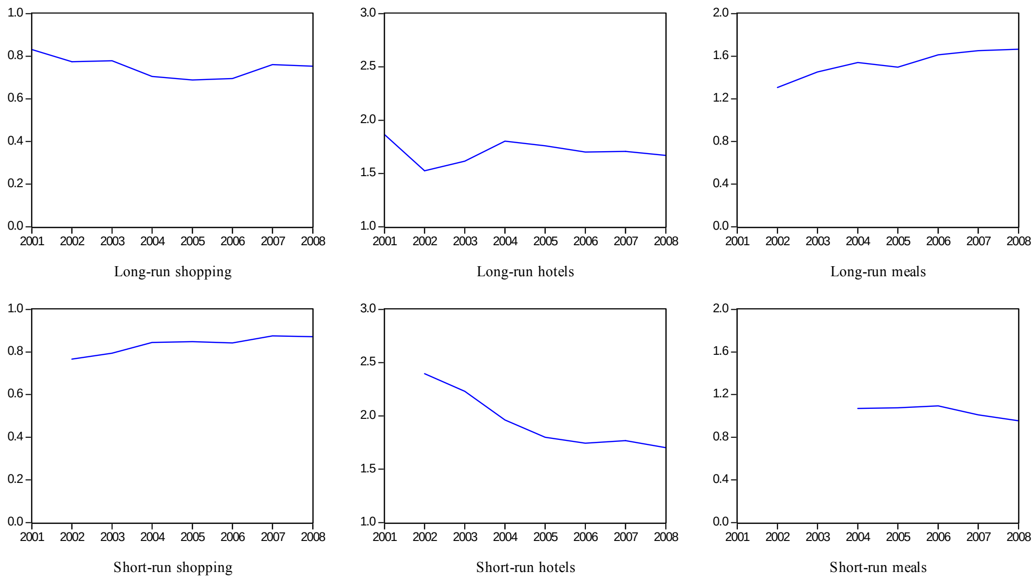

Figure 6.2 Evolution of the long-run and short-run expenditure elasticities of mainland Chinese tourists

Regarding own-price elasticity, only the values of hotel accommodation are significant in most cases (see Table 6.3). It is observed from Figure 6.3 that both the long-run and short-run own-price elasticities of demand for hotel accommodation remain highly stable over time, indicating that mainland Chinese tourist consumption behaviour in relation to hotel accommodation has not changed much. The long-run elasticity varies from -1.313 to -1.165, which indicates that the demand for hotel accommodation by mainland Chinese tourists is weakly price elastic. The short-run own-price elasticities vary from -1.070 to -0.995, indicating an almost unit-elastic demand.

Table 6.3 also indicates that the cross-price elasticities of demand for shopping and hotel accommodation are significant in most years of the sample period. A substitution relationship is identified based on the positive cross-price elasticities. However, it is observed that for mainland Chinese tourists, demand for shopping is less sensitive to a change in the price of hotel accommodation than is demand for hotel accommodation in response to a change in the price of shopping. These findings are consistent with those of the constant-parameter AIDS models in Chapter 5, and both are statistically significant. With regard to the evolution of cross-price elasticities, mainland Chinese tourist demand for hotel accommodation becomes increasingly sensitive to variations in shopping price, whereas their demand for shopping is less and less sensitive to changes in hotel accommodation price over time, although the change is very slow. In other words, shopping becomes less substitutable for hotel accommodation, whereas hotel accommodation becomes more substitutable for shopping amongst mainland Chinese tourists.

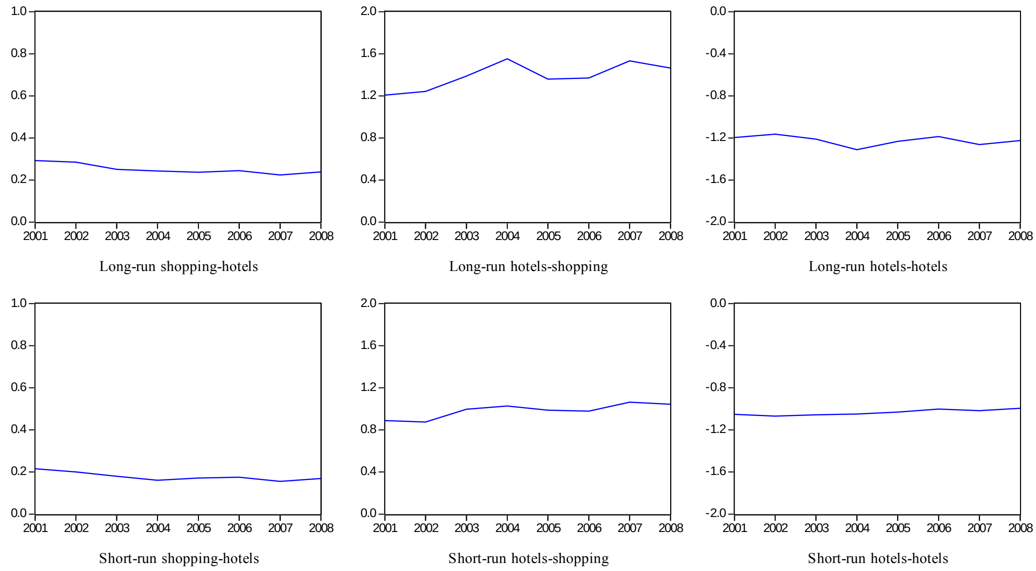

Figure 6.3 Evolution of the long-run and short-run price elasticities of mainland Chinese tourists

6.3.3 Long-haul source markets – Australia, the UK and the US

Tables 6.4 to 6.6 show the evolution of the long-run and short-run demand elasticities in three long-haul source markets: Australia, the UK and the US. Long-haul tourists show different spending behaviours compared to their mainland Chinese counterparts. For example, shopping is treated as a luxury by long-haul tourists, whereas hotel accommodation and meals outside hotels are treated as necessities. These findings are in line with those derived from the constant-parameter AIDS estimations in Chapter 5. In addition, the evolution of the consumption behaviour of these long-haul tourists is found to follow different patterns over time in different product categories.

6.3.3.1 Expenditure elasticities

It is observed from Figure 6.4 that for Australian tourists the most and least stable expenditure elasticities of demand are for meals outside hotels and hotel accommodation, respectively, in recent years (since 2001), in both the long and the short run. The long-run elasticity of demand for shopping appears to be stable over time, whereas the short-run elasticity experiences some big fluctuations, with a sharp decline evident in recent years, indicating that shopping in Hong Kong has become less a luxury amongst Australian tourists.

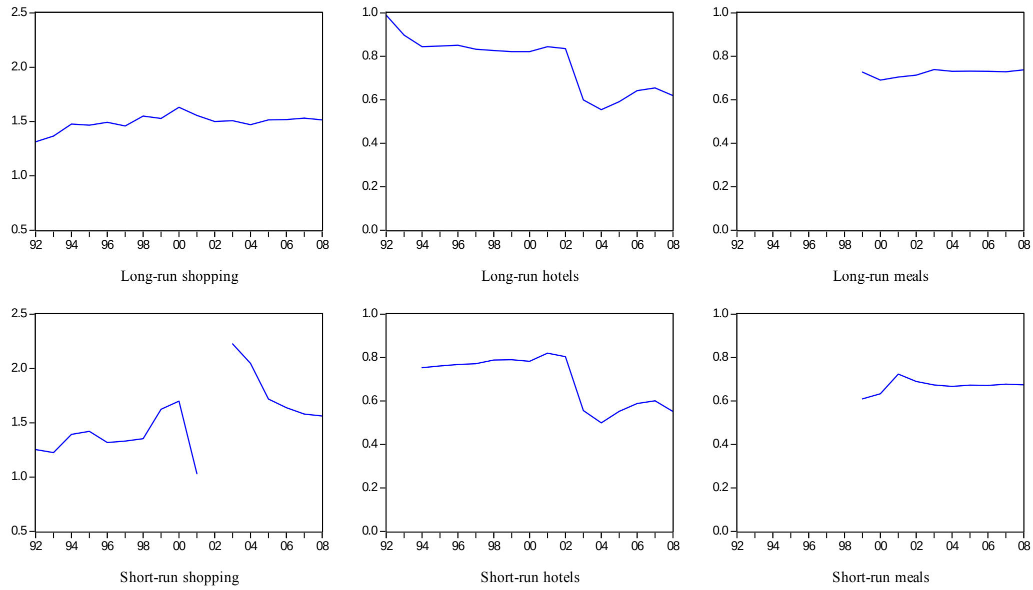

Figure 6.4 Evolution of the long-run and short-run expenditure elasticities of Australian tourists

Amongst all long-haul tourists, the most stable expenditure elasticities of demand for all product categories concerned are found for those from one of the most mature markets, the UK (see Figure 6.5). It is observed that the level of the long-run expenditure elasticity of demand for shopping dropped slightly in the 2000s compared with that in the 1990s. This can be explained by the price competitive advantage of Hong Kong, because from 1999, the consumer price index of Hong Kong exhibits a decreasing tendency. The increase in price competitiveness leads UK tourists to treat shopping less as a luxury in the 2000s than before. The demand for meals outside hotels in the long run shows a similar tendency, with a decreasing expenditure elasticity curve from 1999 to 2008 (see Figure 6.5).

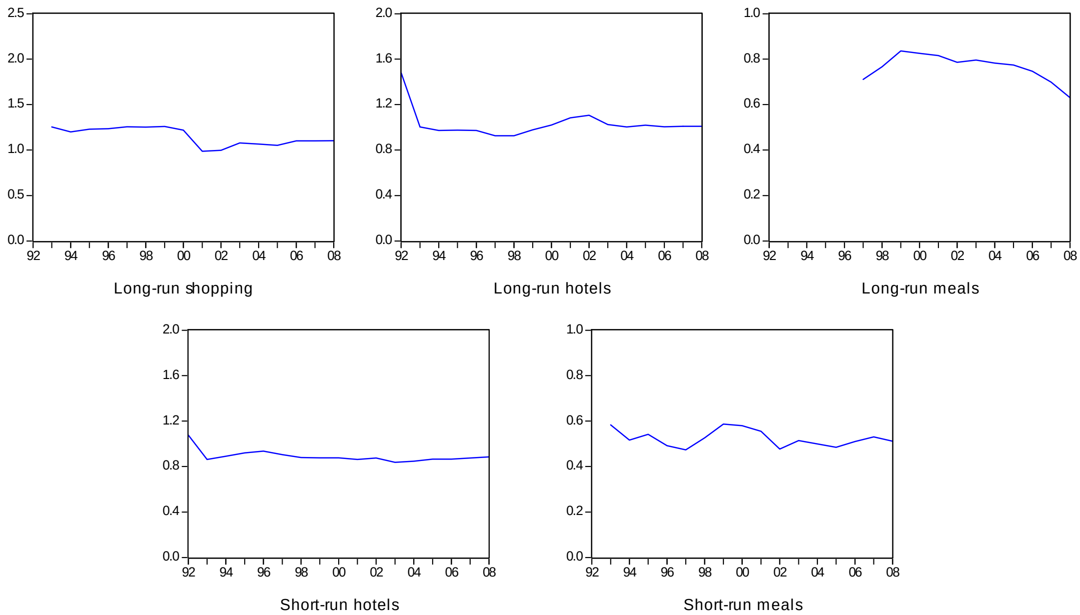

Figure 6.5 Evolution of the long-run and short-run expenditure elasticities of UK tourists

In contrast to the case for Australian tourists but in line with that for UK tourists, the expenditure elasticities of demand for hotel accommodation for American tourists are relatively stable (see Figure 6.6). Shopping gradually becomes more expenditure elastic in both the long and the short run, which means that American tourists increasingly perceive shopping in Hong Kong as a luxury. The most recent expenditure elasticity values in the long and the short run are 1.915 and 1.877, respectively (see Table 6.6), which are the highest amongst the eight source markets under consideration. These findings imply that shopping has become of less interest to American tourists. Therefore, promoting Hong Kong as a shopping paradise may not be an effective strategy to attract inbound tourists from the US. The long-run expenditure elasticity of demand for meals outside hotels declines sharply until 2004, suggesting that American tourists increasingly view meals in Hong Kong as a necessity over the 1999-2003 period. In the last years of the study period, the expenditure elasticity becomes stable. There is a recent converging tendency regarding the expenditure elasticity of demand for meals outside hotels amongst all long-haul markets, evidenced by similar levels of long-run expenditure elasticities in 2008 (0.738, 0.630 and 0.641 for Australia, the UK and the US, respectively).

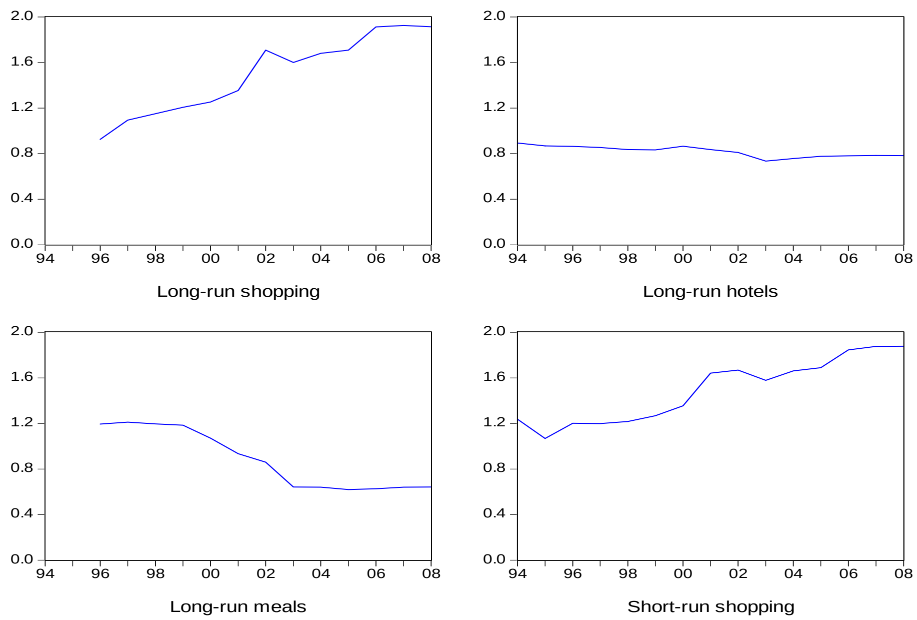

Figure 6.6 Evolution of the long-run and short-run expenditure elasticities of American tourists

6.3.3.2 Price elasticities

For Australian tourists, a substitution relationship between shopping and hotel accommodation is identified, consistent with the findings in Chapter 5. Figure 6.7 also indicates that since 2003, their demand for shopping has been less sensitive to the price change of hotel accommodation in both the long and the short run. It is also found that the mutual substitution effects between shopping and hotel accommodation converge, with cross-elasticities of 0.340 and 0.329 in the long run and 0.375 and 0.363 in the short run, respectively, in 2008 (see Table 6.4). The demand for hotel accommodation by this group is price inelastic but relatively more price elastic since 2003 in both the long and short run.

