DEVELOPMENT OF A MODEL TO EXAMINE THE DETERMINANTS OF DEMAND FOR INTERNATIONAL HOTEL ROOMS IN SEOUL

by

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(Abstract)

The primary objective of this study was to develop an empirical model that accounts for factors affecting the demand for international tourist hotels, and that enables demand estimation and projection of demand, in the context of the metropolitan Seoul area.

Models were hypothesized to explain market behavior of selected segments of the hotel industry. Demand Model I accounted for international hotel demand incorporating such explanatory variables as price, trade volume and events. Both demand and price were treated as endogenous variables and the time-dependent error processes were all examined. Demand Model I was further expanded by incorporating segmentation variables. The inclusion of segmentation variables into the model in Demand Model II enabled the

analysis of the interdependence of market segments that affects demand. Along with the incorporation of a time series structure, a system of equations was employed for Demand Model II.

The results indicated that the explanatory variables, which were own price, the number of events and the volume of trade, had a significant impact on international hotel demand. The results from the demand equations also revealed that the demand for a segment is significantly influenced by price and demand for other segments. A cross-segment substitution effect on the demand side is quite relevant for the international lodging market in Seoul and demand for a market segment fluctuates in the same direction as the total market demand changes.

From the price equations, the market price of lodging services was found to be related to demand and supply influences simultaneously. The results also indicated that seasonality and economic factors, such as exchange rates and consumer price index, have significant influence directly on international lodging prices. Such factors also were found to have indirect effects on the demand level.

Dedicated to the memory of my father, In-soo Kim

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CHAPTER I. INTRODUCTION

1.1 INTRODUCTION

During the second half of the twentieth century, tourism has become one of the largest and most rapidly growing sectors in the world economy (Eadington and Redman 1991). It is now highly competitive and often constitutes an important component of a country's balance of payments. The need to enhance our understanding of the determinants of international tourism demand is therefore considerable for both government and private enterprises engaged in the tourism and hospitality industry. The purpose of this study is to estimate international tourism demand in terms of the hotel industry.

When the tourism sector increases its size or scale, new economic benefits are injected into the economy of the host region. Even though the initial revenue may stem from the additional capital investment, the major economic impact of tourism results from the continuing expenditures by tourists. Especially for developing nations, tourism creates employment opportunities, contributes to the balance of payments as an earner of hard currency, and affects positively general economic development through multiplier effects (Uysal 1985). Some empirical studies have revealed that the economic impacts of foreign tourist receipts are significant to their hosting countries (Seow 1981; Lee and Kwon 1995).

Therefore, meaningful estimates of international tourism demand are absolute necessities for developing countries seeking to make tourism a viable component of their economic development strategies (Uysal 1985). In the tourism literature, there have been many efforts to identify the factors affecting demand for international tourism (Uysal 1985; Witt and Martin 1987; Crouch 1992). The direct and indirect effects of international tourism concern a wide variety of organizations, both private and public, who need more effective tools to assist their long-range planning. Van Doorn (1982) argued that one of the most important data for recreation and tourism is how many people are involved. Information about flows of international tourists are major input into public policy as well as management decisions.

Thus, it is not surprising that many tourism studies so far have been devoted to demand.

A number of studies have been undertaken on various aspects of international tourism demand in many countries. Most quantitative studies are concerned with finding a model that explains either the number of tourists or tourism expenditures in terms of its own price, prices of related goods, and income. These demand studies mostly employ a single equation approach, assuming that explanatory variables are predetermined. Little research has been attempted to measure international tourists' demand for lodging industry. Market segments have never been considered in estimating demand. Most studies used time-series data, while overlooking time-dependent disturbances. These are the problematic diagnoses in the current body of knowledge in demand studies in the tourism and hospitality literature. There are some exceptions (Hiemstra and Ismail 1993; Fujii Khaled and Mak 1985b; Arbel and Ravid 1983) that employed simultaneous equation models that evaluate demand and supply of lodging in the US market, since price and demand are in fact jointly dependent. This still raises more concerns that price is determined by influences of demand and supply simultaneously. Therefore, in order to measure international hotel demand, it is necessary to develop a quantifiable model that would explain the impact of prices and other related variables on demand, the interrelationship among market segments, and time dependent processes.

1.2. TOURISM IN KOREA

1.2.1. Tourist Arrivals

The tourism industry in Korea was a relatively late starter, but it made great strides by hosting the 1988 Olympic Games (Lee and Kwon 1995). As can be seen in Table 1.1, in 1975, right after the first oil price shock, the total number of foreign tourist arrivals in Korea was 632,846. Except for experiencing a decrease from late 1979 to early 1980 – due to the second oil price shock and internal political instability – tourism in Korea had been growing at an annual rate of 10.6% from 1975 to 1994. Up until a year after the 1988 Olympic Games the average annual growth rate was 12.2%; however, it grew an average of only 5.6% for the last five years (1990 - 1994).

Table 1.1. International Tourist Arrivals, 1975-1994

Year	Foreign Tourist Arrivals	Annual Growth Rate (%)
1975	632,846	22.3
1976	834,239	31.8
1977	949,666	13.8
1978	1,079,396	13.7
1979	1,126,100	4.3
1980	976,415	-13.3
1981	1,093,214	12.0
1982	1,145,044	4.7
1983	1,194,551	4.3
1984	1,297,318	8.6
1985	1,426,045	9.9
1986	1,659,972	16.4
1987	1,874,502	12.9
1988	2,340,462	24.9
1989	2,728,054	16.6
1990	2,958,839	8.5
1991	3,196,340	8.0
1992	3,231,081	1.1
1993	3,331,226	3.1
1994	3,580,024	7.5

Source: KNTC, 1994

Arrivals by Japanese tourists appear to dominate the Korean inbound market, representing 45.7% of the Korean international inbound market from 1990 to 1994 (Table 1.2). Tourist arrivals from the US ranked second, accounting for 10.0% of the total international inbound market for the same period. Taiwan is the third largest inbound tourist market, followed by the Philippines, Hong Kong and China (Table 1.2). The top ten tourism generating countries to Korea account for 78.7% of the total international inbound tourism market in Korea.

Table 1.2. International Inbound Tourist Market (numbers in the thousands)

Nationality	1990	1991	1992	1993	1994	Market Share*
Japan	1,460	1,455	1,399	1,492	1,644	45.7
U.S.A.	325	316	334	325	332	10.0
Taiwan	211	281	296	145	138	6.6
Philippines	87	144	117	134	149	3.9
Hong Kong	71	73	94	152	122	3.1
China	43	79	87	100	141	2.8
Russia	26	60	88	117	154	2.7
Thailand	29	38	57	76	69	1.7
U.K.	36	36	36	36	41	1.1
Germany	31	35	33	35	41	1.1
Sub total	2,319	2,517	2,541	2,611	2,831	78.7
Others	640	679	690	720	749	21.3
Total	2,959	3,196	3,231	3,331	3,580	100.0

*Percentage of average market share from 1990 to 1994.
Source: KNTC, 1994

1.2.2. Accommodations

As shown in Table 1.3, total hotel rooms in Korea increased by an annual average of 7.0% during the period from 1979 to 1994. Recently, however, the growth rate has been dropping. From 1990 to 1994, the number of rooms increased only 2.2% annually.

Table 1.3. Tourist Hotels and Rooms in Korea, 1979-1994

Year	No. of Hotels	Growth Rate(%)	No. of Rooms	Growth Rate(%)
1970	62	21.6	4,766	50.9
1979	141	8.5	18,457	20.4
1980	123	-12.8	18,547	0.5
1981	129	4.9	19,702	6.2
1982	144	11.6	21,459	8.9
1983	154	6.9	22,800	6.2
1984	157	1.9	23,013	0.9
1985	165	5.1	23,711	3.3
1986	184	11.5	25,321	6.5
1987	222	20.7	28,043	10.8
1988	276	24.3	33,869	20.8
1989	321	16.3	36,211	6.9
1990	395	23.1	40,386	11.5
1991	424	7.3	42,489	5.2
1992	435	2.6	43,739	2.9
1993	436	0.2	44,285	1.3
1994	435	-0.2	44,043	-0.5

Source: KNTC, 1994

About 40% of the nation's hotel rooms are in and around Seoul (101 hotels with 17,111 rooms), followed by Pusan (58 hotels with 4,724 rooms) and Chejudo Island (38 hotels with 4,526 rooms). Seoul encompasses 56% of the nation's deluxe hotel rooms (Table 1.4).

In terms of the hotel visitor component, bednights occupied by foreign visitors comprise almost 70% of total bednights (Table 1.5). Foreign bednights of Deluxe-A, Deluxe-B, and First Class account for over 90% of total foreign bednights in the Seoul area. Out of total bednights of Deluxe-A class in Seoul, about 90% are foreign; 80% for Deluxe-B, and 62% for First class hotels in the Seoul area (Table 1.5).

In 1994, the average length of stay in Korea was 5.2 days. Tourists from the United States appear to be the longest stayers, with 13.6 days, followed by Germany and England at 11.2 and 7.6 days, respectively. Japanese tourists stayed for 3.2 days on average (KNTC 1994).

Table 1.4. Tourist Hotels and Rooms by Area and Type, 1994

	Tourist Hotels in Korea									
Class	**Deluxe-A**		**Deluxe-B**		**First Class**		**Others**		**Total**	
	Hotels	Rooms	Hotels	Rooms	Hotels	Rooms	Hotels	Rooms	Hotels	Rooms
Seoul	**11**	**6,823**	**15**	**4,120**	**26**	**3,077**	**49**	**3,091**	**101**	**17,111**
Pusan	3	907	2	491	16	1,579	37	1,747	58	4,724
Cheju	3	1,078	6	1,273	11	1,033	18	1,142	38	4,526
Other	5	1,690	16	2,360	86	6,932	131	6,700	238	17,682
Total	**22**	**10,498**	**39**	**8,244**	**139**	**12,621**	**235**	**12,680**	**435**	**44,043**

Source: Korea Tourism Association, 1994

Table 1.5. The Number of Bednights by Origin, 1994

Area	Type	Foreign	Domestic	Total
Seoul	Deluxe-A	2,387,403(89.3)	286,058(10.7)	2,673,461(100.0)
	Deluxe-B	1,679,295(80.2)	415,741(19.8)	2,095,036(100.0)
	First Class	1,180,765(62.2)	717,621(37.8)	1,898,386(100.0)
	Other Types	651,435(32.9)	1,256,757(67.1)	1,980,192(100.0)
	Sub total	**5,898,898(69.4)**	**2,676,177(21.8)**	**8,575,075 (41.3)**
Other Area	Deluxe-A	686,863	1,059,177	1,746,040
	Deluxe-B	643,962	1,351,031	1,994,993
	First Class	781,740	4,020,685	4,802,425
	Other Types	489,729	3,157,349	3,647,078
	Sub total	**2,602,094(30.6)**	**9,588,242(78.2)**	**12,190,336 (58.7)**
Total		**8,500,992(100.0)**	**12,264,419(100.0)**	**20,765,411(100.0)**

1.3 PROBLEM STATEMENT

Tourism is one of the fastest growing sectors in Korea. Seoul, the center of business and politics, has hosted large international conventions, such as the annual conference of the Pacific Asia Travel Association (PATA) in 1979, the World Travel Congress of the ASTA (American Society of Travel Agent) in 1983, the IBRD/IMF (International Bank for Reconstruction and Development/ International Monetary Fund) annual meeting in 1985, and the Rotary World Congress in 1988. This pattern began when the KNTC (Korea National Tourism Corporation) opened its Convention Bureau in 1979. International demand for the hotel sector also has been growing so rapidly that the hotel industry has always been a seller's market. Despite the large expansion of hotel capacity due to mega events, such as the 1986 Asian Games and the 1988 Seoul Olympics, the hotel industry in Korea has continued to grow to absorb the steadily expanding demand for international tourism.

Many developing countries have been experiencing a rapid expansion of the tourism sector. Demand, however, has risen simultaneously and it has been difficult to determine how fast the tourist facilities should be developed. This is critical for the hotel industry, which is the major component of the tourism sector. Because hotels have high ratios of fixed to variable costs, profits are very sensitive to expected demand level versus capacity utilization. Tourism products are perishable in nature and demand for those products is vulnerable to many external factors. Without accurate predictions of tourism demand, investors run the risk of overdeveloping.

Tourism in Korea is still growing. International chain hotels are willing to launch new properties in Korea. Both international and domestic investors are waiting in line to meet the new opportunities. From the view point of policy makers, however, economic resources and incentives in a nation should never be misallocated. The hotel industry in Korea has its uniqueness in that the hotel type (or class) is determined by government bodies, and thus, its rate structure and pricing policy is strongly influenced by hotels in other classes as well as hotels within the same class. Therefore, the interdependence of hotels among different segments (classes) should be considered in the demand estimation. There is also a need for meaningful estimates of international hotel demand in Korea, which is critical to the formulation of a tourism development program in the country.