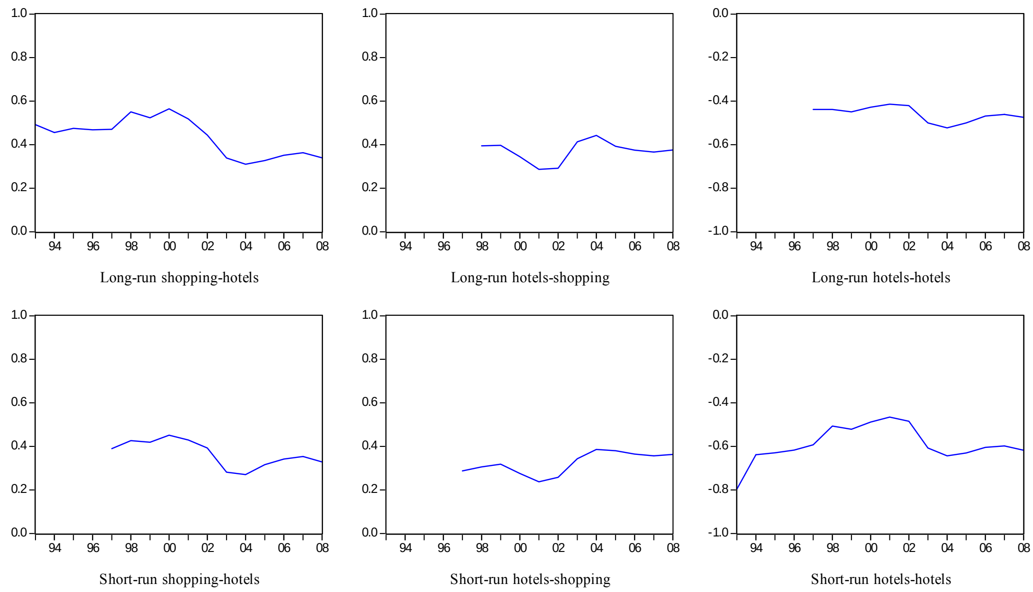

Figure 6.7 Evolution of the long-run and short-run price elasticities of Australian tourists

Regarding UK tourists, the only statistically significant own-price elasticity is that of the demand for hotel accommodation, mainly in the last decade. During this period, the sensitivity of demand for hotel accommodation in response to its price variations remains quite stable in both the long and the short run (see Figure 6.8). In addition, the demand for hotel accommodation by UK tourists is slightly less price sensitive than that by Australian tourists. The evolution pattern of the own-price elasticity of demand for hotel accommodation by UK tourists confirms the abovementioned findings regarding expenditure elasticities; that is, because of the maturity of the market, UK tourist consumption behaviour in Hong Kong tends to change little over time.

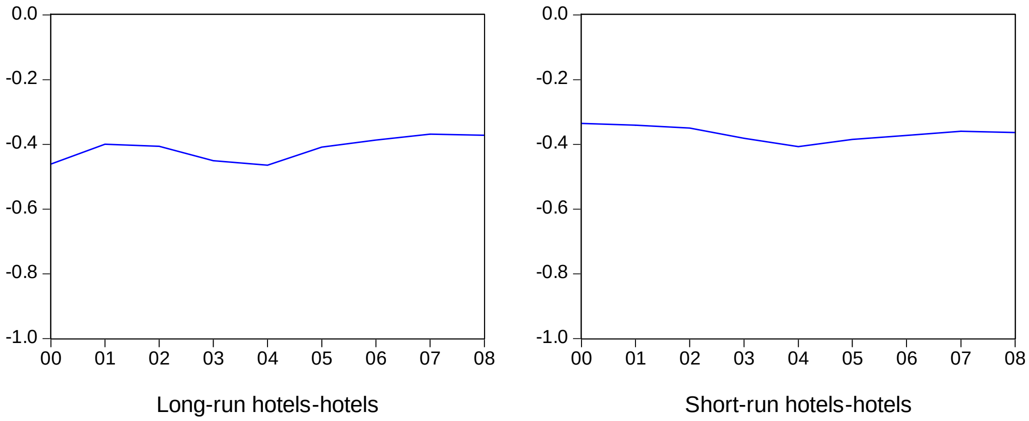

Figure 6.8 Evolution of the long-run and short-run price elasticities of UK tourists

The short-run own-price elasticities of demand for hotel accommodation of American tourists present a pattern similar to that of UK tourists (see Figure 6.9). This leads to the conclusion that hotel accommodation is price inelastic for these two groups, with spending behaviours changing little over the past decade. In addition, a substitution relationship between hotel accommodation and meals outside hotels is identified in the American market, which is consistent with the results shown in Chapter 5 based on the constant-parameter AIDS models. The demand for meals outside hotels is found to be less sensitive to the price change of hotel accommodation during 2000-2003 in the long run, with the spending pattern remaining relatively stable after 2003 (see Figure 6.9). Figure 6.9 also shows that the remaining three significant price elasticities (i.e., the long- and short-run elasticities of demand for hotel accommodation in response to the price change of meals, and the short-run elasticity of demand for meals outside hotels in response to the price change of hotel accommodation) remain relatively stable during the study period.

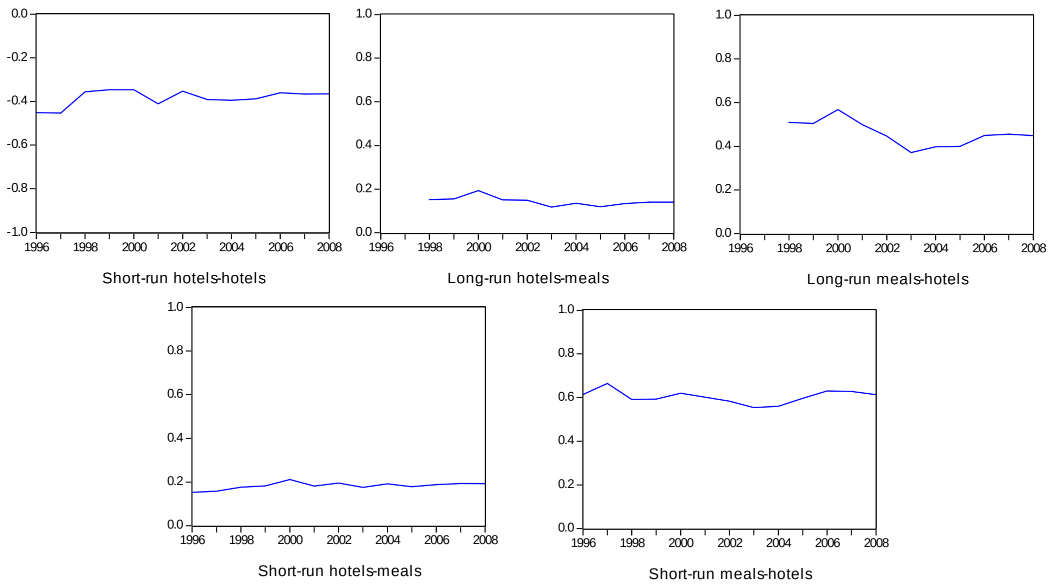

Figure 6.9 Evolution of the long-run and short-run price elasticities of American tourists

6.3.4 Short-haul source markets – Japan, South Korea, Singapore and Taiwan

In this section, the tourist consumption patterns of four short-haul source markets (excluding mainland China) are analysed from the time-varying perspective. The evolution of expenditure elasticities is shown in Tables 6.7 to 6.10 and Figures 6.10 to 6.17 with respect to expenditure and price elasticities in the long and the short run.

6.3.4.1 Expenditure elasticities

Similar to their long-haul counterparts but different from mainland Chinese tourists, tourists from the four short-haul markets treat shopping as a luxury, with expenditure elasticities being greater than one in most cases over the sample period. Again, the TVP-AIDS models provide findings consistent with those of the constant-parameter models presented in Chapter 5, suggesting the robustness of the conclusion. Regarding the evolution of the expenditure elasticities of shopping, different patterns can be seen amongst the four short-haul markets, especially in recent years. For instance, overall upwards trends are observed for the Singapore market (see Figure 6.12), which are most evident in the long run, whereas clear downwards trends appear for the South Korean market, especially in recent years (see Figure 6.11). The expenditure elasticities of demand for shopping by Japanese tourist are relatively stable from 1997 in both the long-run and short-run models. The expenditure elasticities of demand for shopping by this group also remain relatively stable over the whole sample period in both models, with a slight downwards shift from 1997 to 2003.

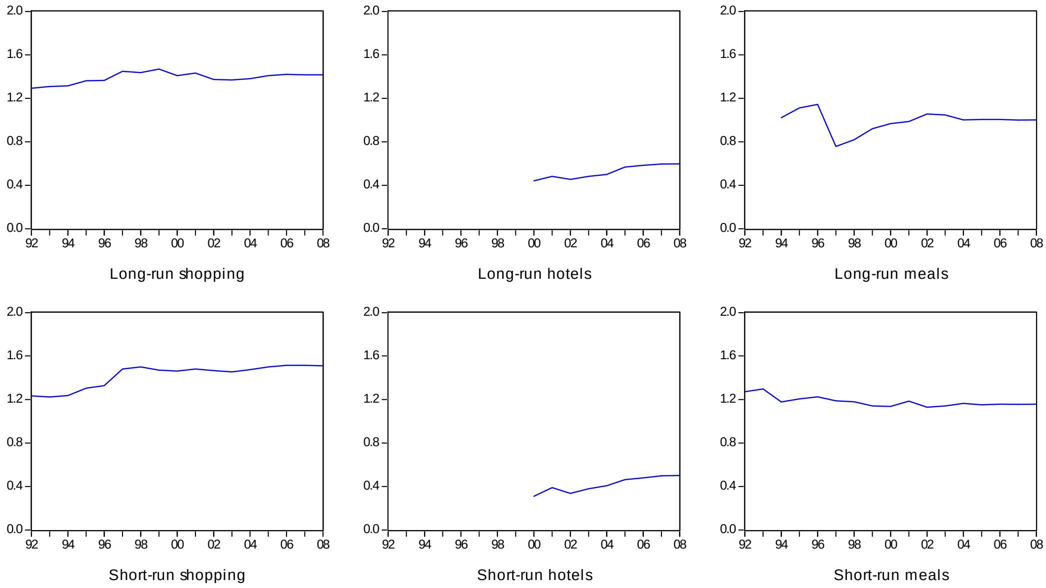

Figure 6.10 Evolution of the long-run and short-run expenditure elasticities of Japanese tourists

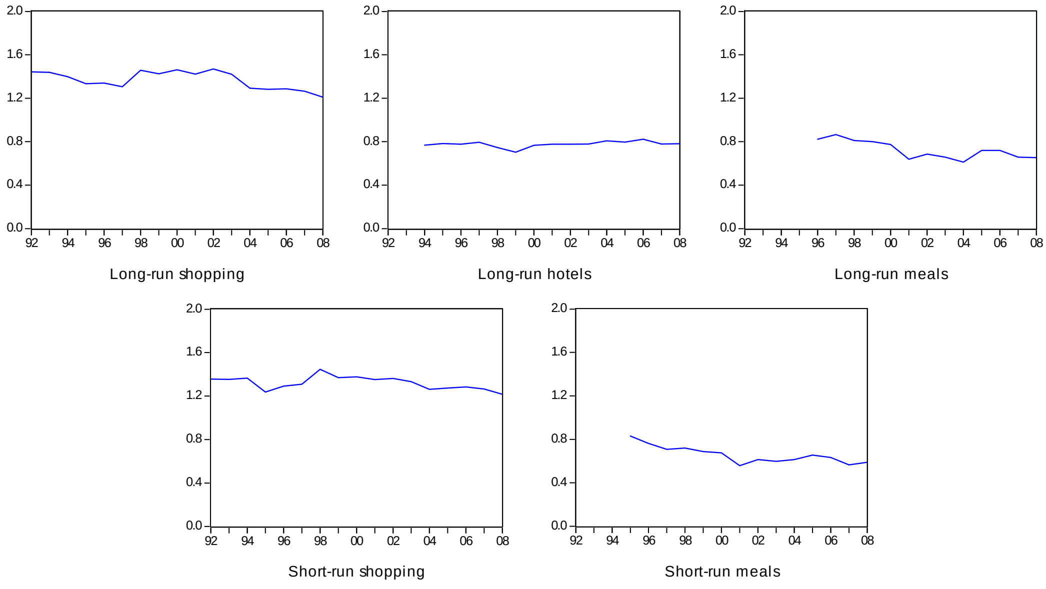

Figure 6.11 Evolution of the long-run and short-run expenditure elasticities of South Korean tourists

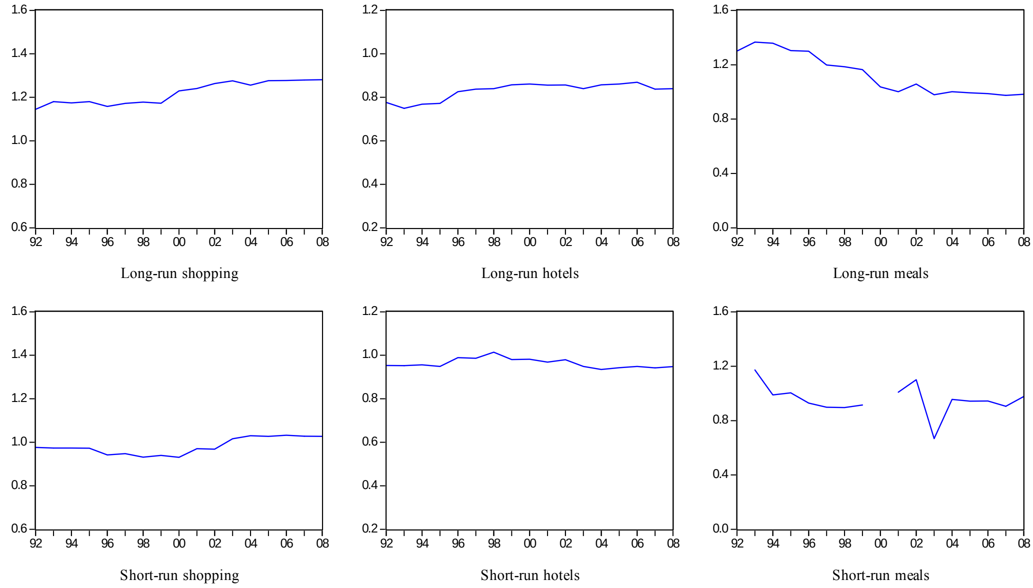

Figure 6.12 Evolution of the long-run and short-run expenditure elasticities of Singaporean tourists

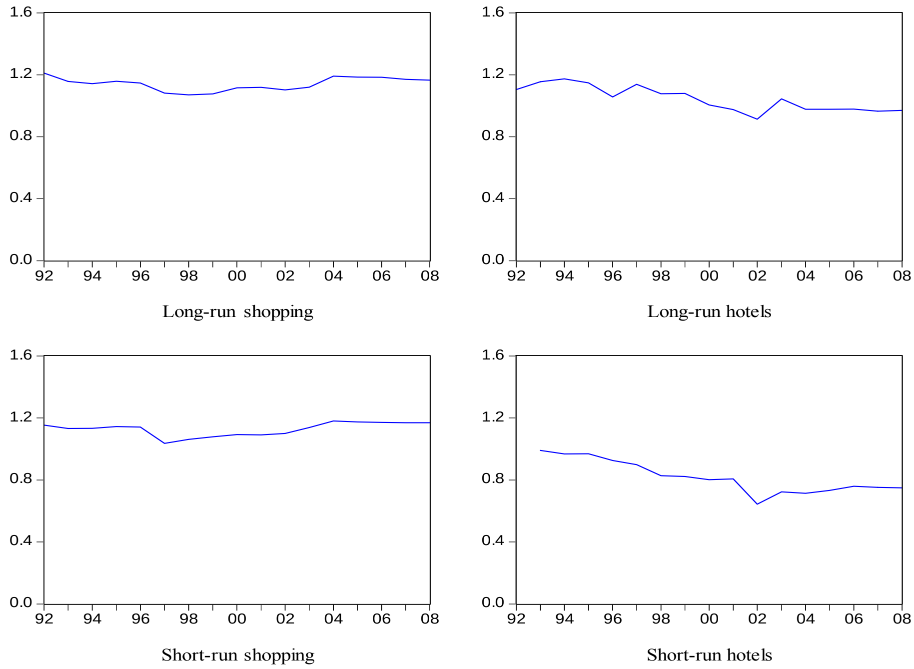

Figure 6.13 Evolution of the long-run and short-run expenditure elasticities of Taiwanese tourists

It is interesting to note that the expenditure elasticities of South Korea and Taiwan converge to 1.210 and 1.166 in 2008 in the long-run models and 1.217 and 1.169 in the short-run ones, respectively (see Tables 6.8 and 6.10). Having the highest values of expenditure elasticity, Japanese tourists appear to view shopping as the greatest luxury compared with those from the other short-haul source markets. This also implies that shopping in Hong Kong is less attractive to tourists from Japan compared to those from South Korea, Singapore or Taiwan.