1.4. JUSTIFICATION OF RESEARCH

1.4.1. Importance of Tourism Demand

According to Johnson and Thomas (1992), tourism demand analysis is of interest from several points of view. First, public policy-makers need to examine trends in and determinants of demand. They must consider how far tourism demand, as expressed through the market place, reflects the extent to which the host society values, or in some cases deplores, tourism. Measures of tourism demand can be used to assess the contribution of the tourism industry to the economic welfare of the local society as a whole, and to provide a guide to the efficient allocation of resources.

Secondly, management has a strong interest in tourism demand analysis. Marketing decisions and strategic planning of tourism provisions require knowledge of factors affecting destination choice and type of holidays, and forecasts of tourism flows in the short and long term. Therefore, one of the purposes of tourism demand is to improve the ability to forecast.

In terms of tourism forecasts, Armstrong (1972) presented important applications of tourism demand analysis. These are:

- Tourist authorities need to deploy their promotional budgets in directions which are likely to yield the maximum return;
- Considerable demands are made on a country's infrastructure by international tourists – airports, roads, hotels, etc. – this being aggregated by factors such as seasonality, official regulations, etc.;
- Carriers need to assess their future requirements both in terms of equipment and its eventual deployment;
- Hoteliers and suppliers of other types of accommodations need to know the amounts and types of future capacity that will be required;
- Financial organizations need to identify areas of significant investment in the tourist industry and to assess their likely profitability;
- Suppliers of tourist equipment, such as clothing, cameras, sports equipment, etc., wish to assess more accurately the potential demand for their products (p.116).

It seems evident that each type of application necessitates a different orientation of the basic forecasting methodology selected. In summary, reliable forecasts are essential for efficient planning by airlines, tour operators, hoteliers, railways and all other industries associated with the foreign tourism market (Quayson and Var 1982; Witt and Martin 1987; Martin and Witt 1989). Most researches of tourism demand, however, have been selecting dependent variables that are too general; they often select too few explanatory factors, which tend to be the same whatever the dependent variable is (Armstrong 1972). The majority of studies have included either tourist arrivals and average expenditures as the measurement of tourism demand, regardless of the application to be implemented. Determining factors also have tended to be dominated by price- and income-related variables.

1.4.2. International Hotel Demand

Though tourism is a growing market, very few econometric models are available to analyze and forecast its producers' and consumers' behavior (van Dijk and van der Stelt-Scheele 1993). As mentioned earlier, tourism accrues to host countries a contribution to the balance of payments by earning hard currency (Uysal 1985). The hotel industry comprises one of the largest sectors of the tourism and hospitality industry in terms of capital investment and tourist expenditure. Hotels also provide the largest number of jobs, generate the greatest multiplier effect outside the industry, and are the major foreign currency earners (Jeffrey 1989). Therefore, the performance of the hotel industry might also be used as an indicator of general trends in tourism demand for a particular area (Jud and Rulison 1983). Few studies, however, have attempted to identify the tourism demand from the viewpoint of the hotel industry. Study of the hotel sector might offer a compromise between tractability and comprehensiveness, since the definition of tourism products is obscure and data tends to be buried in broader data sets (Carey 1991).

1.4.3. Demand and Supply Considerations

The growth in tourism is to some extent demand-driven (Johnson and Thomas 1992). The long-run growth in real incomes in developed economies has brought a more than proportionate increase in demand for tourism and, therefore, any understanding of the development of and prospect for the tourism industry require attention to be given to demand. (Johnson and Thomas 1992). The significance of demand in providing an engine for tourism growth should not be taken to imply that supply elements have not contributed to this growth. The interdependence of supply and demand is evident in the final production of tourism goods and services.

According to economic theory, equilibrium in the market place is determined by factors of demand and supply. In the short run, prices are the only variable that demand can change to maximize utility and that supply manipulates to maximize profit (van Dijk and van der Stelt-Scheele 1993). Investment is another variable that the supply-side can change in the long run. In the tourism industry, supply manipulation should also be a long-run strategy. Most tourism demand estimation models assume an elasticity of supply of tourism services (Summary 1987). Therefore, these models assume prices predetermined outside the model, except for a few simultaneous equation models. However, this might not be true because there are physical constraints on the speed with which a tourist industry can grow – hotels can only be built in a certain lapse of time, and increases in hotel staff are limited in the short run (Witt 1980a). It takes time for supply to adjust to demand. Thus, in the short run, the supply side of the lodging industry cannot respond to changes of rooms demanded. Only the price can change relative to a change in quantity; this is the reciprocal of elasticity of demand (van Meerhaeghe 1969). Of course, as Ellerbrock, Hite and Wells (1984) argue, under slack capacity, the economic supply of rooms is not necessarily fixed at the physical limit even in the short run because marginal costs influence the number of rooms an operator is willing to supply out of the maximum available. It is, however, generally understood that the structure of demand has an impact on market performance and therefore prices are endogenous.

1.5. OBJECTIVE OF THE STUDY

The primary objective of this study is to develop an empirical model that accounts for factors affecting the demand for international tourist hotels, and that enables demand estimation and projection in the context of the metropolitan Seoul area. The dependent variable is the number of bednights occupied by foreign guests in a given period. The explanatory variables are examined through past research in the literature and specified for the proposed models. Demand models are developed in two ways. The first concern is a demand model that accounts for determinants of international tourist flows through hotel bednights for each single market segment. High-, mid- and low-rate segments, which are represented by Deluxe-A, Deluxe-B and the First Class hotels, respectively, are examined separately. The second concern is that the individual demand is a function of entire market demand and that the market demand curve is not the lateral summation of the individual demand curves (Leibenstein 1950). Therefore, the demand for a given segment is influenced by the demand and the performance of the entire group of market segments. Thus the second model is focused on demand influenced by the interdependence of the market segments. In both cases, the price is regarded as determined within the market system and thus, an endogenous variable. The specific objectives, therefore, are:

1) to examine whether economic factors – such as own price, consumer price index and exchange rates – are significant factors that affect bednights occupied by foreign travelers;

2) to examine whether business activities such as trade volume, meetings, conventions and exhibitions are significant factors that affect international hotel demand;

3) to examine whether seasonality affects international hotel demand;

4) to examine whether time series structures affect the international hotel demand;

   a) to examine whether lagged variables affect the demand;

   b) to examine appropriate time dependent process when autocorrelation is detected;

5) to examine whether interdependence of market segments affect the international hotel demand;

   a) to examine whether price of other segments affect international hotel demand;

b) to examine whether demand for other segments affect international hotel demand;

1.6. SIGNIFICANCE OF THE STUDY

The significance of this study can be found in three areas. First, this study will contribute to the existing tourism and hospitality literature by providing empirical results on international tourism demand estimation in terms of the hotel industry. Though tourism is receiving increased attention as a key industry in the economic base of various regions, the accommodation sector lacks basic research on what factors govern its behavior (Ellerbrock, Hite and Wells 1984). Even though several authors have emphasized that accommodations may be the most important sector of the broader tourism industry (Arbel and Pizam 1977; Gunn 1979; Lundberg 1976), little empirical work has been done on the underlying determinants of international hotel demand. Some studies, though, extended their tourism analysis to forecasting the performance of the supply sector. Jeffrey and Hubbard (1988) studied hotel occupancy performance in terms of overseas visitor arrival rate. Baum and Mudambi

(1995), in their study, formed a two-stage recursive system for demand forecasting based on visitor arrivals using a time series technique. Choy (1985) described a method of forecasting the hotel industry occupancy rate for a given locality. However, this study was also based on visitor arrivals. Arbel and Ravid (1983) presented a simultaneous supply-demand model measuring room nights sold as quantity demanded. This study was the one of few studies which estimated hotel demand in an econometric model. The model, however, focused on the impact of energy prices on the industry. The uniqueness of the present study lies in the development of the tourism demand model from the view point of the hotel industry. The study incorporates bednights of foreign quests as tourism demand.

Second, this study will provide additional information to current tourism demand literature by incorporating price as an endogenous variable in the function, assuming demand and prices change simultaneously. Most demand studies assume an elasticity of tourism supply, though there actually exists a certain rigidity of supply (Witt 1980a; Witt 1980b). A good example is a fixed capacity of hotel rooms in the short-run. Previous studies, using single equation models with price as exogenous, have tested constraints of demand in the context of Mexico (Truett and Truett 1982) and Kenya (Summary 1987), but the results were contradicting. Instead, this study incorporates price as endogenous in the model, which responds to the change of demand and availability of supply (the ratio of room availability) in the short run. Further, given that demand changes depending upon the mechanism of the entire market, three major different segments denoted by hotel classes are examined to assess interdependence of markets through demand and supply interaction. Tourism in Seoul, the context of this study, is one of the fastest growing sectors in the nation, where demand grows proportionately faster than supply. The results of this study will offer information about international hotel demand not only to academic researchers of interest but also to policy makers and practitioners in the region.

Third, this study will provide information complementary to the body of knowledge on hospitality and tourism in terms of analytic techniques for handling time series regression analysis and estimation of a system of equations using two stage least squares regression. This study discusses a procedure for correctly estimating a time series regression model. Even consideration is given to the possibility that errors in the model are generated by a time-dependent process more than a first-order autoregressive process. Secondly, endogeneity violates the assumption of the linear model that variables on the right-hand-side are uncorrelated (orthogonal) to the error. A simple but reliable approach is employed to manage violations of orthogonality in the linear model through two-stage estimation.

CHAPTER II. REVIEW OF RELATED LITERATURE

2.1. MEASUREMENT OF TOURISM DEMAND

2.1.1. Introduction

In economic terms, demand can be defined as the quantity of a commodity or service which a community is willing and able to buy during a given time period (Archer 1976). Tourism demand represents the quantity of goods and services that consumers require at a given moment, and explains the reasons behind the development and the intensity of tourism flows between countries (Vellas and Bécherel 1995). Tourism demand is generally measured in terms of the number of tourist visits from an origin country to a foreign destination country, or in terms of tourist expenditures by visitors from the origin country in the destination country. The former method, however, does not account for the fact that visitors stay for different periods of time and have varying consumption patterns, while the latter describes exports in money terms rather than in quantities of goods (Carey 1991). Sheldon (1993) examined issues relating to the measurement and forecasting of international tourist expenditures and tourism arrivals. The results showed that the two series fluctuate differently, and that the accuracy of the forecast differs depending on the country being forecast. Tourist nights spent in the destination country and the average length of stay are alternative measures. In the following sections, measurements of tourism will be examined.

2.1.2. Visitor Arrivals

The measurement of tourist volume in the form of tourist arrivals has dominated tourism demand models. A study by Bechdolt (1973) attempted to present estimates of cross-sectional demand functions for travel from each of the mainland states of the United States and the District of Columbia to Hawaii, for each of the 10 years from 1961 through 1970. Total number of visitors were employed as a dependent variable. He also developed another demand function which measured propensity to travel using the number of visitors in proportion to the population of the origin state as a dependent variable. In a study by Sunday (1978), a dependent variable also measured the host country's share of the total number of overseas travelers in the origin country.

Gunadhi and Boey (1986) employed the total number of tourist arrivals from the generating country in their international tourism demand study to estimate demand elasticities of tourism in Singapore. Kliman (1981) developed a pooled time series cross sectional regression model to explain the number of visits per year by Canadian residents to 25 countries over 5 to 18 years time. The number of foreign tourists to the host country also was included as a dependent variable in the studies of Truett and Truett (1982) and Martin and Witt (1987).

In leisure studies, Arbel and Ravid (1985) incorporated the number of visits to parks as a dependent variable in the model to provide some evidence pertaining to the characteristics of demand functions for recreation and for other tourist facilities, which vary with time rather than across populations. Some refinement of the usual measure of the dependent variable was suggested by Carey (1991). In her study, the dependent variable was measured as the number of hotel arrivals at a particular island destination from a specific origin in a given year; the importance of excluding travelers not staying in hotels was also tested. The results suggested that tourists who are not staying in hotels are best omitted from studies whose purpose is explanation of determinants of tourist arrivals or tourist expenditures. The destinations for such travelers are predetermined and it is questionable whether their behavior will be affected by changes in policy variables such as promotional expenditures or exchange rate adjustments.

Forecasts of tourist volume in the form of arrivals are important for private suppliers of tourism services to plan their operations; they also allow destination countries to foresee infrastructure and superstructure development needs. Data on tourist numbers is generally more reliable (Barry and O'Hagan 1972) but is likely to be less responsive to determinants, since tourists are able to alter both their length of stay and their daily expenditures as they adjust to changing circumstances (Crouch 1994a). Furthermore, volume measures such as annual or monthly arrivals, or average daily census, cannot satisfy the forecasting needs of economic planners because they do not take into account the economic impact of tourism. Forecasts of tourist expenditures are also needed as a foundation on which to assess the economic impact of tourists (Sheldon 1993). In this regard some studies derived tourism demand models using both tourist arrivals and expenditures (Uysal and Crompton 1984a; Uysal and O'Leary 1986; Chadee and Mieczkowski 1987; Qiu and Zhang 1995).