With regard to hotel accommodation, although Japanese tourists regard hotel accommodation in Hong Kong more as a necessity than do tourists from the other three short-haul source markets, their long-run and short-run expenditure elasticities have been increasing steadily since 2000 (see Figure 6.10). This indicates that Japanese tourists view hotel accommodation in Hong Kong as less of a necessity than before, and that their demand for hotel accommodation in Hong Kong has become more sensitive to variation in their overall travel budget. Taiwanese tourists, in contrast, treat hotel accommodation more as a necessity than before, with a slightly decreasing trend shown in Figure 6.13. In the short run, as the relative expenditure elasticities of Singaporean tourists have remained around one over the time span studied, it can be concluded that hotel accommodation is not viewed by this group as a necessity. South Korean tourists appear to have the most stable consumption patterns with regard to hotel accommodation based on the trace of their expenditure elasticities.

Regarding the demand for meals outside hotels, different patterns of expenditure elasticity over time are observed. For instance, the decline in the long-run and short-run expenditure elasticities for South Korea and the long-run expenditure elasticities for Singapore indicate that both South Korean and Singaporean tourists increasingly regard meals outside hotels as a necessity. For the latter, the short-run expenditure elasticity of demand for meals outside hotels shows a sharp decrease in 2003. This could be due to the SARS outbreak in Hong Kong in 2003. This also suggests that the consumption behaviour of Singaporean tourists in relation to meals outside hotels is more sensitive to an external shock in the short run. Japanese consumption patterns with regard to meals outside hotels do not vary significantly, especially in recent years. In the case of Taiwan, the expenditure elasticity of demand for meals is statistically insignificant; hence, it is omitted from the discussion.

6.3.4.2 Price elasticities

The own-price elasticity of demand for hotel accommodation by Japanese tourists shows a decreasing trend in the long run but an increasing trend in the short run. The long-run and short-run price elasticities converge to around -0.57 in 2008. This indicates that the sensitivity of demand for hotel accommodation by Japanese tourists to its price changes reaches long-run equilibrium in 2008. The demand for meals outside hotels by Japanese tourists is highly price inelastic in the long-run model, with values revolving around zero over time. However, a positive own-price elasticity is identified in the short-run model, suggesting that despite the increase in the price of meals outside hotels, Japanese tourists are eating out in Hong Kong more often. However, this positive price elasticity decreases sharply. There appears to be a tendency in the short-run own-price elasticity to move towards long-run equilibrium. The expenditure distribution data in Chapter 4 show that Japanese tourists spend a higher proportion of their travel budget (16.0% in 2008) on meals compared to other short-haul markets in Hong Kong, with this expenditure share continuing to increase over recent years. Combining the findings of the expenditure of Japanese tourists on shopping in Hong Kong, it would appear that Japanese tourists visit Hong Kong to experience its cuisine rather than to shop. With regard to cross-price elasticity, a weak substitution relationship is found between shopping and meals outside hotels in the Japanese model in recent years. This relationship remains very stable.

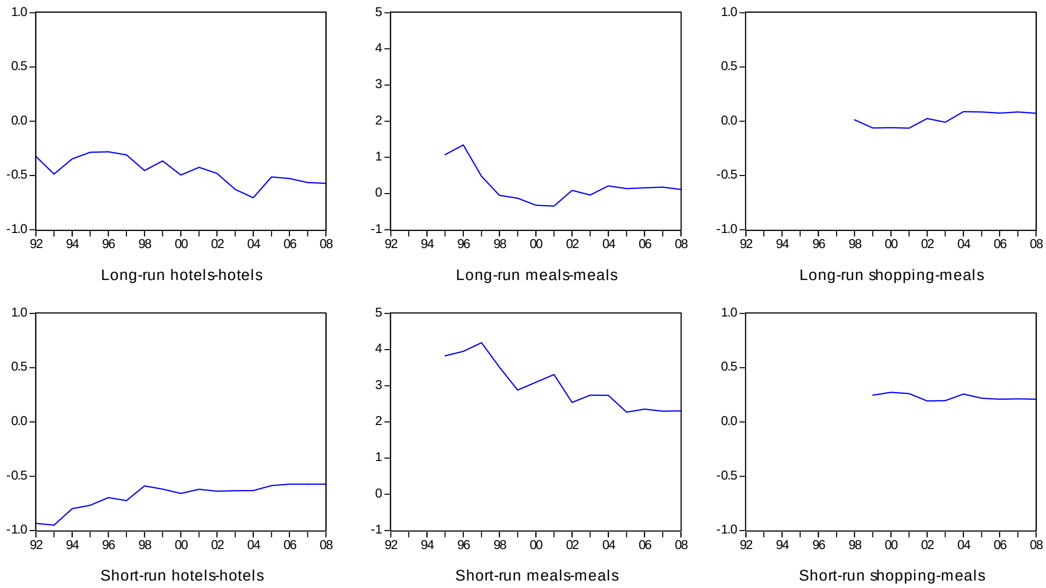

Figure 6.14 Evolution of the long-run and short-run price elasticities of Japanese tourists

Regarding the South Korean market, different patterns emerge in relation to demand for hotel accommodation. Figure 6.15 indicates that in the short run, demand for hotel accommodation by South Korean tourists is more sensitive to hotel tariff variations, while in the long run, the price elasticity remains stable. A substitution relationship is identified between shopping and hotel accommodation for South Korean tourists, but their substitutability changes over time. Figure 6.15 indicates that the demand for shopping by South Korean tourists has become less and less sensitive to the price change of hotel accommodation, while their demand for hotel accommodation has become more and more sensitive in response to the price change of shopping, in both the long and short run. This implies that hotel accommodation in Hong Kong has become more substitutable for shopping but not vice versa amongst South Korean tourists.

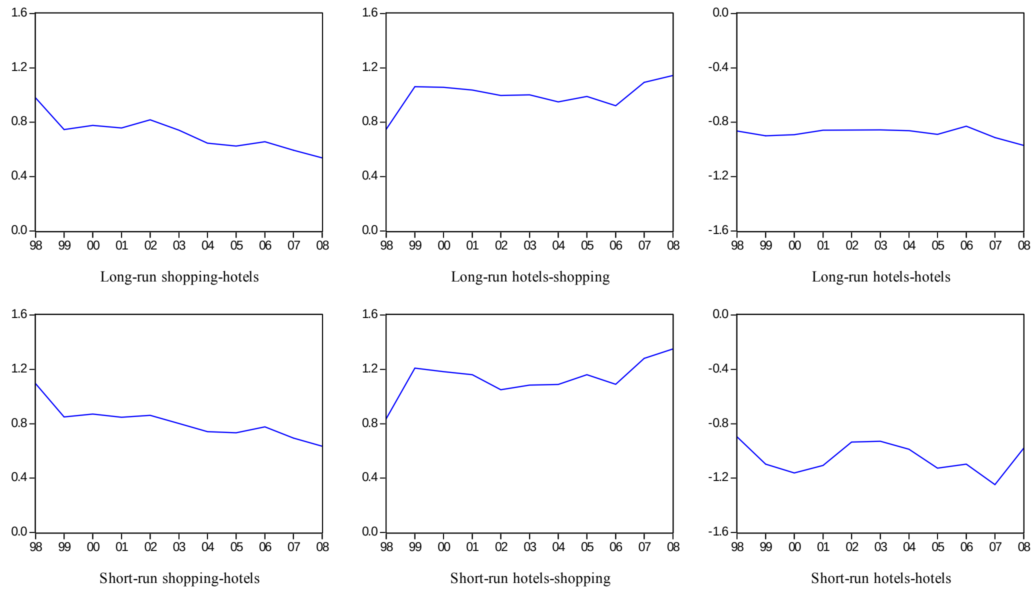

Figure 6.15 Evolution of the long-run and short-run price elasticities of South Korean tourists

Figure 6.16 shows the evolution of the statistically significant price elasticities for the Singapore market. Compared to the case for the other tourist groups, it appears that the short-run price elasticities of Singaporean tourists, including both own-price elasticities (such as for shopping) and cross-price ones, have experienced more fluctuations over time, although their long-run counterparts appear more stable. The demand for hotel accommodation is price inelastic and remains stable over time in both the long-run and short-run models. Figure 6.16 also indicates that shopping is quite price elastic in the short run, although it is relatively less price elastic in the last two years of the study period. Shopping and hotel accommodation are identified as substitutes for each other. The mutual substitution effects are similar and change little during the 1999-2008 period (see Figure 6.16). A substitution relationship is also identified between shopping and meals outside hotels in the short run, with a declining trend in substitution effects over time.

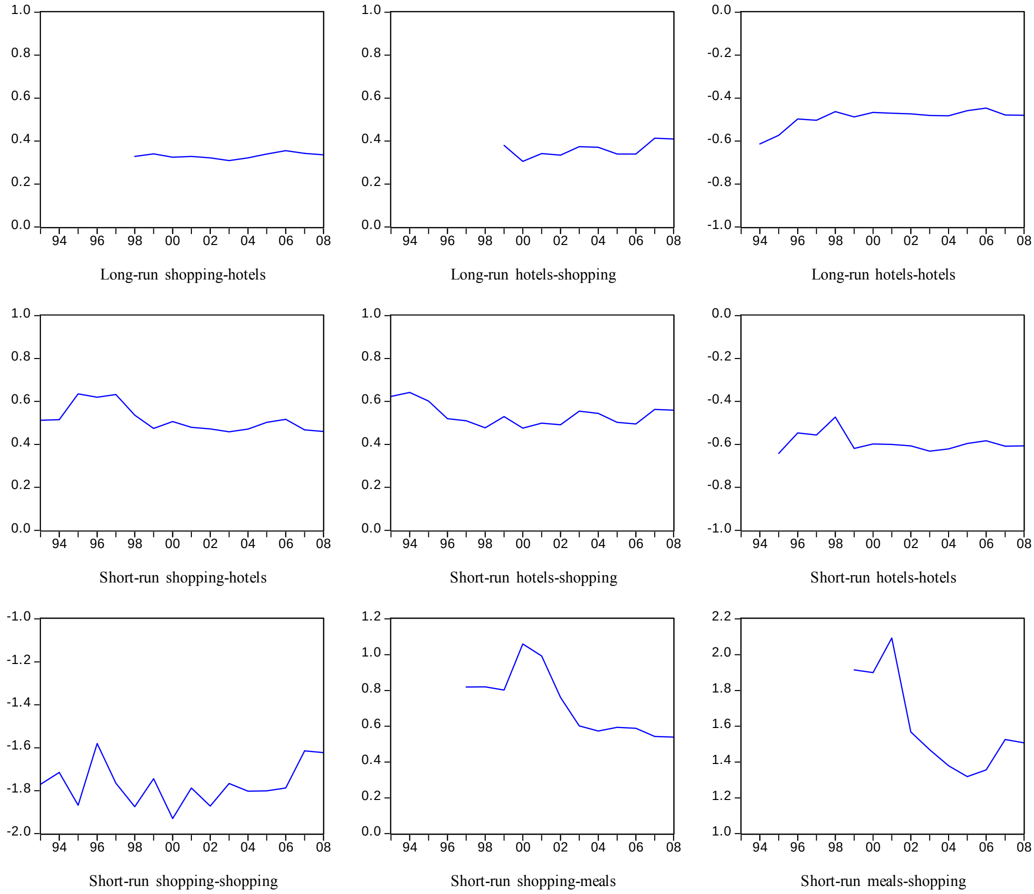

Figure 6.16 Evolution of the long-run and short-run price elasticities of Singaporean tourists

For Taiwanese tourists, the evolution of both own-price and cross-price elasticities is gradual, with few fluctuations over time (see Figure 6.17). The time trend in the own-price elasticities of demand for hotel accommodation in both the long and the short run is upwards. This indicates that demand for accommodation by tourists from Taiwan in Hong Kong has become less and less sensitive to price variations. Shopping and hotel accommodation are identified as substitutable and the substitution effect of the demand for shopping in response to price changes of hotel accommodation is quite stable over time, with a slightly downwards trend in 2002-2003 (see Figure 6.16). At the same time, hotel accommodation is identified as less substitutable for shopping before 2004, but this substitution effect remains relatively stable during the 2004-2008 period.

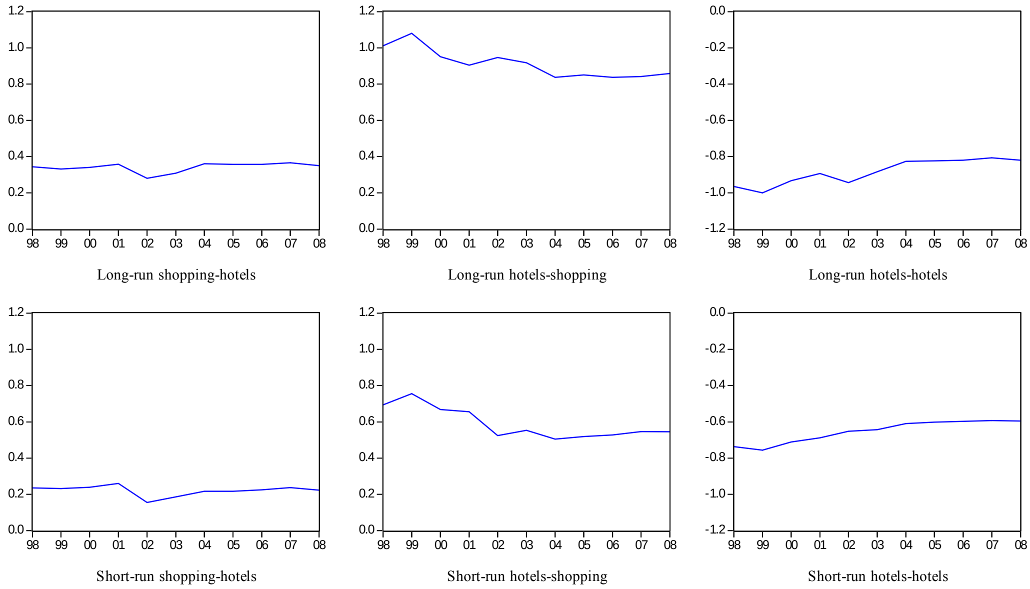

Figure 6.17 Evolution of the long-run and short-run price elasticities of Taiwanese tourists

6.4 Chapter summary

In this chapter, the TVP technique is combined with the long-run AIDS and short-run error-correction AIDS models to examine the evolution of tourist consumption behaviour over time. In line with consumer demand theory, homogeneity and symmetry restrictions are imposed on the estimated models. This bridges the gap in the current literature by advancing the theoretically restricted error-correction TVP-AIDS model and successfully applying it to tourism demand analysis. The empirical results allow the examination of the evolution of tourist consumption behaviour over time.