2.1.3. Tourism Expenditures/Receipts

Expenditures or receipts in a destination country are also popular measures of tourism demand. In the early literature, Guthrie (1961), Gray (1966), and Kwack (1972) analyzed determinants of tourism impact on tourism expenditures in destination countries. Quayson and Var (1982) examined the relative importance of the existing determinants of Okanagan, B.C. tourism receipts. In their study, five major markets for Okanagan tourism were identified and separate regressions run to determine the relative importance of the determinants of demand for Okanagan tourism with respect to these five markets. Total receipts from international tourism was also used as a dependent variable in the study by Truett and Truett (1987). Davies and Mangan (1992) investigated the effect of income on hotel and holiday expenditures using econometric methods with cross-sectional family expenditure data. Their results confirmed that such expenditure is income elastic.

Smeral (1988) developed a more sophisticated model using the real revenue from international tourism as an indicator of tourism demand. The estimation model utilized was based on the linear expenditure system (LES) developed by Stone (1954). This study attempted to estimate how tourism demand reacts to increased economic growth, as illustrated by the effects of a 1% increase in growth on real revenues from tourism in nine European countries.

Fujii, Khaled and Mak (1985a) applied the "Almost Ideal Demand System" to analyze expenditures by visitors in Hawaii. The objective of this study was to estimate a system of demand equations for individual components of vacation travel at a particular resort, to examine both own and cross price elasticities of tourism demand. They analyzed expenditure by visitors to Hawaii for six different classes of goods: 1) food and drink, 2) lodging, 3) recreation and entertainment, 4) local transport, 5) clothing, and 6) other.

These models are suitable for demand theory in that variables used to estimate elasticities of demand should represent the quantity of the product demanded (Crouch 1994a). Furthermore, demand in real money terms represents both the amount of expenditure and the quality of consumption (Smeral 1988). Reliable data, however, is often not available. Tourism expenditure data are difficult to measure because the tourism industry consists of so many component subindustries (Sheldon 1993). As Frechtling (1987) pointed out, expenditure studies alone suffer from biases and inaccuracies and thus are not adequate to measure the economic impact of tourism, because of linkages and leakage in the economy.

2.1.4. Hotel Performance/Night Stay

The performance of the hotel industry might be also used as an indicator of general trends of tourism demand for a particular area (Jud and Rulison 1983). Jeffrey and Hubbard (1988) argued that there was a significant positive correlation between the occupancy contribution of overseas arrivals and the overall occupancy levels in England. This study focused on one aspect of hotel occupancy performance – the overseas visitor arrival rate – through a time series principal components analysis of monthly overseas visitor arrival rates in 266 hotels in England.

Various measures such as total revenue, revenue per room, and profit may be used as indicators of hotel-industry performance. Choy (1985), however, argued that the industry occupancy rate is universally considered one of the most important indicators, since it relates available capacity to existing demand for hotel accommodation. He provided a method which may be used by hospitality managers to forecast the annual hotel industry occupancy rate for their respective localities. The ratio of total occupied room nights to available room nights is calculated, where the numerator is based on projected visitor arrivals. The analysis demonstrated that a forecast of visitor arrivals could be used to develop reasonably accurate forecasts of hotel-industry performance in terms of occupancy.

Baum and Mudambi (1995) employed a similar method in their study for analyzing oligopolistic hotel pricing. They developed a two-stage simultaneous equation model to measure hotel performance in terms of occupancy rates. The model was a function of tourist arrivals, which had been driven by time-series forecasting.

Arbel and Ravid (1983) presented the simultaneous equations, supply-demand energy impact model. This work has demonstrated how energy price's impact on an industry can be empirically evaluated within a framework of a simultaneous supply and demand system. Quantity demanded was measured in terms of room nights sold by dividing total revenues by average room rates. Hotel prices and disposable income were defined in real terms, i.e. discounted by a GNP deflator. As a proxy for the substitution of foreign travel for domestic travel, they used an index of the exchange value of the US dollar against currencies of eight countries with the most substantial exchange of tourists with the US.

Lodging establishments are also interested in the length of stay of tourists, since the night's stay is the basic commodity purchased by tourists. Such a measure might be superior to tourist numbers, since it accounts for changes in the average length of stay, though it does not allow for changes in average daily expenditures (Crouch 1994a).

Laber (1969) argued that length of stay should vary inversely with relative prices in the host region, for travelers will shorten their visits when prices in the region are relatively high. Length of stay will also vary directly with distance, because travelers making long journeys are induced to spread large transportation costs over additional days. Another hypothesis without an empirical test was advanced by Williams and Zelinsky (1970). They suggested that tourists traveling longer distances to reach a destination might be expected to stay for longer periods, make more use of commercial facilities, and in general be economically more important than tourists from neighboring countries who might be 'day-trippers' or 'campers'. This conclusion, however, contrasts with the result found by Mak, Moncur and Yonamine (1977), wherein length of stay was found to be relatively insensitive to marginal changes in air fares. They developed a behavioral model using simultaneous equations to analyze the determinants of actual length of stay and per capita daily expenditure of US visitors in 1974. Empirical results indicated that length of stay does affect the average daily expenditure per person and vice versa. Results also showed that higher income visitors stay longer and spend more per day than visitors with lower incomes.

2.2. DETERMINANTS OF INTERNATIONAL TOURISM DEMAND

2.2.1. Introduction

There has been a need for inquiry concerning the factors affecting demand for international tourism (Uysal 1985; Crouch 1992; Witt and Witt 1995). In the case of the economic models of demand, the concern is usually to measure the responsiveness of tourism flows to changes in economic variables – notably price and incomes – and to ignore changes in tastes (Johnson and Thomas 1992). The economic approach typically takes tastes to be exogenous and fixed (or they are assumed to change so slowly that they can be ignored in short-run analyses). Archer (1980) stated that the demand for tourism is a function of 1) the level of income of the potential tourists, 2) the cost of travel from the tourists' homes to the holiday area, 3) relative price levels in the two countries and alternative destinations, and 4) the currency exchange rate.

Even though income and price related factors are likely to play a major role in determining demand for international tourism, as suggested by economic theory, the number of potential demand determinants in the tourism literature is almost unlimited. Schulmeister (1979) listed the following variables as being the most important exogenous variables in an economic model of tourism demand:

- Disposable income of private households
- Gross National Product (to capture the effect of both private household income and production)
- Private consumption
- Prices of consumer goods
- Tourism prices
- Transportation costs
- Incomes
- Consumer economic expectations
- Special factors (for example, the Olympic Games or social unrest in the destination country)
- Short-term factors (e.g., school holidays, weather)
- Long-term factors (stock of private cars, length of holidays, population by age group, degree of urbanization)
- Relative prices between domestic and foreign tourism
- Relative prices among destinations

Vanhove (1980) also presented 20 causal variables that could affect tourism demand; these include factors other than price- and income-related variables, such as population, promotion, common language, accommodation capacity, carrying capacity, degree of urbanization, and socio-economic factors.

Selection of appropriate variables will depend on a number of factors, including the countries examined, the time period investigated, whether a time-series or cross-sectional study is to be attempted, and the type of tourism involved (Crouch 1994b).

Since international tourism is generally regarded to be a luxury product (Bond and Ladman 1972), it is not surprising that the study of such variables as income and price have dominated the past research. (Crouch 1994b). Other independent variables of particular interest have included measures of marketing effort, distance, social events, political disturbances and supply factors.

2.2.2. Price

Many studies have attempted to evaluate the effect of price on international tourism demand, given that price is surely an exogenous variable in the demand function. On the other hand, a few models (Arbel and Ravid 1983; Fujii, Khaled and Mak 1985b; Hiemstra and Ismail 1993) had to employ simultaneous equations because price is endogenous; price is not predetermined and changes simultaneously with demand. Price responds to demand in the short run, while supply takes time to adjust to quantity demanded.

Price is generally regarded as a major determinant of tourism demand (Martin and Witt 1987), though not with uniform intensity (Kliman 1981). Even though several studies have made a comprehensive attempt to evaluate price effects (Fujii, Khaled and Mak 1985a; Smeral 1988), there have been difficulties in deciding on an appropriate measure of price (Crouch 1994b). According to Martin and Witt (1987), in the case of tourism there are two elements of price: the cost of travel to the destination, and the cost of living for the tourist in the destination. The cost of living is represented by the price of tourist goods and services in the destination, and is sometimes separated by the effect of exchange rate variations on purchasing power. Since a wide range of price definitions have so far been employed, the definition of the price variable in the demand equation is the most significant problem (Clawson and Knetsche 1966). For example, in the context of recreation demand, entry fees to national parks are not deemed significant enough to be included in the visitor expenditure survey.

Fujii, Khaled and Mak (1985a) used own absolute price indices for tourism services to examine cross price elasticities; Arbel and Ravid (1985) used hotel prices defined in real terms, i.e. discounted by the GNP deflator. Relative price, however, expressed by the ratio of prices in the destination country to prices in the origin country, has been commonly used (Archer 1980; Uysal and Crompton 1984a; and Uysal 1985; Gunadhi and Boey 1986; Summary 1987). Whereas, in the study of Quayson and Var (1982), substitute prices enter the demand function, allowing for the impact of competing foreign destinations by specifying the tourists' cost of living variable as destination value relative to a weighted average value calculated for a set of alternative destinations.

Due to the unavailability of price data, a consumer price index (CPI) has been regarded as a reasonable proxy for the cost of tourism (Martin and Witt 1987; Witt and Witt 1995). Gunadhi and Boey (1986) used the CPI as a proxy for both shopping and hotel prices, due to the lack of tourist price indices for the countries of origin. The use of CPI is justified on the grounds of convenience (the data are readily available) and the argument that tourists' spending is spread over a wide part of the economy and so may approximate the general average consumer spending used to weight prices in the CPI, or that at least the CPI will track tourism prices closely (Morley 1994).

Moshirian (1993), however, argued that "by using the consumer price index (CPI), instead of price of travel services, the models... do not necessarily reflect the true elasticity of import and export demand for travel services with respect to relative price of travel services (p.239)." In his study, the price of travel services was constructed, instead, as a weighted average of prices of accommodation, food, shopping, transport, and services applied. This average was then used to estimate import and export demand for travel and passenger services. In order to allow for the effect of substitution between travel (domestic or foreign) and other goods, all travel prices were deflated by each country's CPI before calculating their weighted average.

2.2.3. Income

Changes in consumer income can cause changes in the demand for products. An increase in real income provides consumers with greater spending power. So far in tourism research, income has frequently provided the greatest explanatory power in determining demand for international tourism (Archer 1980; Crouch 1994b). The empirical results in the study of Moshirian (1993) demonstrated that foreign disposable income is a powerful variable in explaining the export flows of travel.

In tourism demand functions, origin country income or private consumption is generally included as an explanatory variable. Real per capita income of tourist generating countries is commonly used (Uysal and Crompton 1984a; Uysal

1985; Carey 1991) and is generally significant. The form of income, however, should be adjusted to accommodate different tourism contexts. For example, if holiday visits or visits to friends and relatives are under consideration, then the appropriate form of the variable is private consumption or personal disposable income (Witt 1980a; Quayson and Var 1982; Summary 1987). If attention focuses on business visits, then a more general income variable should be used (Witt and Witt 1995).

Little (1980) took the income variable as the form of real per capita personal disposable income; results suggested that it cannot be taken for granted that a rise in income abroad will lead to a large increase in a country's bilateral travel exports in real terms. Nonetheless, relative prices and exchange rates exhibited greater explanatory power than did income. In another study (Kliman 1981), the general level of economic activity, as represented by movements in disposable income, did not appear to have an identifiable impact on international travel.

Moreover, Sunday (1978) excluded income variables from the model because "there was a high negative correlation between income and air fares, a multicollinearity problem which led a number of earlier investigators to delete air fares." The other reasons were that the effect of income was not the primary reason for Sunday's study, and that income and time tended to be highly correlated. This effect was accounted for by time dummy variables.

2.2.4. Exchange Rate

Exchange rates are sometimes used to represent tourists' living costs in one way or another. The usual justification for including an exchange rate variable in international demand functions is that consumers are more aware of exchange rates than prices in the destination (Witt and Witt 1995). They usually appear in addition to a consumer price proxy (Truett and Truett 1982; Gunadhi and Boey 1986), or as sole representation of tourists' living cost (Quayson and Var 1982; Arbel and Ravid 1985).

The EIU (Economist Intelligence Unit) (1975) identified the impacts of an unfavorable change in exchange rates to include 1) less travel abroad, 2) travel to different locations, 3) a reduction in expenditure and/or length of stay, 4) changes in the mode or time of travel, and 5) a reduction in spending by business travelers. Martin and Witt (1987), however, argue that exchange rate on its own is not an acceptable proxy, but consumer price index adjusted by exchange rate, whether it alone or together with a separate exchange rate variable, is a reasonable proxy for the cost of tourism (Witt and Witt 1995).

Empirical results have varied. Quayson and Var (1982) found that exchange rate and travel cost did not seem to be significant determinants of Okanagan tourism receipts. They also found multicollinearity between the exchange rate variable and the price ratios. However, Little (1980), Uysal (1985), and Moshrian (1993) empirically proved significant impact of relative exchange rates on international tourism.

2.2.5. Transportation Cost

As with other demand determinants, measuring the cost of transportation presents substantial difficulties. Air fares are important, but difficult to quantify (Kliman, 1981). Problems arise because the complexity of fare structures and the absence of data on transportation costs for origin-destination combinations, for which no direct flights are available, make construction of a meaningful airfare variable difficult (Carey 1991).

Even though Bechdolt (1973) found that airline fares are significant determinants of total and per capita demand for travel to Hawaii, transportation costs are generally not significant (Little 1980). Among the studies that have modeled transportation costs, no satisfactory estimates of the impact of transportation costs on demand have arisen due to multicollinearity between rising real incomes and falling real transportation costs (Fujii and Mak 1980). Quayson and Var (1982) also found multicollinearity between income and the airfare variable.

Alternatively, the travel time from the origin to the destination (Witt 1980a) was used or the transportation cost variable was excluded from the model, because of the fact that many studies have not produced statistically significant results (Uysal 1985).

2.2.6. Marketing Variable

Promotional expenditure, also an important variable from a policy perspective, generally has not been included in models of the demand for international tourism (Carey 1991). Generally promotional expenditures spent by national tourist organizations is expected to play a role in determining the level of international tourism demand, since these activities are destination-specific and are more likely to influence tourist flows to the destination concerned (Witt and Martin 1987). The empirical results by Uysal (1985), however, revealed the collinear relationship with income, which confounded the estimated demand elasticities because marketing expenditures by national tourist offices had increased overtime.

A major problem regarding the inclusion of a marketing variable relates to difficulties in obtaining relevant data. In addition, the impact of advertising on tourism demand may be distributed over time, so that advertising in a given period is likely to influence demand not only in that period but also in subsequent periods (Witt and Martin 1987).

2.2.7. Business Activities

The demand model developed by Rugg (1973) includes a construct which has been ignored by most travel demand economists; namely, the weighted average of the import proportions of a destination country with an origin country, and of the origin with the destination. He argues that the import variable represents the traveler's familiarity with the chosen destination. He studied the determinants of the demand for foreign travel by analyzing the consumer's choice of journey destination.

Kwack (1972) also included the variable of out-flow of US direct investments in his tourism demand model in order to measure the effect of US overseas business activity on travel spending abroad. The sign of the coefficient on this variable was positive as expected. He further included only US real gross national product instead of including both real disposable income and direct investment, because this variable may represent both US disposable income and the desire for US export, imports and investment abroad. He argues that US real gross national product represents the need for business travel better than US real disposable income and that business travel is unlikely to be sensitive to change in income and prices.

2.2.8. Dummy Variables

As indicated by Crouch (1994b), many studies included dummy variables for a variety of purposes. Frequently, dummy variables were introduced to account for the effect of special events that might have had a transitory influence on demand. In cross-sectional studies, dummy variables have occasionally been incorporated to facilitate the estimation of different demand coefficients by country of origin or destination. In time-series studies involving time periods shorter than one year, dummy variables have been used to allow for the effect of seasonality. These variables also cover special factors, such as political disturbances, exchange rate controls, the oil price shock, and special events likely to have an impact on tourism demand (Johnson and Ashworth 1990).

Gunadhi and Boey (1986) included dummy variables to account for local disturbances in specific years. Uysal and Crompton (1984a) also had a dummy variable portraying social/economic instability in the destination country. Summary (1987), in her study, incorporated a dummy variable designed to measure the impact of a border closure upon wanderlust travelers.

2.2.9. Supply Factor

Vellas and Bécheral (1995) argue that tourism flows are directly influenced by the size of a hotel sector, by the way it adapts to demand, and by the quality of the accommodations offered. Some empirical studies support this argument. Faulkner (1988) found that increase in both the quality and quantity of the supply of tourism services in Australia affected permanent and transient changes in tourist numbers. As mentioned earlier, there exists a certain amount of rigidity in the tourism market - it takes time for supply to adjust to demand, and so there is only a partial adjustment process.

In this regard, Truett and Truett (1982), in a study of tourism in Mexico, provided an historical perspective in order to set the stage for changes that occurred after 1970; they described the development that led to a major expansion of investment in tourist facilities during the 1970's. They measured the number of foreign tourists to Mexico regressed on the number of hotel rooms available, the average unemployment rate in the US, and the relative ratio of consumer price indices. The capacity constraint turned out to be significant, and this result suggested that the government's plans to expand hotel facilities and related activities were warranted.

Supply constraints were also tested by Summary (1987). She employed the yearly number of bed-nights available in beach hotels as an independent variable. However, the variable had a negative sign and statistically did not differ from zero. These results contradict the findings of Truett and Truett (1982).

In the demand-supply simultaneous equation model (Fujii Khaled and Mak 1985b), the supply side is accounted for by the change of prices responding to fluctuating quantity demanded. The model includes two endogenous variables; price of lodging and quantity of lodging service. The market price of lodging services is assumed to be related to both demand and supply influences.

2.3. SUMMARY

This chapter discusses important variables that comprise demand models in the hospitality and tourism context. Tourism demand is generally measured in terms of the number of tourist visits or in terms of tourist expenditures by visitors. Alternative measures are tourist nights spent and average length of stay.

Forecasts of tourist arrivals are important not only for private suppliers of tourism services to plan their operations, but also for destination countries to foresee infrastructure and superstructure development needs. The number of arrivals, however, is less responsive to determinants, since tourists are able to alter both their length of stay and daily expenditures as they adjust to economic conditions. Therefore, the measure of nights spent or the length of stay of tourists might be superior to tourist numbers.

Findings from prior research have also indicated that selection of appropriate variables determining demand for international tourism depends on a number of factors. Those factors include the countries examined, the time period investigated, whether a time-series or cross-sectional study is to be attempted, and the type of tourism involved.

Price is generally regarded as a major determinant of tourism demand along with an income variable. Price, however, has been regarded as exogenous in most of the past research. In fact, price is not predetermined and changes simultaneously with demand. Other independent variables of particular interest in the international tourism study have included measures of exchange rate, transportation costs, marketing efforts, business activities, supply factors, and dummy variables covering seasonality, political disturbances, and special events. Constructs such as business activities and supply factors, however, have been ignored by most demand economists in hospitality and tourism research.

Based on the literature review on the measurement of tourism demand factors, several research hypotheses were derived for the setting of international lodging demand in Seoul; proposed models of this study are presented in the following chapter.

CHAPTER III. METHODOLOGY

3.1. DERIVING THE DEMAND MODEL

For estimating demand, an econometric model is applied, since it has two major advantages: it enables investigation of causal effects of changes in the explanatory variables on the demand variable, and it allows "what if" simulations (Uysal and Crompton 1984b; Witt and Martin 1987). Econometric models are behavioral models that attempt to measure cause and effect relationships among variables (Sheldon and Var 1985). The causal independent variables used in the analysis depend on the variables being forecast. Because of these factors, causal methods which estimate a specified demand model – in terms of chosen explanatory variables using multiple regression techniques to estimate the model parameters – are often preferred (Uysal and Crompton 1985; Morley 1991).

As reviewed in the previous chapter, the various factors which influence the consumer's demand for a particular commodity or service are known as the determinants of demand. Since these determinants vary from individual to individual and can change through time, they are called variables. Changes in the values or intensities of any of these variables affect the consumer's demand for the particular commodity or service (Archer 1976).

Thus, the demand for tourism by the inhabitants of a particular country can be expressed as a function of several explanatory variables – variables which theory suggests might exert causal influences upon demand – and the dependent variable, as in the formula:

$$Y = f\ (X_i, \varepsilon) \tag{3.1}$$

where,

Y = demand for tourism
X_i = explanatory variables, $i = 1, \ldots, k$
ε = disturbance term

Price, however, which is one of explanatory variables, needs special attention because of its endogeneity. Many studies in tourism implicitly assume that quantity demanded is a function of price and perhaps of some other factors which are exogenous. This assumption is fine if the firm has explicit control over price. In many settings, however, price is determined by overall demand and supply conditions

(Samuelson and Marks 1995). The price of tourism services is assumed to be related to demand and supply influence (Fujii, Khaled and Mak 1985b). Thus, a complete demand model requires two endogenous variables of demand and price, as in the formula:

$$Y = f(P, X_{1i}, e_1) \tag{3.2}$$

$$P = g(Y, X_{2j}, e_2) \tag{3.3}$$

where,

Y = demand for tourism

P = price for tourism services

X_{1i} = explanatory variables for demand, $i = 1, 2, \ldots, m$

X_{2j} = explanatory variables for price, $j = 1, 2, \ldots, n$

3.2. SPECIFICATION OF HYPOTHESIZED MODELS

The international market demand for lodging in Seoul is expected to be affected by a great number of variables. The hypotheses stated below provide a description of the factors that are expected to impact the international hotel demand for the region, as well as the specification of the models. Insight gained from a literature review was applied to hypothesized models and a complete specification of the models is presented here, along with their expected hypotheses and coefficient signs.

3.2.1. Hypothesized Demand Model I

International hotel demand for such a metropolitan area as Seoul might be a function of the price of hotel rooms; the number of events such as international conventions, seminars and exhibitions; and total trade volume of the destination country. The price of hotel rooms is regarded as an endogenous variable which is influenced by demand, availability of rooms, and lagged price, as well as external factors such as exchange rate, consumer price index, and seasonality. Therefore, the supply factor, economic factors and the lagged price are hypothesized to affect demand indirectly through market performance, which is a change of price. These hypotheses indicate that some form of the following function exists.

Demand: $B_i = f(P_i, Tr, Ev)$ (3.4)

Price: $P_i = g(B_i, P_{it-12}, Ra_i, Cp, Ex_i, Se)$ (3.5)

where,

i = 1, 2, 3 (indicates segments: 1=Deluxe-A, 2=Deluxe-B, 3=First class hotels);

B_i = Number of bednights occupied by foreign travelers for the hotel segment i;

P_i = Price of for the segment i;

Tr = Trade volume for the destination country;

Ev = Number of international events such as conventions, meetings, exhibitions held in the area;

P_{it-12} = Price of the hotels lagged one year (12 months);

Ra_i = The ratio of rooms available for the segment i to the total rooms available for the area;

Cp = Consumer price index for the destination country;

Ex_i = Exchange rate for the segment i;

Se = Dummy variable indicating seasonality (0 = off-peak months, 1 = peak months)

Traditional analyses of tourism have focused largely on the determinants of travel (trip) demand. That is, they attempt to explain the number of tourists who travel to a particular destination area. This is a very limited view of tourism (Mak, Moncur and Yonamine 1977). While airlines and other common carriers may be primarily interested in the number of visitors who travel to specific destination areas, hotel associations are also interested in how many days and how much money visitors spend. Governments in major tourist destinations are interested in all dimensions of tourism for policy-making purposes.

Reliable forecasts of international tourism demand are essential for airlines, coach operators, railways, ferry operators, tour operators and hotel operators. Therefore, measured dependent variables and also explanatory variables have to be more specific to each sector. For this reason, the dependent variable is measured as the number of bednights sold to foreign guests in the region. This generally accounts for hotel arrivals as well as hotel expenditures, given that the length of stay is affected by the traveler's budget.

Demands for three different market segments, which are Deluxe-A, Deluxe-B, and First class, are measured. However, only foreign bednights are considered. Hotels in Seoul are classified into 5 different categories based on facilities and the quality of service: Deluxe-A, Deluxe-B, and the First, Second, and the Third class hotels. The Second and the Third class hotels are not involved in the analysis, since foreign bednights for those segments together represent only 11% of total foreign bednights in the Seoul area; those hotels are oriented more to domestic than foreign guests. The type of hotels can also be regarded as price segmentation, as Deluxe-A class would be a high-rate segment, Deluxe-B would be a mid-rate segment, and the First class would be a low-rate segment.

An assumption has to be made to estimate hotel demand in an aggregate manner, since individual hotels behave competitively and economically. Even though each firm offers a slightly different product, an assumption can be made that most of the hotel rooms are similar enough that the factors shifting the demand curve for one firm will do so for all others.

An income variable is excluded in the model, since it might not be possible to measure the income level of hotel guests. The total trade volume represents the need for business travel better than the real disposable income of travelers. The trade volume between countries also represents the traveler's familiarity with the chosen destination (Rugg 1973), which influences the demand of pleasure travelers as well as business travelers.