In the empirical study, the consumption patterns of Hong Kong inbound tourists from eight major source markets are analysed using both the theoretically restricted long-run TVP-AIDS and short-run error-correction TVP-AIDS models. Tourist preferences for three categories of tourism products – shopping, hotel accommodation and meals outside hotels – are measured using the TVP approach. The results are consistent with those based on the constant-parameter models discussed in Chapter 5.

The empirical results presented in this chapter further confirm that tourist spending behaviour contains time-varying characteristics in some cases. This supports the use of the TVP technique in tourism demand analysis. Tables 6.11 and 6.12 roughly summarise the general trends in the evolution of expenditure and price elasticities.

Table 6.11 Summary of long-run and short-run tourism expenditure elasticities

	Long-run expenditure elasticities			Short-run expenditure elasticities		
	Shopping	Hotels	Meals	Shopping	Hotels	Meals
Mainland China	→	↘	↗	↗	↘	→
Australia	→	↘	→	〰	↘	→
The UK	↘	→	↘	n.a.	→	→
The US	↗	→	↘	↗	n.a.	n.a.
Japan	→	↗	→	→	↗	→
South Korea	↘	→	↘	↘	n.a.	↘
Singapore	↗	→	↘	↗	→	〰
Taiwan	→	↘	n.a.	→	↘	n.a.

Note:

→ Denotes that demand elasticity does not change much over time;

↗ Denotes gradual movement towards greater demand elasticity over time (i.e., absolute values of the demand elasticity increase over time);

↘ Denotes gradual movement towards less demand elasticity over time (i.e., absolute values of the demand elasticity decrease over time);

〰 Denotes fluctuations over time;

n.a. Denotes that the demand elasticities are not significant.

Table 6.12 Summary of long-run and short-run tourism price elasticities

		Long-run price elasticities			Short-run price elasticities		
		Shopping	Hotels	Meals	Shopping	Hotels	Meals
Mainland China	Shopping	n.a.	↘	n.a.	n.a.	↘	n.a.
	Hotels	↗	→	n.a.	↗	→	n.a.
	Meals	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Australia	Shopping	n.a.	↘	n.a.	n.a.	↘	n.a.
	Hotels	∿∿∿	↗	n.a.	∿∿∿	↗	n.a.
	Meals	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
The UK	Shopping	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Hotels	n.a.	→	n.a.	n.a.	→	n.a.
	Meals	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
The US	Shopping	n.a.	n.a.	n.a.		n.a.	n.a.
	Hotels	n.a.	n.a.	→	n.a.	→	. →
	Meals	n.a.	↘	n.a.	n.a.	→	n.a.
Japan	Shopping	n.a.	n.a.	→	n.a.	n.a.	→
	Hotels	n.a.	↗	n.a.	n.a.	↘	n.a.
	Meals	n.a.	n.a.	→	n.a.	n.a.	↘
South Korea	Shopping	n.a.	↘	n.a.	n.a.	↘	n.a.
	Hotels	↗	→	n.a.	↗	∿∿∿	n.a.
	Meals	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Singapore	Shopping	n.a.	→	n.a.	∿∿∿	→	↘
	Hotels	→	→	n.a.	→	→	n.a.
	Meals	n.a.	n.a.	n.a.	∿∿∿	n.a.	n.a.
Taiwan	Shopping	n.a.	→	n.a.	n.a.	→	n.a.
	Hotels	↘	↘	n.a.	↘	↘	n.a.
	Meals	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Note: See the note for Table 6.11.

For mainland Chinese tourists, the expenditure elasticity of the demand for shopping remains at a highly inelastic level during the time span under consideration. However, this expenditure elasticity has increased slightly in recent years, which indicates that the demand for shopping by mainland Chinese tourists is more sensitive to their expenditure budget (or personal income). Hotel accommodation is viewed by mainland Chinese tourists as a luxury, but this trend has declined in recent years. This can be explained by the gradually increasing personal income level and the appreciation of the currency in mainland China in recent years. It is also found that meals outside hotels in Hong Kong are still quite expensive for mainland Chinese tourists, compared with those in mainland China.

Regarding the long-haul markets, it is found that American tourists increasingly view shopping in Hong Kong as a luxury in both the long and short run. This implies that the competitive advantage of the retail sector in Hong Kong has weakened with respect to the US market. Amongst American tourists, the decrease in their disposable income level because of the financial crisis starting from the end of 2007 may account for the reduction in the level of their expenditure on shopping in Hong Kong. Australian tourists view hotel accommodation as more of a necessity than they did before, which suggests that the strategies of Hong Kong's hotel industry to attract tourists from Australia should focus on high-quality hotel services and facilities rather than a reduction in hotel room rates.

In addition, it is found that South Korean tourists view shopping less as a luxury than they did before, but the opposite case is found for Taiwanese tourists. The expenditures of the two groups on shopping in Hong Kong converge to similar levels in terms of expenditure elasticity over the last years of the study period. In other words, there is a tendency towards convergence between the two markets regarding their shopping behaviour in Hong Kong. It is found that the demand for shopping by Singaporean tourists is relatively less price elastic in the last two years of the sample period, but still much more price elastic than that of the other three short-haul source markets in the short-run models. Pricing strategies should be much more effective for the Singaporean market than for the other source markets.

The expenditure elasticity in the Taiwanese hotel model declines during the same period, while the same elasticity in the Japanese model moves in a different direction. These findings provide practitioners in Hong Kong's hotel industry with useful information that can help them to develop appropriate marketing plans for different source markets.

CHAPTER 7 CONCLUSION AND FUTURE RESEARCH DIRECTIONS

7.1 Introduction

Using the framework of a theoretically sound system-of-equations demand approach, the AIDS model, this thesis aims to analyse tourist consumption patterns across a number of tourism categories. The research background, scope and objectives are introduced, followed by a comprehensive review of the literature related to tourism demand analysis, specifically focusing on techniques employed for tourism demand modelling and forecasting. Constant-parameter and TVP versions of homogeneity- and symmetry-restricted error-correction AIDS models are then proposed. To the author's best knowledge, this is the first study to employ the error-correction AIDS model for analysing tourist expenditure on different tourism goods and services.

In an empirical study, the consumption behaviour of tourists from eight source markets of Hong Kong inbound tourism is analysed for three categories of tourism products: shopping, hotel accommodation and meals outside hotels. The constant-parameter error-correction AIDS model is employed to analyse average consumption patterns during the time span under consideration, and the error-correction TVP-AIDS model is used to examine the evolution of these consumption behaviour patterns over time.

This chapter gives a brief overview of tourism demand analysis and discusses the significance of the study. The key findings and economic implications are then summarised. Finally, the study limitations are addressed and suggestions for future research are advanced.

7.2 An overview of tourism demand analysis

In the past three decades, international tourism has achieved enormous growth due to the rapid development of airlines, considerable decrease in transportation costs and continuous increase in personal income levels. Today, tourism is a common phenomenon and makes a significant contribution to both developing and developed economies. Hence, tourism demand analysis has been attracting increasing interest from academics and industry practitioners.

Quantitative techniques have long been employed for tourism demand analysis. With the development of advanced econometrics since the early 1980s, a large number of advanced econometric techniques have been applied to tourism demand modelling and forecasting. In univariate time series approaches, tourism demand is forecast based only on historic trends. Examples include the naïve, exponential smoothing and ARMA models. Such models are easy to estimate and data collection presents few obstacles. However, these methods can only forecast tourism demand, and cannot analyse the determinants of tourism demand. In contrast, multivariate econometric approaches measure the impact of influencing factors on tourism demand by incorporating these factors into the modelling process. Widely used single-equation multivariate methods in tourism demand analysis include the traditional regression, error-correction and vector autoregressive models and the ADLM.

However, the majority of the foregoing techniques have been criticised for lacking a strong theoretical foundation and the ad hoc inclusion of independent variables in the models (Durbarry & Sinclair, 2003). The AIDS model, which is a system-of-equations demand method, is explicitly derived from economic demand theory and hence has a strong theoretical basis. In addition, homogeneity and symmetry, which are the two basic conditions in consumer demand theory, can be formally tested under the AIDS framework. Finally, as the AIDS model can analyse a complete tourism demand system, the demands for different tourism goods and services along with their interactions can be simultaneously examined.

Because of these advantages, the AIDS model has received considerable attention in the economic literature in terms of analysing demand for non-durable goods by households. However, this approach has been little used in tourism demand studies. Most of these studies are limited to market share analysis of outbound tourism for one given origin. To the author's best knowledge, no study to date has examined tourist expenditure allocation amongst bundles of tourism goods and services using the error-correction AIDS model framework. This study aims to fill this research gap by introducing the error-correction AIDS model to examine tourist consumption behaviour related to different tourism products. Furthermore, by incorporating the TVP technique into the error-correction AIDS model, this study can analyse the evolution of tourist consumption behaviour. Tourism demand elasticities, including expenditure, own-price and cross-price elasticities, can also be examined from a time-varying perspective.

Practically, this study sheds new light on the consumption behaviour of tourists from different Hong Kong inbound tourism source markets. The findings can enrich the knowledge of academics and practitioners of tourist consumption behaviour. The implications will also help tourism-related businesses and the local government to establish efficient pricing and marketing strategies and to implement appropriate macroeconomic and political policies, respectively. The major findings and economic implications are summarised in the following section.

7.3 Major findings and economic implications

The consumption patterns of tourists from eight source markets of Hong Kong's tourism industry are examined and discussed in detail in Chapters 5 and 6. The empirical results reveal the diversity in the consumption patterns amongst the various groups of tourists, which provide important implications for Hong Kong's tourism-related sectors with regard to such strategic issues as pricing, market segmentation and service quality. This section highlights the important findings and their underlying economic implications.

7.3.1 Mainland China

Mainland China is the largest source market of Hong Kong inbound tourism. In 2008, visitor arrivals from mainland China reached 16.86 million, accounting for 57.1% of total arrivals in Hong Kong. Tourist expenditure in that year reached HKD 53.24 billion, or 56.5% of total tourist expenditure (HKTB, 2009). Therefore, identifying the consumption behaviour of this group is particularly important to develop strategies to ensure their continued contribution to the Hong Kong tourism industry and to maintain Hong Kong's competitive advantage as a tourism destination.

This study shows that in contrast to tourists from the other source markets considered, mainland Chinese tourists view shopping in Hong Kong as a necessity, which is more necessary in the long than in the short run. This indicates that Hong Kong is a competitive choice for mainland Chinese tourists with regard to shopping. It is also found that Hong Kong is encountering difficulties in attracting tourists from mainland China, as shopping in Hong Kong has become less necessary amongst them in recent years (indicated by increasing expenditure elasticities in both the long and the short run). This may be due to the recent economic crisis, which has created challenges for the Hong Kong retail sector in stimulating inbound tourists to spend money on shopping. In addition, the inelastic price elasticity of demand for shopping amongst mainland Chinese tourists implies that the strategy of reducing prices may not be effective in increasing the level of their spending.

Also in contrast to the others, mainland Chinese tourists regard hotel accommodation as a luxury. They are quite sensitive to the price change of hotel accommodation. These findings imply that pricing strategies can benefit the Hong Kong hotel sector where the mainland China market is concerned. It is also found that in recent years, hotel accommodation has come to be considered less of a luxury by these tourists than previously. This may be due to the increase in the level of their personal income and the continuous appreciation of their currency.

Amongst mainland Chinese tourists, meals outside hotels in Hong Kong are considered less (more) a luxury than hotel accommodation (shopping). In addition, a substitution relationship is identified between shopping and hotel accommodation. It is also found that shopping is increasingly less substitutable by hotel accommodation, whereas hotel accommodation is increasingly substitutable by shopping. This implies that the performance of Hong Kong hotels, particularly those that target mainland Chinese tourists, increasingly relies on the effective pricing strategies of the retail industry.

7.3.2 Other source markets

In contrast to the case for mainland Chinese tourists, retail products purchased by tourists from the other seven source markets under consideration are consistently regarded as luxuries, whereas hotel accommodation and meals outside hotels are commonly perceived as necessities. This indicates that for these seven groups of tourists, spending on shopping is more sensitive to their expenditure budget or personal income level. Practitioners in the Hong Kong retail sector should therefore pay particular attention to changes in tourist personal income levels before planning and investing in marketing strategies. It is also found that meals outside hotels are regarded more as a necessity amongst non-Asian tourists than amongst Asian ones.

Interestingly, shopping in Hong Kong is viewed less as a luxury by Australian tourists in recent years and by UK tourists in the 2000s, compared to previously. This may be due to the competitive advantage of Hong Kong. For example, since 1999, the consumer price index of Hong Kong has demonstrated a continuously decreasing trend.

American tourists increasingly perceive shopping in Hong Kong as a luxury. Therefore, promoting Hong Kong as a shopping paradise may not be an effective strategy to attract inbound tourists from the US.

The demand for retail products by Japanese tourists is found to be more price inelastic than that by Singaporean, Taiwanese or South Korean tourists. This can be explained by the high income level of Japanese tourists. The implication is that pricing strategies will not be effective in stimulating expenditure by Japanese tourists on retail products in Hong Kong. With regard to hotel accommodation, although Japanese tourists regard it more as a necessity than do their counterparts from the other source markets, it has increasingly been considered less of a necessity since 2000. Therefore, Japanese tourists are slightly more sensitive to the price change of hotel accommodation than before.

With regard to the South Korean market, more recently, the demand for shopping is less sensitive to the price change of hotel accommodation, whereas that for hotel accommodation is more sensitive to the price change of shopping than before, in both the long and the short run. Therefore, for this market, hotel accommodation is more substitutable for shopping but shopping is less substitutable for hotel accommodation in recent years. This conclusion suggests that Hong Kong hotels targeting the South Korean market should pay particular attention to price fluctuations in the retail sector, in order to adjust their supply when the demand changes. It is also found that the demand for hotel accommodation of South Korean tourists is more price elastic than that of their counterparts from the other source markets. Therefore, Hong Kong hotels need to develop appropriate promotional campaigns to target the South Korean market to boost revenues.