The number of events represents the attractiveness of the destination. The more attractive is the destination area, the more the destination will be the venue of events such as international conventions, meetings and exhibitions. These events attract both business travelers and pleasure travelers.

The price equation (Equation 3.5) demonstrates the need for simultaneous estimation of the model with two endogenous variables, Price (P_i) and Demand (B_i). This equation indicates that demand and price are determined simultaneously and are in fact jointly dependent. In the short run, the supply side of the lodging industry cannot respond by increasing the number of rooms available. The response takes the form of changes in price. From an individual consumer's point of view, the observed price – represented by the daily lodging expense – can be assumed to represent the quality of travel, as well as price. One could choose to stay fewer nights in the destination by buying a high-priced room, or one could choose to stay more nights by buying a lower quality room (Mak, Moncur and Yonamine 1977). Therefore, the optimal combination of bednights and the quality of room stay are determined simultaneously.

The price is influenced by overall demand and supply conditions, so the variable of ratio of room availability for the segment is included. Tourism prices are well known for varying seasonally in response to expectations of demand based upon past demand patterns (Morley 1991). Thus, the seasonality variable (Se), and lagged price variable (P_{t-12}) are included in the equation. Price is also known to be affected by economic conditions such as exchange rate (Ex) and consumer price index (Cp). The variables that affect price, however, are not addressed by Demand Model I. The endogeneity of price and the relationship between price and other external variables are addressed by Demand Model II. Thus, the hypothesized model can be illustrated as in Figure 3.1. The specific hypotheses to be tested can be written as:

Hypothesis 1.1. Price of accommodation (own price) is a significant factor that determines international demand for each segment. The price affects the demand negatively.

Hypothesis 1.2. The number of events held in the destination area has a positive effect on the international hotel demand for each segment.

Hypothesis 1.3. The total volume of trade in the destination country has a positive effect on the international hotel demand for each segment.

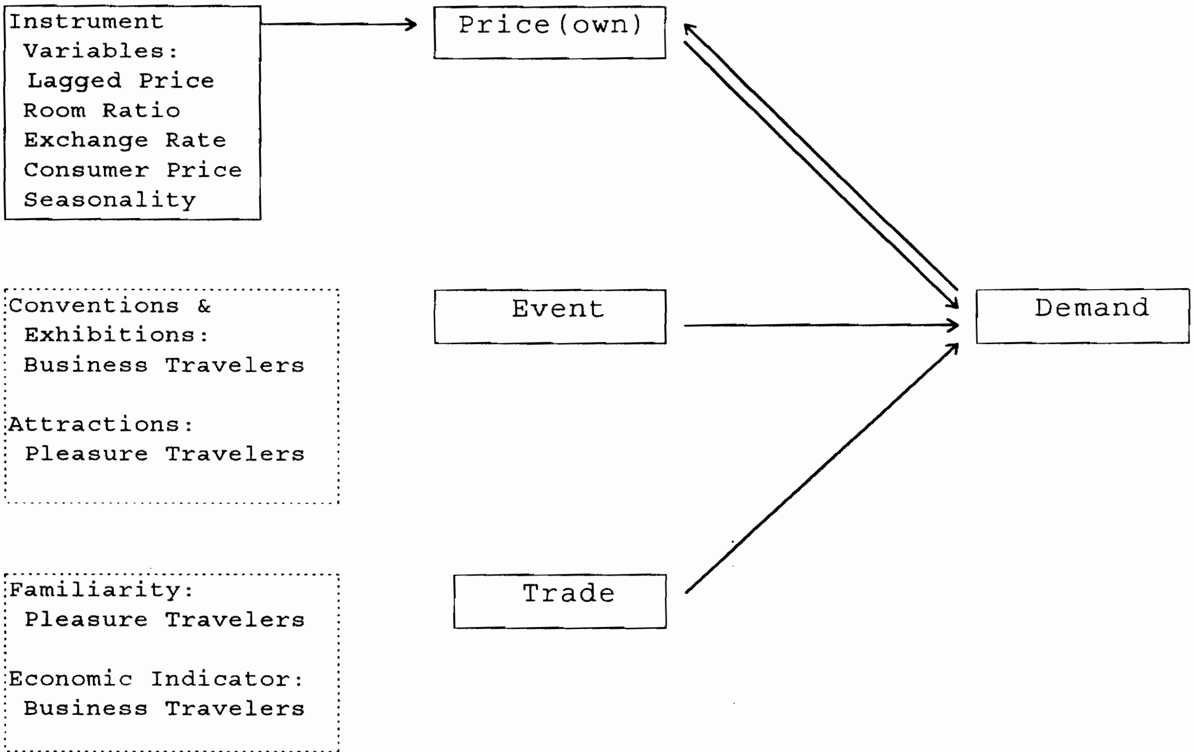


Figure 3.1. The Hypothesized Demand Model for A Single Market

3.2.2. Hypothesized Demand Model II

Demand Model I can be extended to include overall market mechanisms, accounting for the interdependence of three different price segments. According to economic theory, the individual demand is a function of the entire market demand. And if the accommodations of different classes are the substitutes for one another, the demand for the high-rate segment, i.e. Deluxe-A class hotels, are affected by the price and demand for other lower-rate segments, i.e. Deluxe-B class hotels and vice versa.

International hotel demands in a region tend to fluctuate in the same direction regardless of their classes. If Deluxe-A hotels attract customers of a certain segment to be the full house, the overflow of this segment and the other segments will be turned away or spilt over to hotels of the other classes, i.e., Deluxe-B or First class hotels, because of the rigidity of hotel room supply in the short run.

On the other hand, prices of hotels in different classes are competitive among themselves. If the price of hotel rooms in a class increases in the short run, the rooms will be substituted for those of other classes. If the price goes down, the hotel will increase its demand even from clients of the other classes. Thus, these hypotheses define some forms of the following function(s).

<u>Deluxe-A</u>

Demand 1: $B_1 = f(P_1, Tr, Ev, B_2, P_2)$ (3.6)

Price 1: $P_1 = g(B_1, P_{1t-12}, Ra_1, Cp, Ex_1, Se)$ (3.7)

<u>Deluxe-B</u>

Demand 2: $B_2 = f(P_2, Tr, Ev, B_1, P_1, B_3, P_3)$ (3.8)

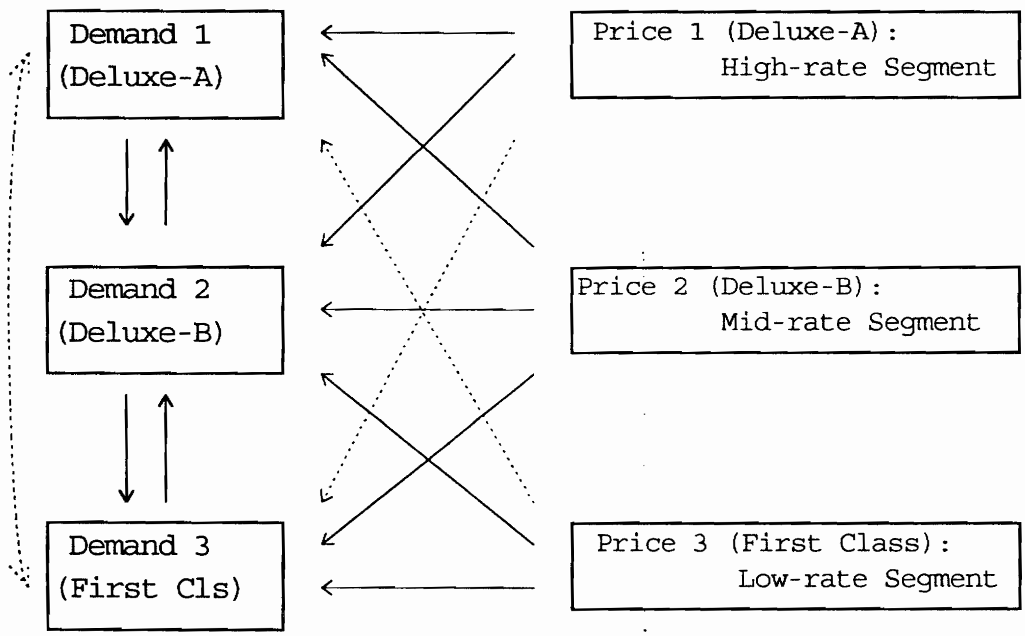
Price 2: $P_2 = g(B_2, P_{2t-12}, Ra_2, Cp, Ex_2, Se)$ (3.9)

<u>First Class</u>

Demand 3: $B_3 = f(P_3, Tr, Ev, B_2, P_2)$ (3.10)

Price 3: $P_3 = g(B_3, P_{3t-12}, Ra_3, Cp, Ex_3, Se)$ (3.11)

In each demand equation, the price and the demand of other classes are included, while the price equation remains the same as in the individual market demand function. In Equation 3.6, demand (B_1) for Deluxe-A is hypothesized to be influenced by demand (B_2) and price (P_2) for Deluxe-B hotels. In Equation 3.8, the demand (B_2) for Deluxe-B is hypothesized to be affected by demand (B_1) and price (P_1) for Deluxe-A and demand (B_3) and price (P_3) for First class hotels. Consequently, the demand equation for First class hotels (Equation 3.10) includes B_2 and P_2, which are the demand and price for Deluxe-B class hotels, respectively. It is assumed that Deluxe-A and First class hotels are not significantly dependent on each other because of considerable differences in prices and customer profiles. This structural relationship can be illustrated as in Figure 3.2.



<u>Figure 3.2. The Hypothesized Demand Model for the Overall Market</u>

The specific hypotheses to be tested can be written as:

<u>Demand equations</u>

<u>Hypothesis 2.1.</u> International hotel demand for Deluxe-A hotels has a positive relationship with demand for Deluxe-B hotels.

Hypothesis 2.2. International hotel demand for Deluxe-A hotels has a positive relationship with the price of Deluxe-B hotel rooms.

Hypothesis 2.3. International hotel demand for Deluxe-B hotels has a positive relationship with the demand for Deluxe-A and First class hotels.

Hypothesis 2.4. International hotel demand for Deluxe-B hotels has a positive relationship with the prices of Deluxe-A and First class hotel rooms.

Hypothesis 2.5. International hotel demand for First class hotels has a positive relationship with the demand for Deluxe-B hotels.

Hypothesis 2.6. International hotel demand for First class hotels has a positive relationship with the price of Deluxe-B hotel rooms.

Price Equations

Hypothesis 3.1. The price of international hotel rooms is determined by demand simultaneously. The price has a negative relationship with the demand.

Hypothesis 3.2. The price of international hotel rooms is positively affected by the price of the previous year.

Hypothesis 3.3. The price of international hotel rooms is positively influenced by the change of room availability.

Hypothesis 3.4. The price of international hotel rooms has a negative relationship with the variables of exchange rates.

Hypothesis 3.5. The price of international hotel rooms is positively affected by the consumer price index of the destination area.

Hypothesis 3.6. The price of international hotel rooms is affected by seasonality.

3.2.3. Definition of Variables

The variables used in the model are defined in the following ways:

Number of bednights (B_i) represent the daily average number of bednights occupied by overnight foreign travelers in a given month for hotel segment *i* in Seoul. It is calculated by the number of foreign quest arrivals, multiplied by the length of stay, and divided by the number of days of the month, so that double occupancy is taken into consideration.

Price of hotels (P_i) is represented by average daily expenditure for rooms per foreign guest staying in hotels of segment *i*. It is calculated as the monthly total room revenue for foreign quests divided by monthly total bednights of foreign guests.

Trade volume (Tr) is represented by the sum of indices of import and export in a given month for the destination country. Indices are expressed as the combination of export and import volume, with 1990 as the base year (100).

Events (Ev) represent the total number of international events targeting international participants, such as conventions, meetings, and exhibitions held in the Seoul area in a given month.

Lagged Price (P_{it-12}) represents the price of the hotels lagged a year (12 months) for segment *i*, which is also represented by average daily expenditures for rooms per foreign guest for the month.

Room Ratio (Ra_i) represents the ratio of rooms available for segment *i* to the total rooms available for the entire market in Seoul in a given month.

Consumer price index (Cp) represents indices for a given month for the destination country.

Exchange rate (Ex_i) represents monthly average exchange rate for segment *i*, which is calculated by dividing total monthly revenue for rooms expressed in the currency of the destination country by the same revenue expressed in US dollars.

Seasonal Dummy (Se) is the variable indicating seasonality (0 = off-peak months, 1 = peak months). Off-peak months are December, January, February, July and August; peak months are March, April, May, June, September, October, and November.

3.2.4. Functional Form

In terms of the functional form of the model, there appears to be an almost universal agreement that the multiplicative (i.e., log-linear) form is superior to the additive (i.e., linear) form (Johnson and Ashworth 1990). The multiplicative model often fits the data better (Kliman 1981; Uysal and Crompton 1984) and conveniently provides constant demand elasticities (Morley 1991). Theil (1971) has noted that, in preliminary experiments which included other functional forms, the double log specification had a lower residual variance than other functional forms with the same dependent variable.

Thus, the functional form of the Demand Model I will be multiplicative and of a simultaneous equation type, because there are two endogenous variables. The functional form of demand can be written as:

Demand: $B_i = f(P_i, Tr, Ev, \varepsilon)$ (3.12)

Price: $P_i = g(B_i, P_{it-12}, Ra_i, Cp, Ex_i, Se)\varepsilon$ (3.13) and the relationship of the variables are multiplicative, as in the following equations:

$$B_i = \beta_0 (P_i)^{\beta 1} (Tr)^{\beta 2} (Ev)^{\beta 3} \varepsilon \quad (3.14)$$

$$P_i = \beta_4 (B_i)^{\beta 5} (P_{it-12})^{\beta 6} (Ra_i)^{\beta 7} (Cp)^{\beta 8} (Ex_i)^{\beta 9} (Se)^{\beta 10} \varepsilon. \quad (3.15)$$

$(\beta_0, \beta_{1,} \ldots, \beta_{10}$ = parameters)

After linear transformation of the function (Equations 3.14 and 3.15) with a logarithm, the function is;

$$ln B_i = ln\beta_0 + \beta_1 ln P_i + \beta_2 ln Tr + \beta_3 ln Ev + ln\varepsilon \quad (3.16)$$

$$ln P_i = ln\beta_4 + \beta_5 ln B_i + \beta_6 ln(P_{it-12}) + \beta_7 ln(Ra_i)$$

$$+ \beta_8 ln Cp + \beta_9 ln Ex_i + \beta_{10} ln Se + ln\varepsilon \quad (3.17)$$

and the final form of the loglinear function is then written as;

$$Lb_i = \beta_0^* + \beta_1 Lp_i + \beta_2 Ltr + \beta_3 Lev + \varepsilon^* \quad (3.18)$$

$$Lp_i = \beta_4^* + \beta_5 Lb_i + \beta_6 (Lagp_i)$$

$$+ \beta_7 Lra_i + \beta_8 Lcp + \beta_9 Lex + \beta_{10} Se^* + \varepsilon^*. \quad (3.19)$$

$(\beta_0^*, \beta_{1,} .., \beta_4^* .., \beta_{10}$ = parameters, and the dummy variable is not transformed, $Se=Se^*$)

Given the model specified for explaining international tourism flows to Seoul, the following signs of the coefficients of elasticity are expected:

$\beta_1 < 0$, $\beta_2 > 0$, and $\beta_3 > 0$

Consequently, the functional form of the Demand Model II is:

$$Lb_1 = \beta_0^* + \beta_1 Lp_1 + \beta_2 Ltr + \beta_3 lev + \beta_4 Lb_2 + \beta_5 Lp_2 + \varepsilon^* \quad (3.20)$$

$$Lp_1 = \beta_6^* + \beta_7 Lb_1 + \beta_8 (Lagp_1)$$
$$+ \beta_9 Lra_1 + \beta_{10} Lcp + \beta_{11} Lex_1 + \beta_{12} Se^* + \varepsilon^* \quad (3.21)$$

$$Lb_2 = \beta_{13}^* + \beta_{14} Lp_2 + \beta_{15} Ltr + \beta_{16} Lev$$
$$+ \beta_{17} Lb_1 + \beta_{18} Lp_1 + \beta_{19} Lb_3 + \beta_{20} Lp_3 + \varepsilon^* \quad (3.22)$$

$$Lp_2 = \beta_{21}^* + \beta_{22} Lb_2 + \beta_{23} (Lagp_2)$$
$$+ \beta_{24} Lra_2 + \beta_{25} Lcp + \beta_{26} Lex_2 + \beta_{27} Se^* + \varepsilon^* \quad 3.23)$$

$$Lb_3 = \beta_{28}^* + \beta_{29} Lp_3 + \beta_{30} Ltr + \beta_{31} Lev + \beta_{32} Lb_2 + \beta_{33} Lp_2 + \varepsilon^* \quad (3.24)$$

$$Lp_3 = \beta_{34}^* + \beta_{35} Lb_3^* + \beta_{36} (Lagp_3)$$
$$+ \beta_{37} Lra_3 + \beta_{38} Lcp + \beta_{39} Lex_3 + \beta_{40} Se^* + \varepsilon^* \quad (3.25)$$

Especially for the interdependence of market segments, the following signs of parameters are expected:

$\beta_4 > 0$, $\beta_5 > 0$, $\beta_{17} > 0$, $\beta_{18} > 0$, $\beta_{19} > 0$, $\beta_{20} > 0$, $\beta_{32} > 0$, and $\beta_{33} > 0$

3.3. DATA SOURCES

For the model estimation, monthly data were collected from secondary sources from January 1991 to December 1995. Data in the form of time series has been commonly employed. The principal advantage of time-series analysis is that it enables the modeling of trends (Armstrong 1972). Three different market samples were selected because each included a large and relatively homogeneous group of competitive hotels. Hotel prices, capacity, and revenues are gathered from *Monthly Report for Hotel Performance*, published by the Korea Tourism Association (KTA). Information about events is collected from *Korea Convention and Exhibition Calendar*, published by the Korea National Tourism Cooperation (KNTC). General tourism data, such as visitor arrivals and profiles, are collected from *Annual Statistical Report on Tourism*, the Korea National Tourism Corporation.

The consumer price indices, volume of trade and exchange rates are obtained from *International Financial Statistics* published by the IMF (International Monetary Fund).

3.4. ESTIMATION OF THE MODEL

3.4.1. Two Stage Least Squares

It is well known that the inclusion of endogenous variables in the right-hand side of the equation is a serious source of bias. Endogeneity violates the assumption of the linear model that variables on the right-hand side are uncorrelated (orthogonal) to the error. Because an endogenous effect is correlated with the error in regression terms, the variance-covariance matrix is singular and unable to be inverted to derive an estimate of the effect of the exogenous variables on the dependent variable (Ostrom 1990). A simple but reliable approach to managing violations of orthogonality in the linear model is through two-stage estimation. The two-stage estimator relies on the use of an instrument for those variables that violate orthogonality (Kennedy 1979).

The technique of instrumental variable estimation in OLS (ordinary least squares) refers to finding some variable, termed an instrument, that maximizes the correlation between itself and the original variable, while minimizing the correlation between that instrument variable and the error term. If an appropriate instrument can be found for each endogenous variable that appears as a regressor in a simultaneous equation, the instrumental technique provides consistent estimates.

Two-stage least squares (2SLS) is a special case of the instrumental variable technique in which the 'best' instrumental variables are used. A suggestion is to combine all the exogenous variables to create a combined variable to act as a 'best' instrumental variable (Kennedy 1979). This suggests regressing each endogenous variable being used as a regressor on all the exogenous variables in the system and using the estimated results as the required instrumental variable. This defines the 2SLS procedure and the procedure consists of two stages.

Stage 1: regress each endogenous variable acting as a regressor in the equation being estimated on all exogenous variables in the system of simultaneous equations and calculate the predicted or fitted values of these endogenous variables.

Stage 2: use these estimated values as instrumental variables for those endogenous variables, or simply use these estimated values and the included exogenous variables as regressors in an OLS regression.

In the current demand model, P would be regressed on all exogenous variables to obtain the values of P^ (P 'hat') which would then replace P in the demand equation in the second stage of OLS estimation. This can be shown as:

$$B = \beta_0 + \beta_1 P\hat{} + \beta_2 Tr + \beta_3 Ev + \varepsilon$$

$$P\hat{} = \beta\hat{}_4 + \beta\hat{}_5 Tr + \beta\hat{}_6 Ev + \beta\hat{}_7 (P_{it-12}) + \beta\hat{}_8 Ra + \beta\hat{}_9 Cp + \beta\hat{}_{10} Ex + \beta\hat{}_{11} Se.$$

If additional endogenous variables are on the right hand side of an equation, 2SLS will determine estimates for as many as necessary. If there are no endogenous variables on the right hand side of the equation then the 2SLS for that particular equation would be identical to the OLS estimation.

3.4.2. Autocorrelation

When the off-diagonal elements of the variance-covariance matrix of the disturbance terms are non-zero, the disturbances are said to be autocorrelated. This could occur for several reasons. In time-series data, random disturbances have effects that often persist over more than one time period. First-order autocorrelation occurs when the disturbance in one time period is a portion of the disturbance in the previous time period, plus a spherical disturbance. In mathematical terms, this is written as

$$\varepsilon_t = \rho\varepsilon_{t-1} + u_t$$

where, ρ (rho) is called the autocorrelation coefficient and u_t is a spherical disturbance, independent of the disturbance ε.

Most of the available tests for autocorrelation are based on the principle that if the true disturbances are autocorrelated, this will be revealed through the autocorrelations of the least squares residuals. The Durbin-Watson (DW) *d* test is commonly used to determine if the disturbances actually are autocorrelated (Greene 1993). The test statistic is,

$$d = \frac{\sum_{t=2}^{T}(\varepsilon_t - \varepsilon_{t-2})^2}{\sum_{t=1}^{T}\varepsilon_t^2}$$

where T is the number of observations. The DW test statistic has a range from 0 to 4 and tests the null hypothesis that the autocorrelation parameter ρ is 0. If the value of ρ is 0, then the DW statistic will be 2, since the relationship between DW and ρ is DW=2(1-ρ^). Positive serial correlation is associated with DW values below 2 and negative serial correlation with values greater than 2. Tables are available that give acceptable limits for the DW statistic, usually based on testing for positive serial correlation given the number of independent variables and observations. There is a lower and upper limit associated with each test. A *d*-statistic below the lower limit allows rejection of the null hypothesis that the autocorrelation parameter is 0 (zero), and a value above the upper limit indicates acceptance of the null hypothesis. In between the lower and upper limits the test is inconclusive.

In those cases where the Durbin-Watson (DW) statistic indicates the presence of autocorrelation, the parameter estimates are inefficient and the usual hypothesis-testing procedures are no longer strictly valid, so those equations should be re-estimated using the Cochrane-Orcutt (CO) iterative procedure in an attempt to reduce the likelihood of autocorrelation.

3.4.3. ARMAX Process[1]

One can consider the possibility that the residuals are generated by a higher-order autoregressive process. It could be possible that the current disturbance is made up of portions of the previous two disturbances. This would be consistent with a second-order auto regressive model, AR(2), and can be formalized as:

$$\varepsilon_t = \rho_1 \varepsilon_{t-1} + \rho_2 \varepsilon_{t-2} + u_t,$$

where ε_t is the error term at time t, ε_{t-1} the error term at $t-1$, ε_{t-2} the error term at $t-2$, ρ's are autocorrelation coefficients, and u_t's are independent drawings on a random

[1] The discussion of time-series follows Greene (1993, pp.538-539, pp.550-551) and Goldberger (1991, pp.281-284)

variable u with $E(u) = 0$ and $V(u) = \sigma^2$. Therefore, suppose that for $t = \ldots, -2, -1, 0, 1, 2, \ldots$, the values of y_t are determined by

$$y_t = \mu + \gamma_1 y_{t-1} + \gamma_2 y_{t-2} + u_t,$$ [2]

where $\mu = E(y)$, u_t's are independent drawings on a random variable u with $E(u) = 0$ and $V(u) = \sigma^2$, and γ's are coefficients. A more general, pth order autoregression or AR(p) process would be written as:

$$y_t = \mu + \gamma_1 y_{t-1} + \gamma_2 y_{t-2} + \ldots + \gamma_p y_{t-p} + u_t.$$

Unlike in an auto-regressive process, in a moving average process, the pattern of disturbances is described completely by a weighted sum of current and lagged random disturbances. If these disturbances have both an immediate effect on the dependent variable and a discounted effect over time, and if the discounting is such that the disturbances exert an influence up to q periods after their occurrence, then a moving average process of order q, MA(q), may be an appropriate model for the time-dependent process.

---

[2] Because under certain assumptions, $E[y_t | y_{t-1}, y_{t-2}] = \mu + \gamma_1 y_{t-1} + \gamma_2 y_{t-2}$ (See Greene 1993, pp. 538)

The moving average process of order 2, MA(2), is given by the following equation:

$$\varepsilon_t = \theta_1 u_{t-1} + \theta_2 u_{t-2} + u_t,$$

where ε_t is the error term at time t, θ's are coefficients, and u_t's are independent drawings on a random variable u with $E(u) = 0$ and $V(u) = \sigma^2$. Therefore, suppose that for $t = \ldots, -2, -1, 0, 1, 2, \ldots$, the value of y_t's are determined by

$$y_t = \theta_0 + \theta_1 u_{t-1} + \theta_2 u_{t-2} + u_t,$$

where u_t's are independent drawings on a random variable u with $E(u) = 0$ and $V(u) = \sigma^2$, and θ's are coefficients. Generally, the moving average, MA(q), model is:

$$y_t = \mu + \theta_1 u_{t-1} + \ldots + \theta_q u_{t-q} + u_t,$$ [3]

where, $\mu = E(y)$.