It is found that the short-run expenditure elasticity of demand for meals outside hotels shows a sharp decline for the Singaporean market in 2003. This is explained by the SARS outbreak in Hong Kong during that year. It is concluded that the expenditure on meals outside hotels by Singaporean tourists is sensitive to external shocks in the short run. It is also found that in recent years, retail products are increasingly viewed by Singapore tourists as a luxury, whereas meals outside hotels are increasingly viewed as a necessity.

Regarding Taiwanese tourists, hotel accommodation is found to be more substitutable for shopping but shopping to be less substitutable for hotel accommodation over the study period. This is consistent with the findings for the South Korean market. It is suggested that Hong Kong hotels reliant on Taiwanese guests gain a better understanding of the market situation by paying attention to price fluctuations in the retail sector. Also, the upwards-sloping curve of hotel own-price elasticity for Taiwan indicates that demand for hotel accommodation by Taiwanese tourists has become less sensitive to price.

Based on the calculated cross-price elasticities, a substitution relationship is found between shopping and hotel accommodation for all source markets with one exception, the US; between shopping and meals outside hotels only for Taiwan; and between hotel accommodation and meals outside hotels for three source markets: Japan, the UK and the US. However, the degree of these substitution effects differs between each pair of the consumption categories. For example, for two of the long-haul source markets – the UK and the US – demand for meals is more sensitive to the price change of hotel accommodation than is demand for hotel accommodation in response to the price change of meals outside hotels. Notably, if the average hotel room rate in Hong Kong increases by 10%, then UK (American) tourists will spend 3.04% (5.34%) more on meals; however, if the average price of meals outside hotels increases by 10%, then UK (American) tourists will spend only 1.03% (1.45%) more on their hotel accommodation. These results suggest that those Hong Kong restaurants whose receipts mainly rely on Western tourists should pay attention to the price change of hotel accommodation, in order to adjust their supply more effectively and promptly when market demand changes, because of the sensitivity of demand for meals outside hotels to the price change of hotel accommodation. In this study, no complementary relationship is identified for any pair of tourism products.

7.4 Recommendations

Based on the findings, the following suggestions and recommendations are highlighted for Hong Kong tourism-related industries as well as the government to enhance the competitiveness of Hong Kong as an international tourism destination. However, the recommendations should be interpreted with caution due to the small sample size and the scope of the study.

Mainland China has continued to be the leading source market for Hong Kong's inbound tourism since 1997. In 2008, the visitor arrivals from mainland China accounted for more than 57% of the total arrivals in Hong Kong. Especially, the fast increase in personal disposable income and the appreciation of Renminbi (RMB) in recent years has fuelled the growth of visitor arrivals from mainland China. Since Hong Kong has been perceived as a shopping paradise by Chinese tourists, the retail industry has benefited greatly from the mainland Chinese tourists. It is, therefore, important that both the retail industry and the government should make every possible effort in maintaining the attractiveness of Hong Kong's retail industry. For those retail shops that target the mainland Chinese tourists as their major customers, the diversity of the products and the quality of the service are also vital. The investment in improving the shopping environment and establishing a fair and trusting relationship between customers and retail shops would further boost the demand for retail products by tourists from mainland China.

Retail shops are likely to be affected the most by economic crises as sales of retail shops are closely related to the economic conditions in the source markets. Therefore, during the economic down turns, it is important for the retail industry to adopt proper marketing and promotional strategies in order to attract tourists from various source markets according to the level of the economic down turns faced by the source markets. For example, the long-haul markets for Hong Kong tourism, such as the European and American markets, have suffered greatly from the recent economic crisis while tourists from mainland China have continued to grow over the past two years. Therefore, it was crucial for the retail sector in Hong Kong to target the mainland Chinese tourists in their promotional and marketing efforts, which Hong Kong has done brilliantly over the past two years as a number of initiatives, such as extending the individual visit scheme to non-Guangdong residents who live in Shenzhen, were introduced to encourage shopping tourism from mainland China.

Regarding the hotel industry, pricing strategies would be more effective to attract tourists from Korea than from other countries according to the price elasticity estimates. However, the implementation of price discrimination should only be applied with caution, as applying different prices to tourists from different source markets can be perceived negatively. A better strategy would be to improve the service quality with a view to increasing the level tourists' satisfaction, which tends to be more effective in terms of attracting more tourists than the pricing strategies.

To maintain the competitive advantages of Hong Kong as a popular international tourism destination, the government is also recommended to formulate effective a broader range of tourism policies and invest in public facilities for tourists. Along with the sharp increase in tourists from mainland China, new immigration ports for the mainland Chinese tourists should be introduced. Additional investment should also be made in simplifying the entry procedure and further extend the individual visit scheme to other cities in China. Furthermore, different from tourists from other countries who usually visit Hong Kong by air, a large proportion of the mainland Chinese tourists travel to Hong Kong by train and bus. Therefore, the Hong Kong government should further invest in land transportation in order to diversify the means of transportation, shorten travel time and reduce transportation costs for the mainland Chinese tourists.

7.5 Study limitations and potential research directions

Because of limited data availability, this study examines tourist consumption behaviour solely on the basis of annual data. However, researchers and practitioners commonly observe that tourism demand systems have strong seasonal characteristics. Therefore, expenditure and price elasticities are likely to display seasonal variations. Where seasonal data are available, future research should employ the TVP version of the error-correction AIDS model to examine the seasonality patterns of tourist budget allocation amongst various tourism consumption categories over time.

Another limitation of this study is that it focuses on tourist expenditure allocation amongst a number of tourism goods and services in one specific tourism destination (i.e., Stage 3 of the budgeting process depicted in Figure 3.1). However, there is interaction amongst the three stages defined in the budgeting process; hence, including these three stages in one AIDS model and estimating them simultaneously would allow for the more accurate description of tourist consumption patterns, compared to focusing on one stage. Multi-stage budgeting systems have been applied in other fields (e.g., Decoster & Vermeulen, 1998) but not yet in tourism contexts. Where richer data are available, a multi-stage budgeting system should be considered within the AIDS framework in tourism demand analysis.

Furthermore, the potential endogeneity problem may exist in the AIDS models employed in this study. The independent variables, i.e., prices of tourism products and total expenditure per capita, are assumed to be exogenous in the system models. Since the demand system is determined simultaneously by both supply and demand and it would be risky to assume that the prices of tourism goods and services are exogenous to the demand variables. In this study, tourism prices for shopping, meals outside hotels and others were constructed based on the consumer price index of Hong Kong. These prices are barely influenced by tourists, and hence can be safely treated as exogenous variables. However, the other two independent variables, the price of hotel accommodation and the total expenditure per capita, may suffer from the endogeneity problem. And this may lead to inconsistent estimates of the AIDS models. Therefore, testing and solving the problem of endogeneity in the AIDS model would be another possible future research direction.

REFERENCES

Akal, M. (2004). Forecasting Turkey's tourism revenues by ARMAX model. *Tourism Management, 25*, 565-580.

Alleyne, D. (2006). Can seasonal unit root testing improve the forecasting accuracy of tourist arrivals? *Tourism Economics, 12,* 45-64.

Anderson, G., & Blundell, R. (1983). Testing restrictions in a flexible dynamic demand system: An application to consumer's expenditure in Canada. *Review of Economic Studies, 50*, 397-410.

Ashworth, J., & Johnson, P. (1990). Holiday tourism expenditure: Some preliminary econometric results. *Tourist Review, 3*, 12-19.

Athanasopoulos, G., & Hyndman, R. J. (2008). Modelling and forecasting Australian domestic tourism. *Tourism Management, 29*, 19-31.

Attfield, C. L. F. (1997). Estimating a cointegrating demand system. *European Economic Review, 41*, 61-73.

Au, N., & Law, R. (2000). The application of rough sets to sightseeing expenditures. *Journal of Travel Research, 39*, 70-77.

Au, N., & Law, R. (2002). Categorical classification of tourism dining. *Annals of Tourism Research, 29*, 819-833.

Balcombe, K. G., & Davis, J. R. (1996). An application of cointegration theory in the estimation of the almost ideal demand system for food consumption in Bulgaria. *Agricultural Economics*, *15*, 47-60.

Baldwin, M. A., Hadid, M., & Phillips, G. D. A. (1983). The estimation and testing of a system of demand equations for the UK. *Applied Economics, 15*, 81-90.

Balk, B. M., & Diewert, W. E. (2001). A characterization of the Törnqvist price index. *Economics Letters, 72*, 279-281.

Barten, A. P. (1964). Consumer demand functions under conditions of almost additive preferences. *Econometrica, 32*, 1-38.

Bates, J. M., & Granger, C. W. J. (1969). The combination of forecasts. *Operational Research Quarterly, 20*, 451-468.

Bera, A. K., Byron, R. P., & Jarque, C. M. (1981). Further evidence on asymptotic tests for homogeneity and symmetry in large demand systems. *Economics Letters, 8*, 101-105.

Blake, A., Durbarry, R., Eugenio-Martin, J. L., Gooroochurn, N., Hay, B., Lennon, J., Sinclair, M. T., Sugiyarto, G., & Yeoman, I. (2006). Integrating forecasting and CGE models: The case of tourism in Scotland. *Tourism Management, 27*, 292-305.

Box, G., & Jenkins, G. (1970). *Time series analysis: Forecasting and control*. San Francisco: Holden Day.

Breusch, T. S. (1978). Testing for autocorrelation in dynamic linear models. *Australian Economic Papers, 17*, 334-355.

Breusch, T. S., & Pagan, A. R. (1980). The Lagrange multiplier test and its applications to model specification in econometrics. *The Review of Economic Studies, 47*, 239-253.

Burger, C. J. S. C., Dohnal, M., Kathrada, M., & Law, R. (2001). A practitioners guide to time-series methods for tourism demand forecasting: A case study of Durban, South Africa. *Tourism Management, 22*, 403-409.

Buse, A. (1994). Evaluating the linearized almost ideal demand system. *American Journal of Agricultural Economics, 76*, 781.

Buse, A., & Chan, W. H. (2000). Invariance, price indices and estimation in almost ideal demand systems. *Empirical Economics, 25*, 519-539.

Chambers, M. J. (1990). Forecasting with demand systems: A comparative study. *Journal of Econometrics, 44*, 363-376.

Chambers, M. J. (1992). Estimation of a continuous-time dynamic demand system. *Journal of Applied Econometrics, 7*, 53-64.

Chambers, M. J. (1993). Consumers' demand in the long run: Some evidence from UK data. *Applied Economics, 25*, 727-733.

Chan, F., Lim, C., & McAleer, M. (2005). Modelling multivariate international tourism demand and volatility. *Tourism Management, 26*, 459-471.

Christensen, L. R., Jorgenson, D. W., & Lau, L. J. (1975). Transcendental logarithmic utility functions. *American Economic Review, 65*, 367-383.

Chu, F. L. (2004). Forecasting tourism demand: A cubic polynomial approach. *Tourism Management, 25*, 209-218.

Clemen, R. T. (1989). Combining forecasts: A review and annotated bibliography. *International Journal of Forecasting, 5*, 559-583.

Cortes-Jimenez, I., Durbarry, R., & Pulina, M. (2009). Estimation of outbound Italian tourism demand: A monthly dynamic EC-LAIDS model. *Tourism Economics, 15*, 547-565.

Coshall, J. (2000). Spectral analysis of international tourism flows. *Annals of Tourism Research, 27*, 577-589.

Court, R. H. (1968). An application of demand theory to projecting New Zealand retail consumption. *The Economic Review, 3*, 401-411.

Davidson, J., Hendry, D. F., Saba, F., & Yeo, S. (1978). Econometric modelling of the aggregate time series relationships between consumer's expenditure and income in the United Kingdom. *Economic Journal, 88*, 661-692.

De Mello, M. M., & Nell, K. S. (2005). The forecasting ability of a cointegrated VAR system of the UK tourism demand for France, Spain and Portugal. *Empirical Economics, 30*, 277-308.

De Mello, M., Pack, A., & Sinclair, M. T. (2002). A system of equations model of UK tourism demand in neighbouring countries. *Applied Economics, 34*, 509-521.

Deaton, A. S. (1974). The analysis of consumer demand in the United Kingdom: 1900-1970. *Econometrica, 42*, 341-361.

Deaton, A., & Muellbauer, J. (1980). An almost ideal demand system. *American Economic Review, 70*, 312-326.

Decoster, A., & Vermeulen, F. (1998). Evaluation of the empirical performance of two-stage budgeting AIDS, QUAIDS and Rotterdam models based on weak separability. Working Paper 98/07, Katholieke University Leuven, Belgium.

Dickey, D. A., Hasza, H., & Fuller, W. A. (1984). Testing for unit roots in seasonal time series. *Journal of the American Statistical Association, 79*, 355-367.

Diebold, F. X., & Pauly, P. (1990). The use of prior information in forecast combination. *International Journal of Forecasting, 6*, 503-508.

Diewert, W. E. (1976). Exact and superlative index numbers. *Journal of Econometrics, 4*, 115-145.

Divisekera, S. (2003). A model of demand for international tourism. *Annals of Tourism Research, 30*, 31-49.

Divisekera, S. (2009a). Economics of domestic tourism: A study of Australian demand for tourism goods and services. Tourism *Analysis, 14*, 279-292.

Divisekera, S. (2009b). Ex post demand for Australian tourism goods and services. *Tourism Economics, 15*, 153-180.

Dritsakis, N., & Athanasiadis, S. (2000). An econometric model of tourist demand: The case of Greece. *Journal of Hospitality & Leisure Marketing, 7*, 39-49.

Duffy, M. (2002). Advertising and food, drink and tobacco consumption in the United Kingdom: A dynamic demand system. *Agricultural Economics, 1637*, 1-20.

Durbarry, R., & Sinclair, M. T. (2003). Market shares analysis: The case of French tourism demand. *Annals of Tourism Research, 30*, 927-941.

Durbin, J., & Koopman, S. J. (2001). *Time Series Analysis by State Space Methods*. Oxford: Oxford University Press.

Durbin, J., & Watson, G. S. (1950). Testing for serial correlation in least squares regression I. *Biometrika, 37*, 409-428.

Durbin, J., & Watson, G. S. (1951). Testing for serial correlation in least squares regression II. *Biometrika, 38*, 159-179.

Dwyer, L., Forsyth, P., & Spurr, R. (2007). Contrasting the uses of TSAs and CGE models: Measuring tourism yield and productivity. *Tourism Economics, 13*, 537-552.

Eadington, W. R., & Redman, M. (1991). Economics and tourism. *Annals of Tourism Research, 18*, 41-56.

Edgerton, D. L., & Shukur, G. (1995). *Testing autocorrelaiton in a system perspective.* Paper presented at the Econometric Society Meeting, Uppsala.

Edgerton, D. L., Assarsson, B., Hummelmose, A., Laurila, I. P., Rickertsen, K., & Vale, P. H. (1996). *The* econometrics *of demand systems with applications to food demand in the Nordic countries*. London: Kluwer Academic Publishers.

Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica, 55*, 251-276.

Engle, R. F., Granger, C. W. J., & Hallman, J. (1988). Merging short- and long-run forecasts: An application of seasonal co-integration to monthly electricity sales forecasting. *Journal of Econometrics, 40*, 45-62.

Engle, R. F., Granger, C. W. J., Hylleberg, S., & Lee, H. S. (1993). The Japanese consumption function. *Journal of Econometrics, 55*, 275-298.