An extremely general model that encompasses both of the above cases is the autoregressive moving average, or ARMA(p,q) model,

$$y_t = \mu + \gamma_1 y_{t-1} + \gamma_2 y_{t-2} + \ldots + \gamma_p y_{t-p} + \theta_1 u_{t-1} + \ldots + \theta_q u_{t-q} + u_t.$$

[3] Because $\mu = \theta_0 + \theta_1 E(u_{t-1}) + \theta_2 E(u_{t-2}) + E(u_t) = \theta_0$.

This process has p autoregressive (lagged dependent variable) terms and q lagged moving average terms, but has no regressors.

The ARMA model with regressors is generally referred to as ARMAX (Greene 1993). For example, an ARMAX(2,2) model is written as:

$$y_t = \mu + \beta_0 \chi_t + \beta_1 \chi_{t-1} + \beta_2 \chi_{t-2} + \gamma_1 y_{t-1} + \gamma_2 y_{t-2} + \theta_1 u_{t-1} + \theta_2 u_{t-2} + u_t,$$

and in a more general form,

$$C(L) y_t = \alpha + B(L) \chi_t + D(L) u_t.$$

The conventional notation ARMAX(p,q) indicates that the number of lagged terms are in the AR part, $C(L)y_t$, and in the MA part, $D(L)u_t$, respectively.[4]

The adequacy of the ARMAX model can be checked by examining the autocorrelation function (ACF) of series y_t. There are diagnostic tests based on the ACF which are used to discern whether a time series appears to be non-autocorrelated. The Box-Pierce statistic is commonly used to

[4] C(L), B(L), and D(L) are polynomials in the lag operator. For example, if B(L) is quadratic, then $B(L)\chi_t = (\beta_0 + \beta_1 L + \beta_2 L^2)\ \chi_t = \beta_0 \chi_t + \beta_1 \chi_{t-1} + \beta_2 \chi_{t-2}$

test whether a series is white noise.[5] In other words, the test is designed to ascertain if the residuals of the model are distributed as white noise. If the residuals are completely random, the autocorrelation function will be completely flat (i.e., all autocorrelations are equal to zero). The Box-Pierce Q statistic is;

$$Q = T\sum_{k=1}^{p} r_k^2,$$

where r_k^2 is the product moment correlation between e_t and e_{t-k}; k=1,2,...,m, where m is chosen to reflect the highest anticipated order of the autoregressive or the moving average process.

[5] A sequence of random variables, a_t, a_{t-1}, a_{t-2}, ..., which are random drawings from a fixed distribution, usually assumed Normal having mean zero and variance σ^2_a (See Box, Jenkins, and Reisel 1994, p.8).

CHAPTER 4. EMPIRICAL ESTIMATION AND DISCUSSION

4.1. INTRODUCTION

The previous three chapters have provided the basis for the specification of the models to be estimated as well as provided the theory behind the model specification. In this chapter, first, the data used to estimate the model are discussed, and then the results of the model estimations are presented.

4.2. DATA COLLECTED

The data used are collected from all the hotel properties that belong to each category: Deluxe-A, Deluxe-B, and First Class hotels. As mentioned in Chapter 1, Deluxe-A class hotels in Seoul represent 11 hotels with 6,823 rooms; Deluxe-B class, 15 hotels with 4,120 rooms; First class, 26 hotels with 3,077 rooms; other classes, 49 hotels with 3,091 rooms. There are 101 hotels and 17,111 rooms total in the Seoul area. Monthly average data are used from January 1991 to December 1995, forming 60 time points (observations). Monthly data are represented by daily averages for a given month. Table 4.1 illustrates the summary statistics for these data.

Table 4.1. Summary Statistics of Variables

Variables	Mean	Standard Deviation	Minimum	Maximum	N
Number of Bednights(Deluxe-A)	6886.98	1733.40	4691	15636	60
Number of Bednights(Deluxe-A)	4603.33	849.11	2815	6842	60
Number of Bednights(First)	2723.01	747.89	1496	4870	60
Price(D-A, USD)	94.67	24.57	33.66	151.91	60
Price(D-B, USD)	42.29	11.24	19.08	61.45	60
Price(First, USD)	34.55	7.92	13.22	67.06	60
Exchange Rate(D-A)	773.74	26.69	716.69	805.01	60
Exchange Rate(D-B)	768.02	27.81	707.67	799.69	60
Exchange Rate(First)	769.00	26.95	707.48	810.67	60
Room Ratio(D-A)	.41	.01	.3812	.4310	60
Room Ratio(D-B)	.23	.01	.2177	.2412	60
Room Ratio(First)	.16	.01	.1416	.1677	60
Number of Events	22.92	13.27	1.00	66.00	60
Trade Volume Index	274.19	61.58	169	404	60
Consumer Price Index	122.3	9.45	104.6	137.1	60

Figures 4.1 - 4.8 are presented in order for better understanding of the characteristics and time trends of the data set. Figures include variables for three different segments if applicable, which provide insight into the interdependence of market segments for the development of an overall market demand model. From observations of each

variable, extreme points are also detected to alleviate the problem that outliers could cause.

Figure 4.1 illustrates that the demand for international hotels has been relatively stable in the recent 5 years. It also shows that demand shifted in the same direction at most of the time points, but at some points demand reacted differently from segment to segment. Demand for number of bednights shows some extreme points that might influence the analysis: the points are November and December in 1991. In contrast, occupancy rates for the three markets illustrated in Figure 4.2 show relatively similar patterns over the same time period.

Figure 4.3 shows that the price of Deluxe-A hotel rooms increased steadily, while the prices of Deluxe-B and First Class hotel rooms were relatively stable. The figure also shows seasonality that reflects pricing policies for the deluxe hotels. They have off-season rates for Summer and Winter months and peak-season rates for Spring and Fall months.

Figures 4.4 and 4.5 present total trade volume and consumer price index, respectively. Both increased steadily over the past five years. The number of events illustrated in Figure 4.6 shows that it fluctuates by season. Exchange rates presented in Figure 4.7 increased up to the end of 1994 and from that point onward, the rates decreased, while the prices remained stable. Finally the availability of rooms for each segment showed little change over the same time period (Figure 4.8).