English, J. M., & Kearnan, G. L. (1976). The prediction of air travel and aircraft technology to the year 2000 using the Delphi method. *Transportation Research, 10*, 1-8.

Fanelli, L., & Mazzocchi, M. (2002). A cointegrated VECM demand system for meat in Italy. *Applied Economics, 34*, 1593-1605.

Fang, Y. (2003). Forecasting combination and encompassing tests. *International Journal of Forecasting, 19*, 87-94.

Fujii, E. T., Khaled, M., & Mak, J. (1985). An almost ideal demand system for visitor expenditures. *Journal of Transport Economics and Policy, 19*, 161-171.

Geanakoplis, J. (1987). Arrow-Debreu model of general equilibrium. In J. Eatwell, M. Milgate, P. Newman (Eds.), *The new palgrave dictionary of money and finance, Vol. 1.* (pp. 116-124). London: Macmillan Press.

Glejser, H. (1969). A new test for heteroscedasticity. *Journal of the American Statistical Association, 41*, 316-323.

Godfrey, L. G. (1988). Misspecification *tests in econometrics*. Cambridge: Cambridge Univiersity Press.

Goh, C., & Law, R. (2002). Modeling and forecasting tourism demand for arrivals with stochastic nonstationary seasonality and intervention. *Tourism Management, 23*, 499-510.

Goldfeld, S. M., & Quandt, R. E. (1965). Some tests for homoscedasticity. *Journal of the American Statistical Association, 60*, 539-547.

Goldfrey, L. G. (1978). Testing for higher order serial correlation in regression equations when the regressors include lagged dependent variables. *Econometirca, 46*, 1303-1310.

Gunadhi, H., & Boey, C. K. (1986). Demand elasticities of tourism in Singapore. *Tourism Management, 7*, 239-253.

Gustavsson, P. (2001). The impact of seasonal unit roots and vector ARMA modelling on forecasting monthly tourism flows. *Tourism Economics, 7*, 117-133.

Han, Z., Durbarry, R., & Sinclair, M. T. (2006). Modelling US tourism demand for European destinations. *Tourism Management, 27*(1), 1-10.

Harvey, A. C. (1989). *Forecasting, structural time series models and the Kalman filter.* Cambridge: Cambridge University Press.

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica, 46*, 1251-1271.

Hendry, D. F. (1986). Empirical modeling in dynamic econometrics. *Applied Mathematics and Computation, 20*, 201-236.

Hibon, M., & Evgeniou, T. (2005). To combine or not to combine: Selecting among forecasts and their combinations. *International Journal of Forecasting, 21*, 15-24.

Hiemstra, S., & Wong, K. F. (2002). Factors affecting demand for tourism in Hong Kong. *Journal of Travel and Tourism Marketing, 13*, 43-62.

Hong Kong Tourism Board (HKTB) (2009). *A statistical review of Hong Kong tourism 2008*. Hong Kong: Hong Kong Tourism Board.

Hylleberg, S., Engle, R. F., Granger, C. W. J., & Yoo, B. S. (1990). Seasonal integration and cointegration. *Journal of Econometrics, 44*, 215-238.

Jarque, C. M., & Bera, A. K. (1980). Efficient tests for normality, Homoscedasticity and serial independence of regresion residuals. *Economics Letters, 6*, 255-259.

Jensen, T. C. (1998). Income and price elasticities by nationality for tourists in Denmark. *Tourism Economics, 4*, 101-130.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control, 12*, 231-254.

Jorgenson, D. W., & Lau, L. J. (1975). The structure of consumer preferences. *Annals of Economic and Social Measurement*, *4*, 49-101.

Judge, G. G., Hill, R. C., Griffiths, W. E., Lütkepohl, H., & Lee, T. C. (1988). *Introduction to the theory and practice of econometrics*. New York: Wiley.

Kalman, R. E. (1960). A new approach to linear filtering and prediction problems. *Transactions of the ASME-Journal of Basic Engineering, 82*, 35-45.

Karagiannis, G., & Mergos, G. J. (2002). Estimating theoretically consistent demand systems using cointegration techniques with application to Greek food data. *Economics Letters*, *74,* 137-143.

Karagiannis, G., & Velentzas, K. (1997). Explaining food consumption patterns in Greece. *Journal of Agricultural Economics, 48*, 83-92.

Karagiannis, G., Katranidis, S., & Velentzas, K. (2000). An error correction almost ideal demand system for meat in Greece. *Agricultural Economics, 22*, 29-35.

Kibedi, G. (1981). Future trends in international tourism. *Tourist Review, 36*, 3-6.

Kim, J. (1999). Forecasting monthly tourist departures from Australia. *Tourism Economics, 5*, 227-290.

Kim, Y., & Uysal, M. (1998). Time-dependent analysis for international hotel demand in Seoul. *Tourism Economics, 4*, 253-263.

Kiviet, J. F., & Phillips, G. D. A. (1993). Alternative bias approximations in regressions with a lagged dependent variable. *Econometric Theory, 9*, 62-80.

Kiviet, J. F., & Phillips, G. D. A. (1994). Bias assessment and reduction in linear error-correction models. *Journal of Econometrics, 63*, 215-243.

Kon, S. C., & Turner, W. L. (2005). Neural network forecasting of tourism demand. *Tourism Economics, 11*(3), 301-328.

Koning, J., Franses, H., Hibon, M., & Stekler, H. O. (2005). The M3 competition: Statistical tests of the results. *International Journal of Forecasting, 21*, 397-409.

Kulendran, N., & King, M. L. (1997). Forecasting international quarterly tourist flows using error-correction and time-series models. *International Journal of Forecasting, 13*, 319-327.

Kulendran, N., & Witt, S. F. (2001). Cointegration versus least squares regression. *Annals of Tourism Research, 28*, 291-311.

Kulendran, N., & Witt, S. F. (2003a). Forecasting the demand for international business tourism. *Journal of Travel Research, 41*, 265-270.

Kulendran, N., & Witt, S. F. (2003b). Leading indicator tourism forecasts. *Tourism Management, 24*, 503-510.

Kulendran, N., & Wong, K. K. F. (2005). Modeling Seasonality in Tourism Forecasting. *Journal of Travel Research, 44*, 163.

Laitinen, K. (1978). Why is demand homogeneity so often rejected. *Economics Letters, 1*, 187-191.

Law, R., & Au, N. (1999). A neural network model to forecast Japanese demand for travel to Hong Kong. *Tourism* Management*, 20*, 89-97.

Lee, C. K., Var, T., & Blaine, T. W. (1996). Determinants of inbound tourist expenditures. *Annals of Tourism Research, 23*, 527-542.

Leybourne, S. J. (1993a). Empirical performance of the AIDS model: Constant-coefficient versus time-varying-coefficient approaches. *Applied Economics, 25*, 453-463.

Leybourne, S. J. (1993b). Estimation and testing of time-varying coefficient regression models in the presence of linear restrictions. *Journal of Forecasting, 12*, 49-62.

Li, G., Song, H., & Witt, S. F. (2004). Modeling tourism demand: A dynamic linear AIDS approach. *Journal of Travel Research, 43*, 141-150.

Li, G., Song, H., & Witt, S. F. (2005). Recent developments in econometric modeling and forecasting. *Journal of Travel Research, 44*, 82-99.

Li, G., Song, H., & Witt, S. F. (2006). Time varying parameter and fixed parameter linear AIDS: An application to tourism demand forecasting. *International Journal of Forecasting, 22*, 57-71.

Li, G., Wong, K. K. F., Song, H., & Witt, S. F. (2006). Tourism demand forecasting: A time varying parameter error correction model. *Journal of Travel Research, 45*, 175-185.

Lim, C. (1997). Review of international tourism demand models. *Annals of Tourism Research, 24*, 835-849.

Lim, C., & McAleer, M. (2001). Cointegration analysis of quarterly tourism demand by Hong Kong and Singapore for Australia. *Applied Economics, 33*, 1599-1619.

Liu, J. C. (1988). Hawaii tourism to the year 2000. *Tourism Management, 9*, 279-290.

Loeb, P. D. (1982). International travel to the United States: An econometric evaluation. *Annals of Tourism Research, 9*, 7-20.

Luiz, M., & Witt, S. F. (1995). Forecasting the tourism environment using a consensus approach. *Journal of Travel Research, 33*, 46-50.

Makridakis, S., & Winkler, R. L. (1983). Averages of forecasts: Some empirical results. *Management Science, 29*, 987-996.

Martin, C.A., & Witt, S. F. (1987). Tourism demand forecasting models: Choice of appropriate variable to represent tourists' cost of living. *Tourism Management,* 233-246.

Mazzocchi, M. (2003). Time-varying coefficients in the Almost Ideal Demand System: An empirical appraisal. *European Review of Agricultural Economics, 30*, 241-270.

Mazzocchi, M. (2006). Time patterns in UK demand for alcohol and tobacco: An application of the EM algorithm. *Computational Statistics & Data Analysis, 50*, 2191-2205.

McKercher, B. (2006). Theories and concepts in tourism. *Study Note for Doctor of Hotel and Tourism Management*. School of Hotel and Tourism Management, The Hong Kong Polytechnic University, Hong Kong.

Meinser, J. F. (1979). The sad fate of the asymptotic Slutsky test for large systems. *Economics Letters, 2*, 231-233.

Morley, C. (1990). What is tourism. *The Journal of Tourism Studies, 1*, 3-8.

Moschini, G. (1995). Units of measurement and the Stone index in demand system estimation. *American Journal of Agricultural Economics, 77*, 63-68.

O'Hagan, J. W., & Harrison, M. J. (1984). Market shares of US tourist expenditure in Europe: An econometric analysis. *Applied Economics, 16*, 919-931.

Ogilvie, F. W. (1933). *The tourism movement: An economic study.* London: Staples Press.

Oh, C. O., & Morzuch, B. J. (2005). Evaluating time-series models to forecast the demand for tourism in Singapore: Comparing within-sample and post-sample results. *Journal of Travel Research, 43*, 404-413.

Papanikos, G. T., & Sakellariou, C. (1997). An econometric application of the almost ideal demand system model to Japan's tourist demand for ASEAN destinations. *Journal of Applied Recreation Research, 22*, 157-172.

Papatheodorou, A. (1999). The demand for international tourism in the Mediterranean region. *Applied Economics, 31*, 619-630.

Park, R. E. (1966). Estimation with heteroscedastic error terms. *Econometrica, 34*, 888.

Payne, J. E., & Mervar, A. (2002). A note on modelling tourism revenues in Croatia. *Tourism Economics, 8*, 103-109.

Ramsey, J. B. (1969). Tests for specification errors in classical linear least squares regression analysis. *Journal of the Royal Statistical Society B, 31*, 350-371.

Riddington, G. (1999). Forecasting ski demand: comparing learning curve and time varying parameter approaches. *Journal of Forecasting*, 18, 205–214.

Schwaninger, M. (1989). Trends in leisure and tourism 2000-2010: Scenario with consequences for planners. In S. F. Witt & L. Moutinho (Eds.), *Tourism marketing and management handbook* (pp. 599-605): Hemel Hempstead: Prentice-Hall.

Shaikh, S. L., & Larson, D. M. (2003). A two-constraint Almost Ideal Demand Model of recreation and donations. *Review of Economics & Statistics, 85*(4), 953-961.

Sims, C. A. (1980). Macroeconomics and Reality. *Econometrica, 48*, 1-48.

Skjerpen, T., & Swensen, A. R. (2000). *Testing for long-run homogeneity in the linear almost ideal demand system: An application on Norwegian quarterly data for nondurables*. Statistics Norway, Discussion Paper 289.

Smeral, E., & Weber, A. (2000). Forecasting international tourism trends to 2010. *Annals of Tourism Research, 27*, 982-1006.

Smeral, E., & Wüger, M. (2005). Does complexity matter? Methods for improving forecasting accuracy in tourism: The case of Australia. *Journal of Travel Research, 44*, 100-110.

Smeral, E., Witt, C. A., & Witt, S. F. (1992). Econometric forecasts: Tourism trends to 2000. *Annals of Tourism Research, 29*, 450-466.

Song, H., & Li, G. (2008). Tourism demand modelling and forecasting - A review of recent research. *Tourism Management, 29,* 203-220.

Song, H., & Turner, L. (2006). Tourism demand forecasting. In L. Dwyer & P. Forsyth (Eds.), *International Handbook on the Economics of Tourism* (pp. 89-116). Cheltenham, UK and Northampton, MA, USA: Edward Elgar.

Song, H., & Witt, S. F. (2000). *Tourism demand modelling and forecasting: Modern econometric approaches.* Pergamon: Oxford.

Song, H., & Witt, S. F. (2003). Tourism forecasting: The general-to-specific approach. *Journal of Travel Research, 42*, 65-74.

Song, H., & Witt, S. F. (2006). Forecasting international tourist flows to Macau. *Tourism Management, 27*, 214-224.

Song, H., & Wong, K. (2003). Tourism demand modeling: A time-varying parameter approach. *Journal of Travel Research, 42*, 57-64.

Song, H., Romilly, P., & Liu, X. (2000). An empirical study of outbound tourism demand in the UK. *Applied Economics, 32*, 611-624.

Song, H., Witt, S. F., & Jensen T. C. (2003). Tourism forecasting: Accuracy of alternative econometric models. *International Journal of Forecasting, 19,* 123-141.

Song, H., Witt, S. F., & Li, G. (2003). Modelling and forecasting the demand for Thai tourism. *Tourism Economics, 9*, 363-387.

Song, H., Witt, S. F., Wong, K. F., & Wu, D. C. (2009). An empirical study of forecast combination in tourism. *Journal of Hospitality and Tourism Research*, 33, 3-29.

Song, H., Wong, K. K. F., & Chon, K. K. S. (2003). Modelling and forecasting the demand for Hong Kong tourism. *International Journal of Hospitality Management, 22*, 435-451.

Spearman, C. (1904). The proof and measurement of association between two things. *American Journal of Psychology, 15*, 72-101.

Stone, J. R. N. (1954). Linear expenditure systems and demand analysis: An application to the pattern of British demand. *Economic Journal, 64*, 511-527.

Syriopoulos, T. C. (1995). A dynamic model of demand for Mediterranean tourism. *International Review of Applied Economics, 9*, 318-336.

Syriopoulos, T. C., & Sinclair, M. T. (1993). An econometric study of tourism demand: The AIDS model of US and European tourism in Mediterranean countries. *Applied Economics, 25*, 1541-1552.

Taplin, J. H. E. (1980). A coherence approach to estimates of price elasticities in the vacation travel market. *Journal of Transport Economics and Policy, 14*, 19-35.

Taube, P. M., Huth, W. L., & MacDonald, D. N. (1990). An analysis of consumer expectation effects on demand in a dynamic almost ideal demand system. *Journal of Economics and Business, 42*, 225-236.

Theil, H. (1965). The information approach to demand analysis. *Econometrica*, *33*, 67-87.

Theil, H. (1976). *Theory and measurement of consumer demand (Vol. II).* Amsterdam: North Holland.

Theil, H. (1980). *System-wide explorations in international economics, input-output analysis, and marketing research*. Amsterdam: North Holland.

Tornqvist, L. (1936). The bank of Finland's consumption price index. *Bank of Finland Monthly Bulletion, 10*, 1-8.

Tribe, J. (2006). The truth about tourism. *Annals of Tourism Research, 33*, 360-381.

Uysal, M., & Roubi, M. S. E. (1999). Artificial neural networks versus multiple regression in tourism demand analysis. *Journal of Travel Research, 38*, 111-118.

van der Stelt, D., & Velthuijsen, J. W. (1989). *Supply and demand on the tourism market: A feasibility study for a simulation model of the Netherlands*. Amsterdam: Foundation for Economic Research of the University of Amsterdam.

van Dijk, J. C., Hagens, J. S., & Windmeijer, F. A. G. (1991). *A simulaiton model of the Dutch tourist market*. Amsterdam: Foundation for Economic Research of the University of Amsterdam.

Vanegas, S. M., & Croes, R. R. (2000). Evaluation of demand: US tourists to Aruba. *Annals of Tourism Research, 27*, 946-963.

Walker, M. B., & White, K. J. (1980). *Tourism and the travel account: An econometric analysis*. Rice University, Department of Economics, Discussion Paper.

Walz, D. T., & Walz, D. B. (1989). Combining forecasts: Multiple regression versus a Bayesian approach. *Decision Sciences, 20*, 77-89.

Wei, W. W. S. (2006). Time Series Analysis, Univariate and Multivariate Methods, Boston: Pearson Addison Wesley.

White, H. (1980). A heteroskedastic-consistent covariance matrix estimator and a direct test of heteroskedasticity. *Econometrica, 48*, 817-838.

White, K. J. (1985). An international travel demand model: US travel to Western Europe. *Annals of Tourism* Research*, 12*, 529-545.

Williams, S. (1998). *Tourism Geography*. London: Routledge.

Winters, P. R. (1960). Forecasting sales by exponentially weighted moving averages. *Management Science, 6*, 324-342.

Witt, S. F., & Song, H. (2001). Forecasting future tourism flows. In: A. Lockwood & S. Medlik, S. (Eds.), *Tourism and hospitality in the 21st century* (pp. 599-605): Oxford: Butterworth-Heinemann.

Witt, S. F., & Witt, C. A. (1995). Forecasting tourism demand: A review of empirical research. *International Journal of Forecasting, 11*, 447-475.

Witt, S. F., Song, H., & Louvieris, P. (2003). Statistical testing in forecasting model selection. *Journal of Travel Research, 42*, 151-158.

Wong, K. K. F., Song, H., Witt, S. F., & Wu, D. C. (2007). Tourism forecasting: To combine or not to combine? *Tourism Management, 28*, 1068-1078.

World Tourism Organization (UNWTO) (2004). *WTO 2004 tourism: General definition.* Retrieved October 20, 2007, from http://www.world-tourism.org/statistics/tsa_project/TSA_in_depth/chapters/ch3-1.htm.

World Tourism Organization (UNWTO) (2009). *Tourism highlights (2009 Edition).* Madrid: World Tourism Organization.

Wu, D. W. (1983). A remark on a generalised specification test. *Economics Letters, 11*, 365-370.

Zellner, A. (1962). An efficient method of estimating seemingly unrelated regressions and test for aggregation bias. *Journal of the American Statistical Association, 57*, 348-368.

Zhang, H. Q., Wong, K. K. F., & Or, Y. S. (2001). An analysis of historical tourism development and its implications to the tourism industry in Hong Kong. *Pacific Tourism Review, 5*, 15-21.

APPENDIX

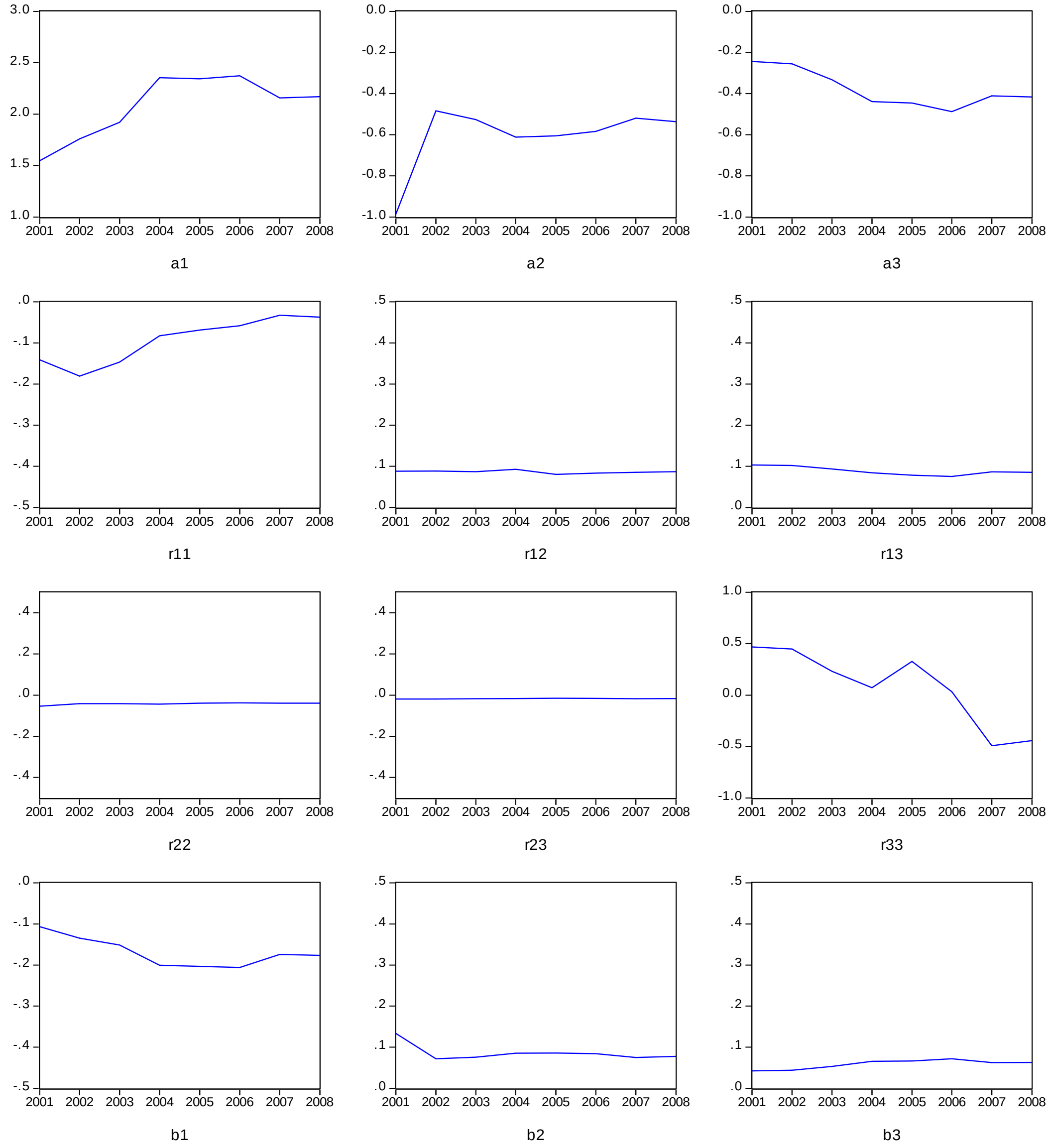

Figure X1 Evolution of the coefficients in the long-run AIDS model for mainland China

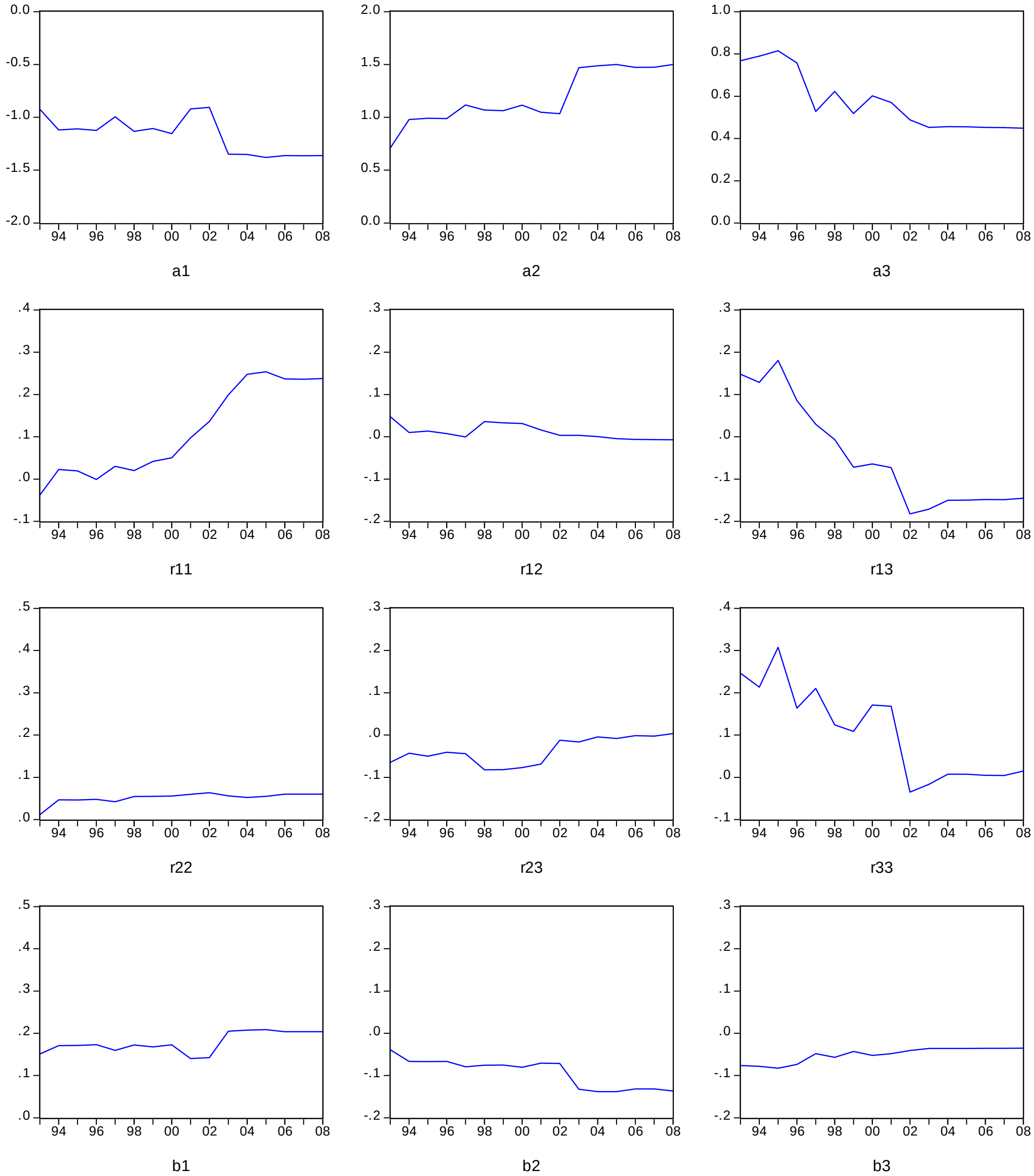

Figure X2 Evolution of the coefficients in the long-run AIDS model for Australia

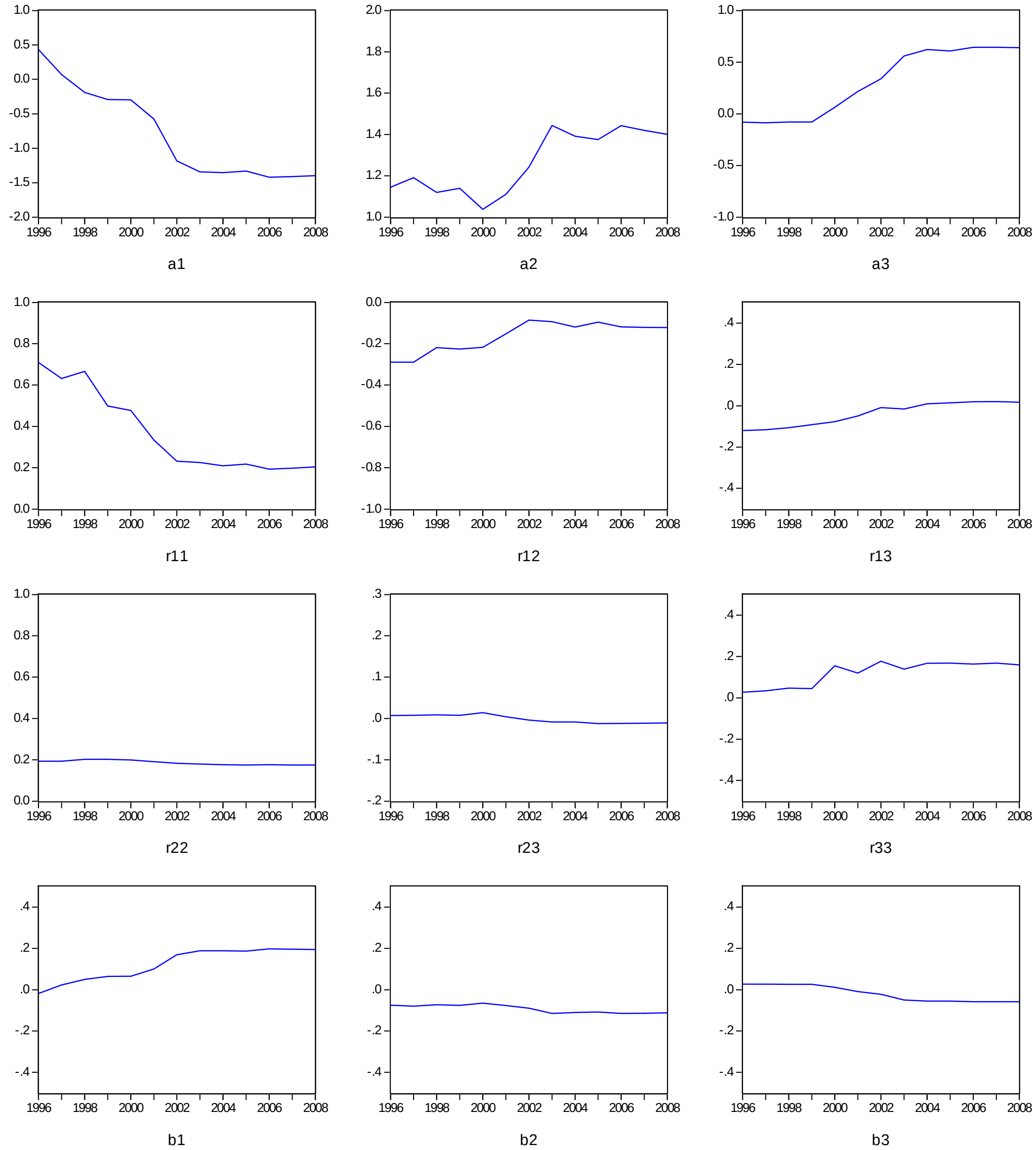

Figure X3 Evolution of the coefficients in the long-run AIDS model for the US

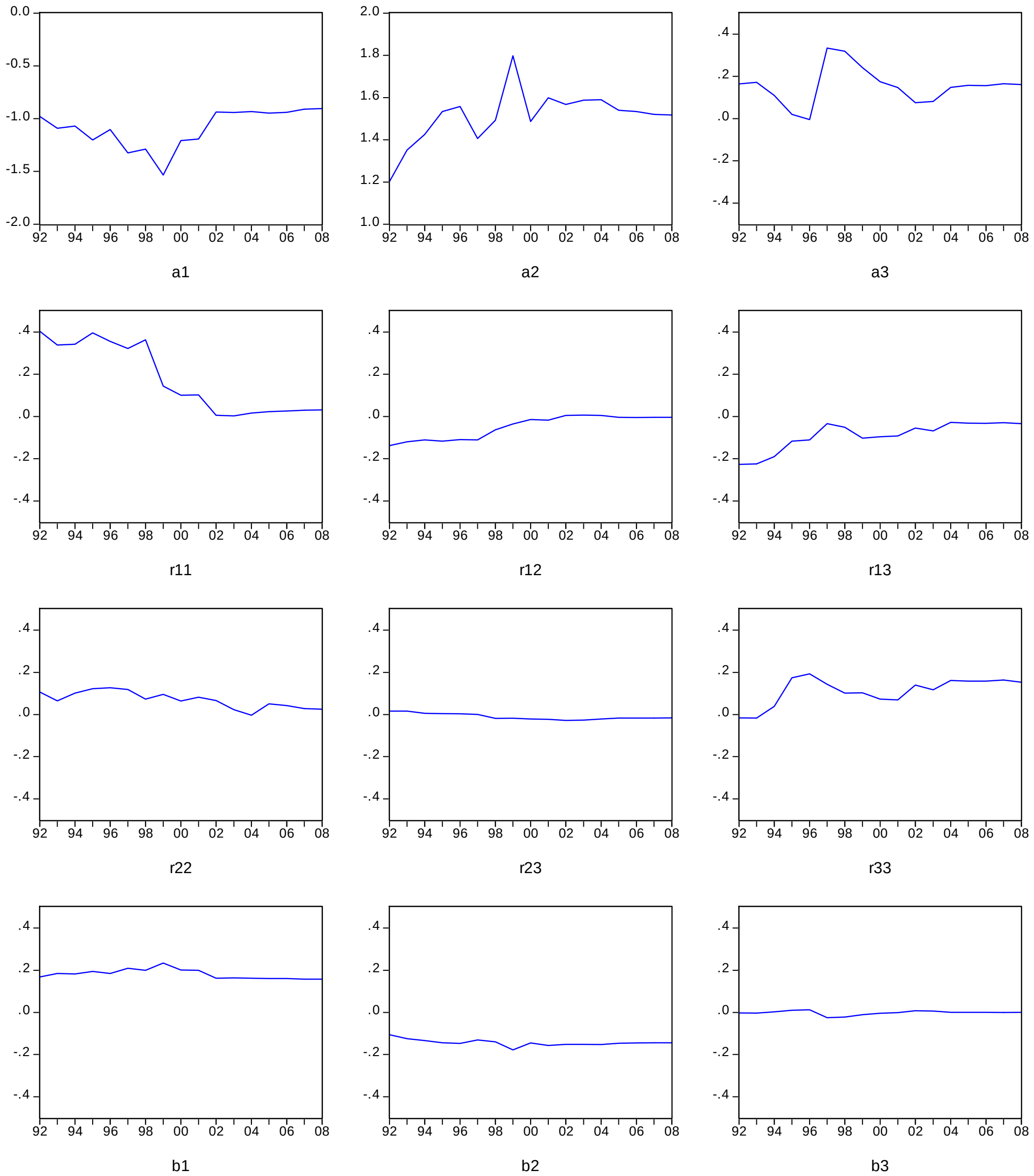

Figure X4 Evolution of the coefficients in the long-run AIDS model for Japan

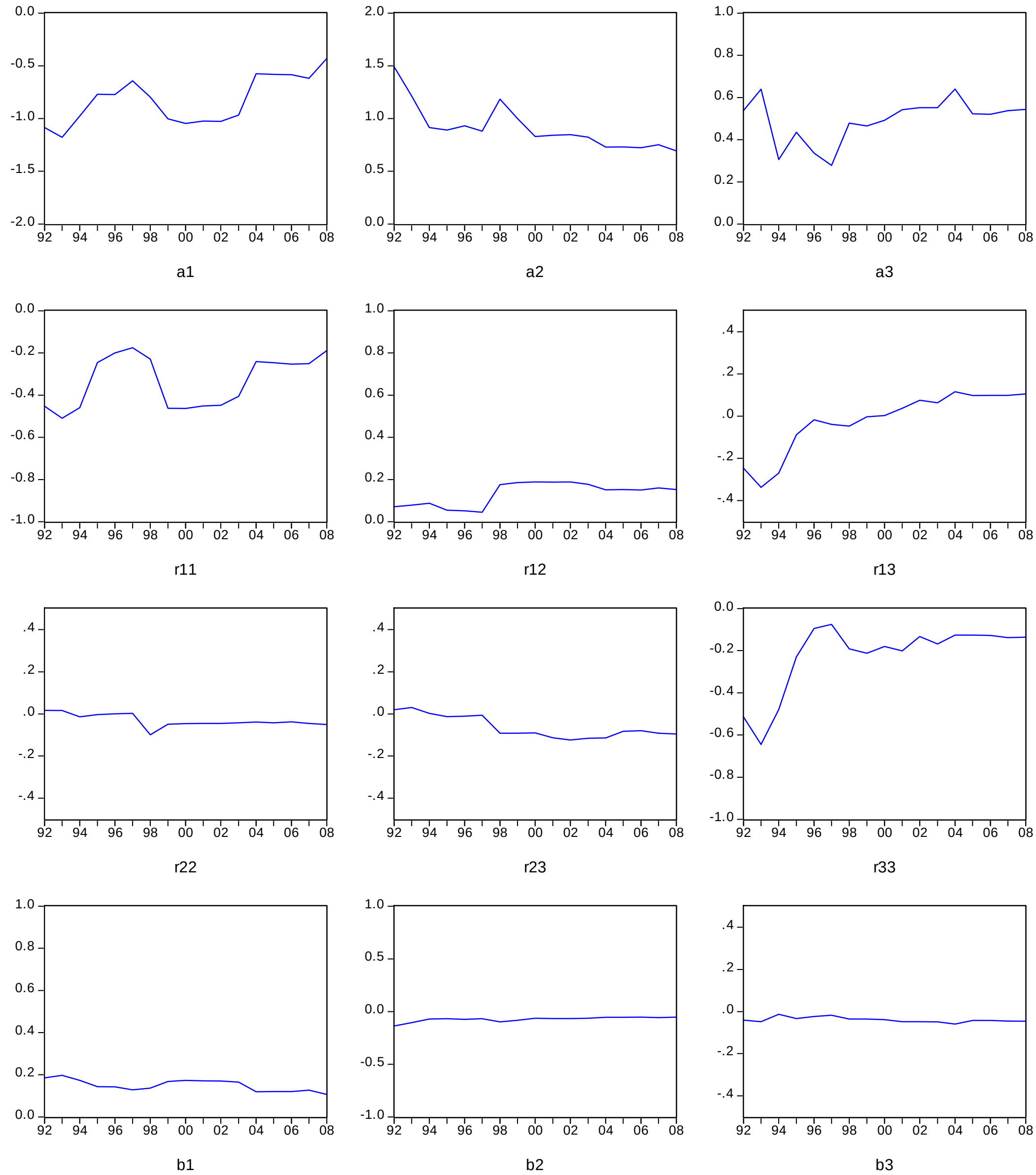

Figure X5 Evolution of the coefficients in the long-run AIDS model for South Korea

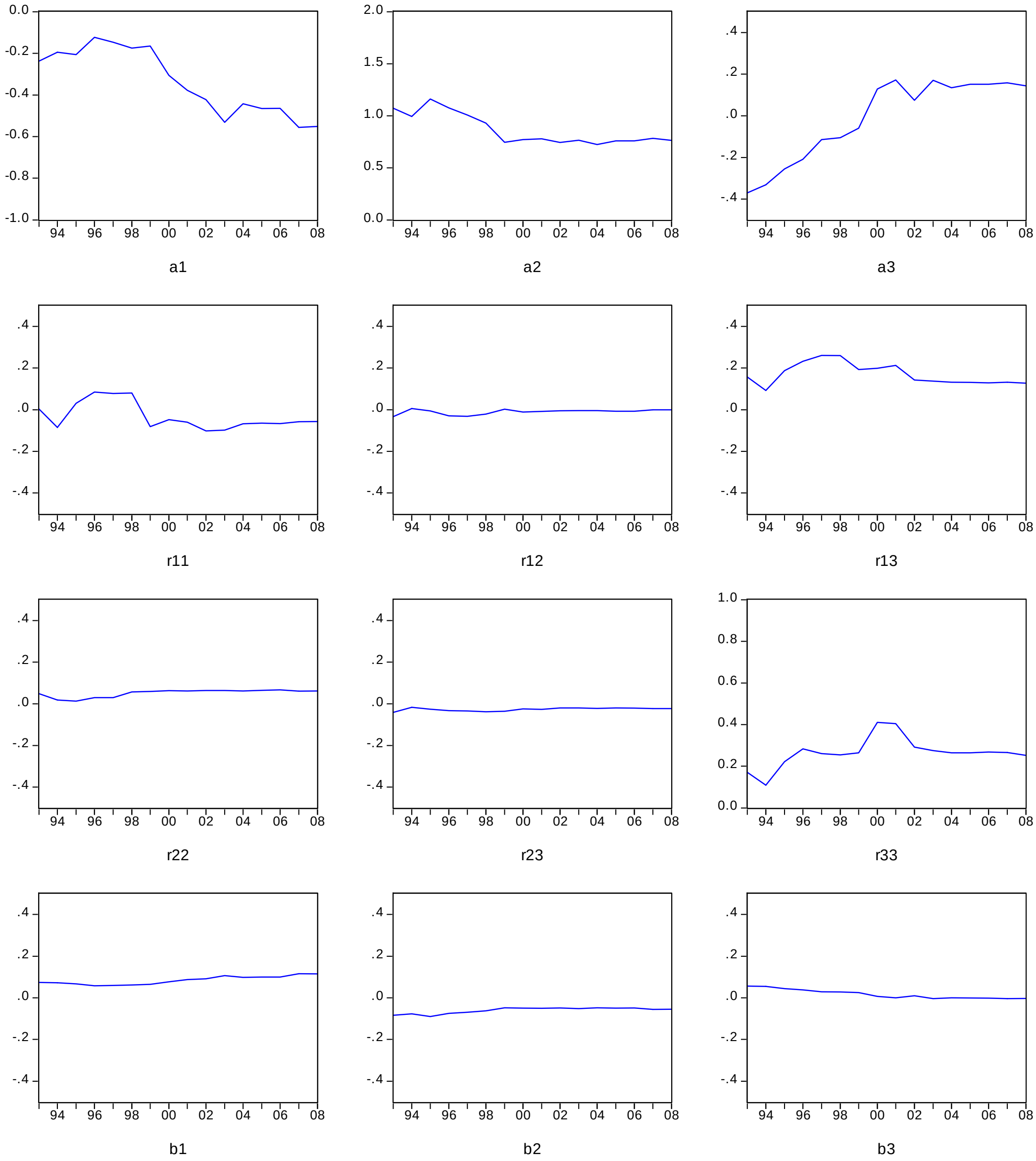

Figure X6 Evolution of the coefficients in the long-run AIDS model for Singapore

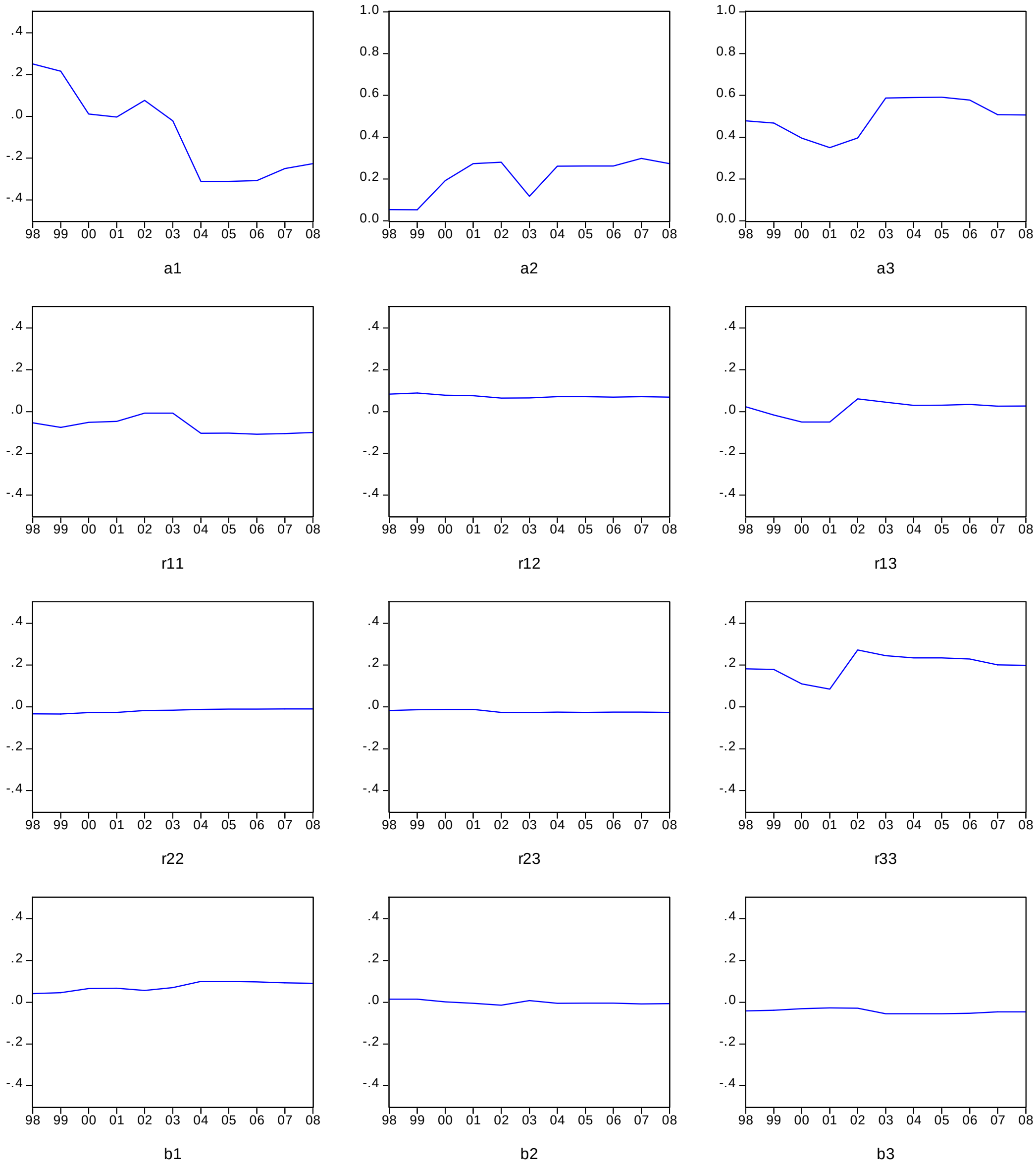

Figure X7 Evolution of the coefficients in the long-run AIDS model for Taiwan