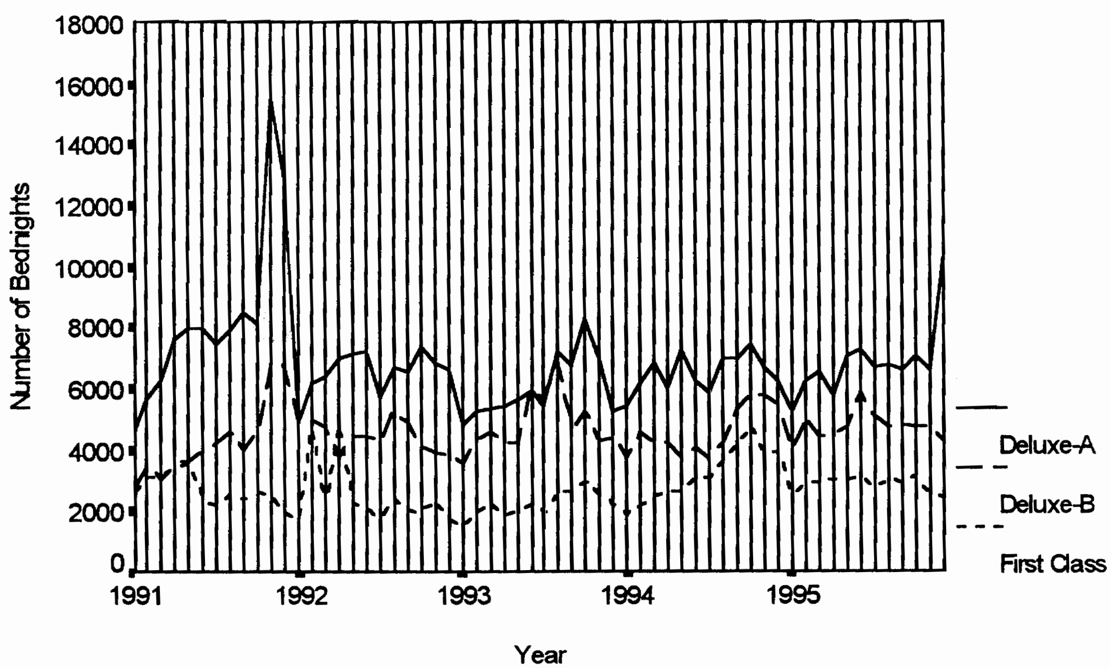


Figure 4.1. Number of Bednights

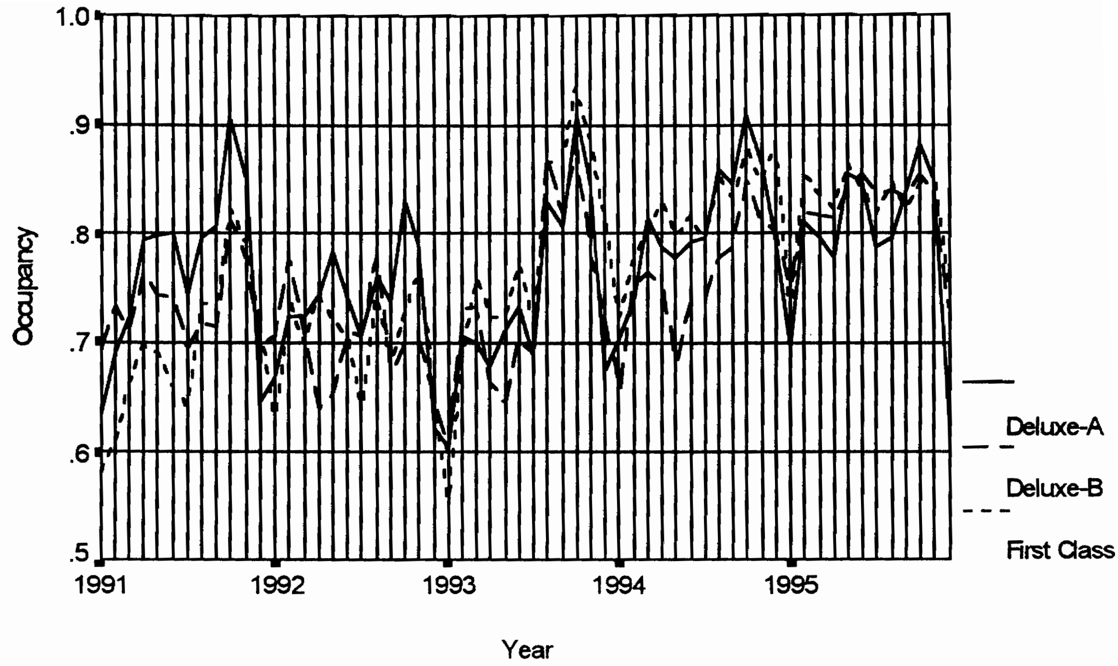


Figure 4.2. Occupancy Rates

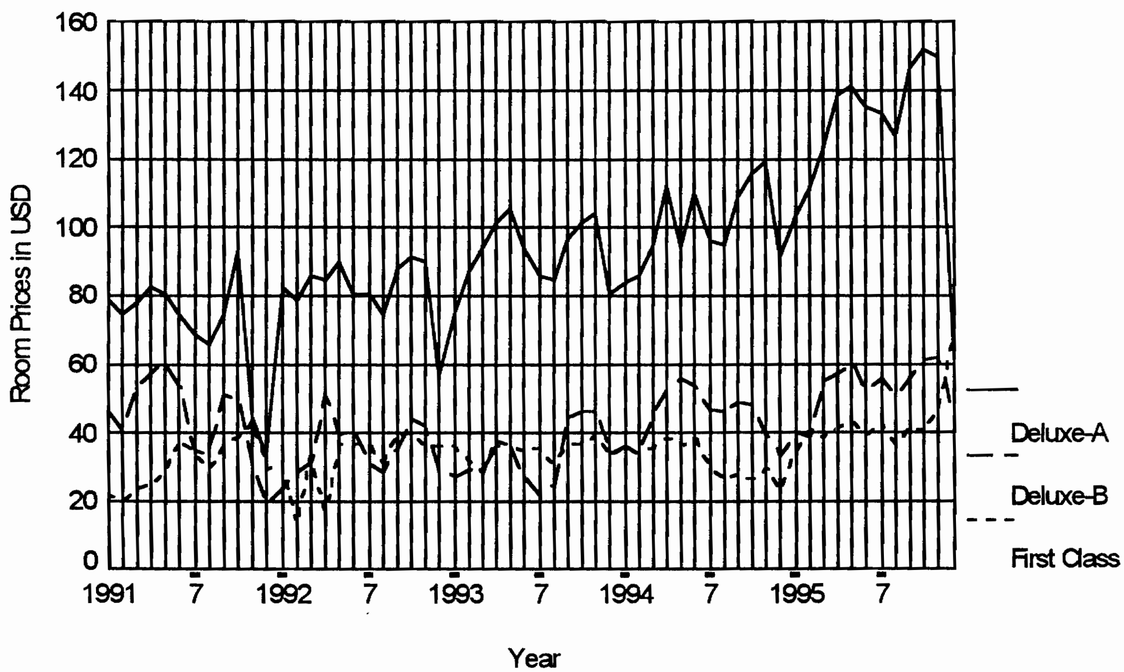


Figure 4.3. Room Prices

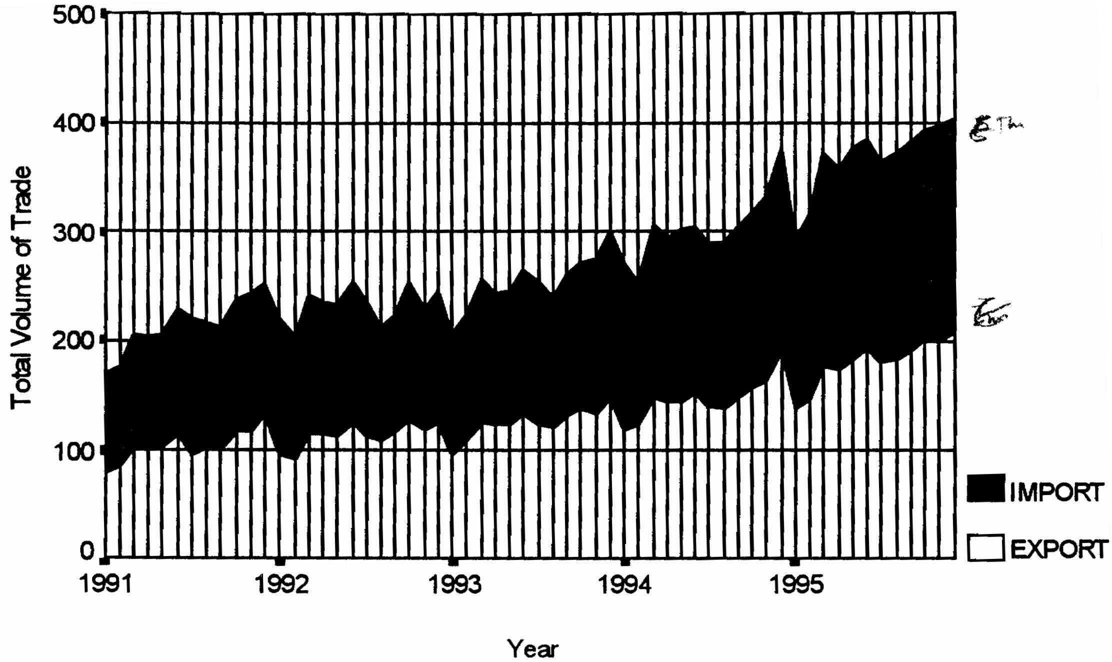


Figure 4.4. Total Volume of Trades

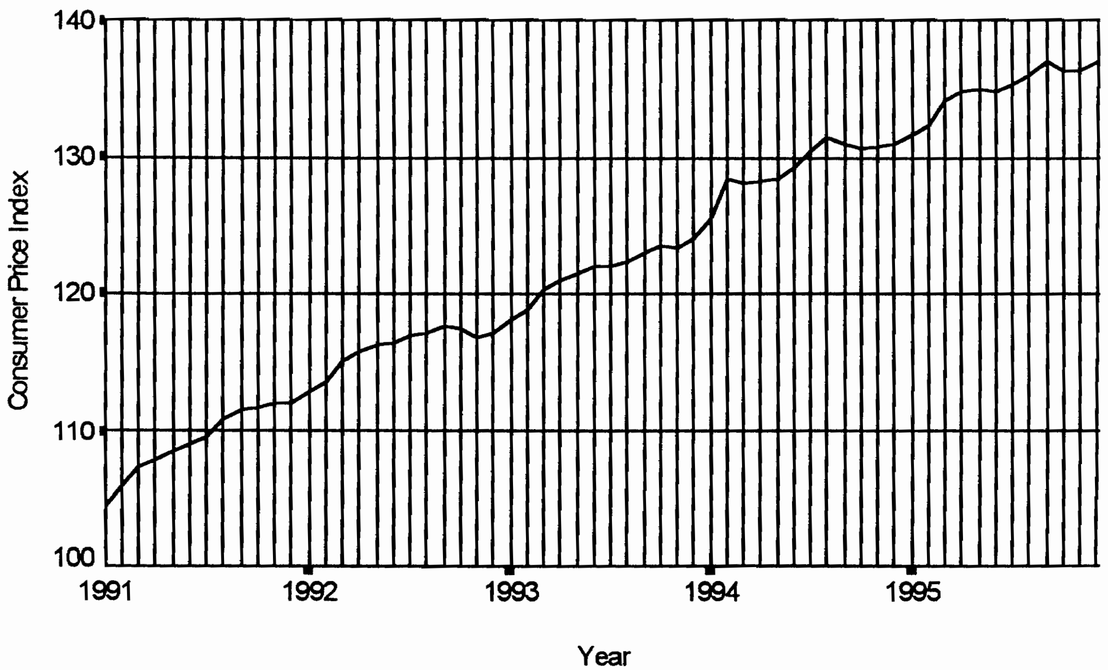


Figure 4.5. Consumer Price Index

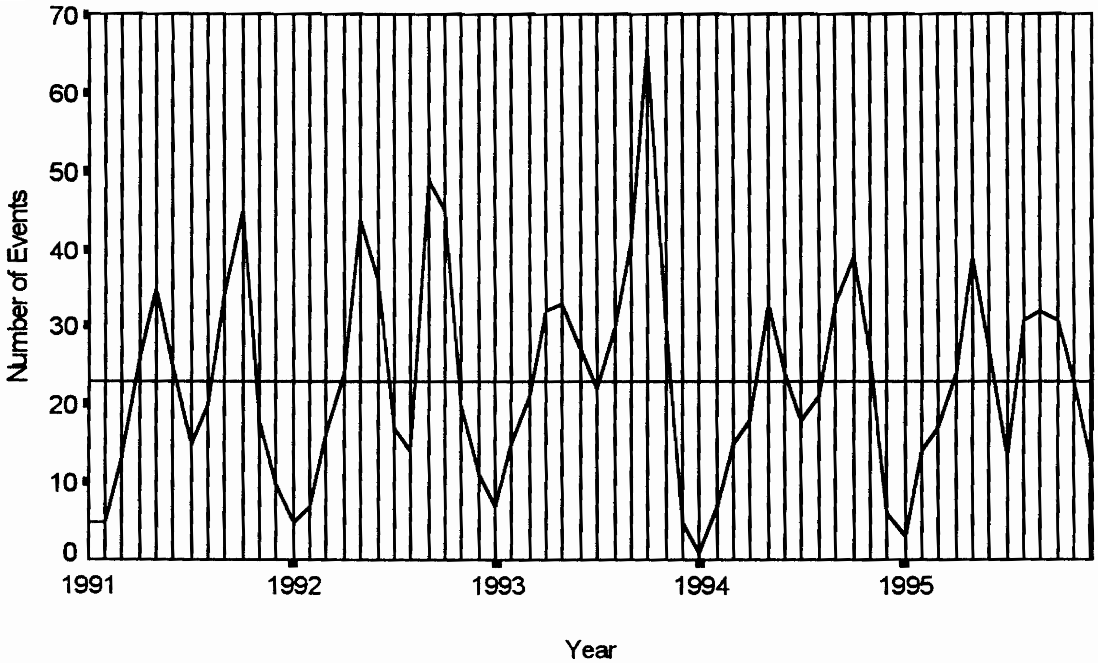


Figure 4.6. Number of Events

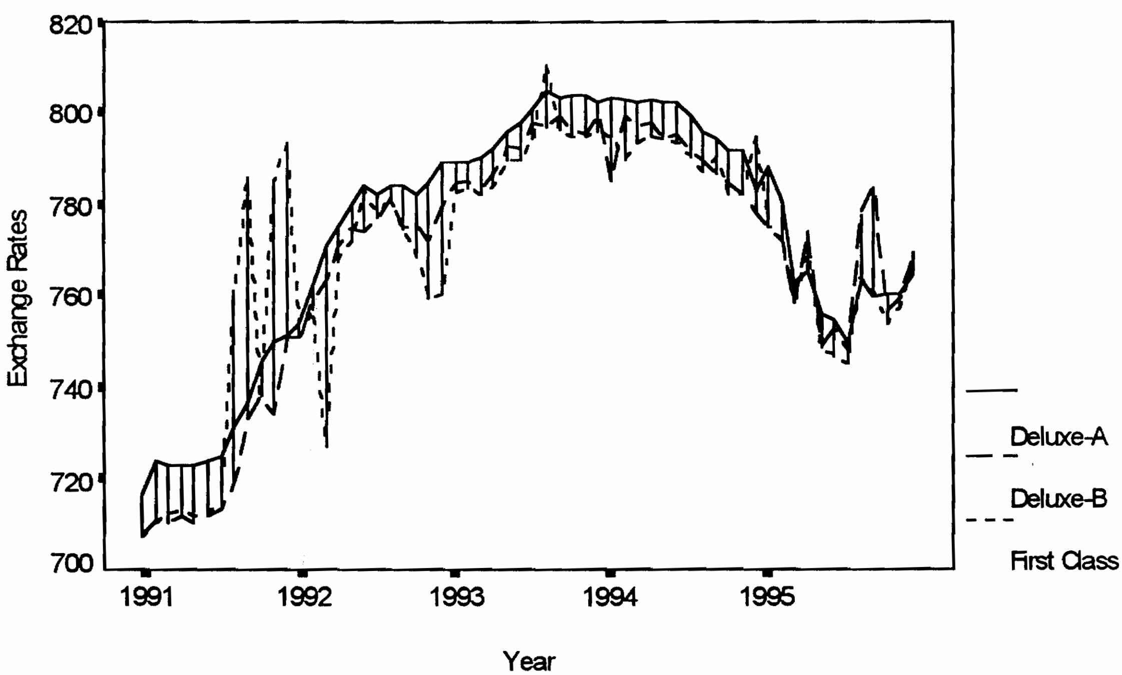


Figure 4.7. Exchange Rates (Korean Won/US Dollar)

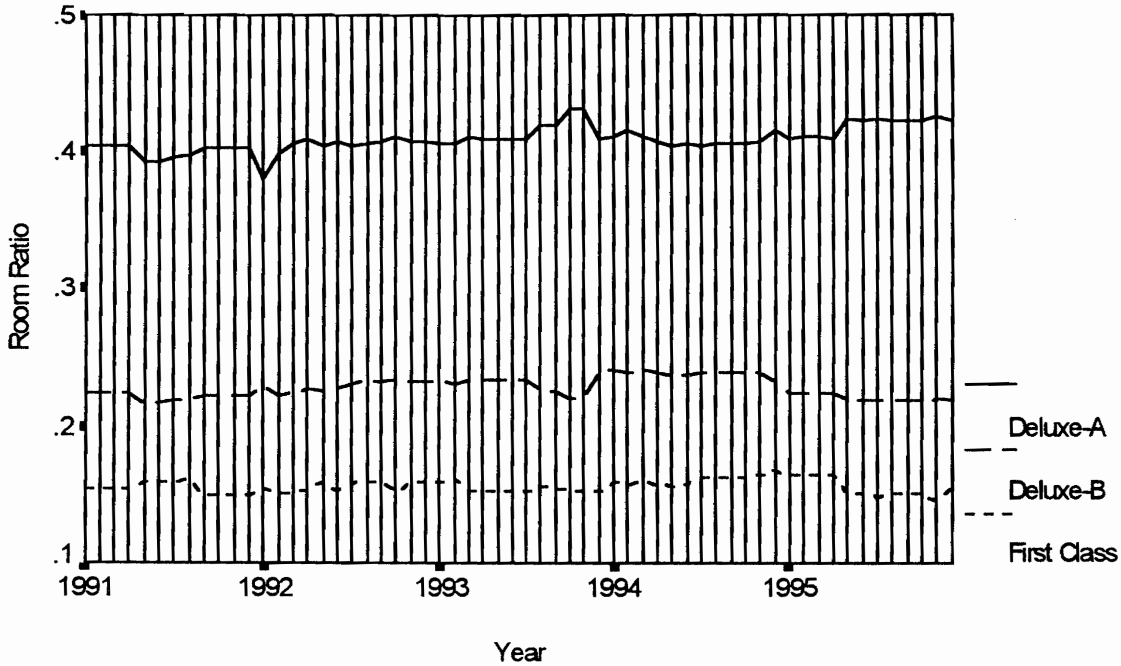


Figure 4.8. Availability of Rooms

4.3. ESTIMATION OF DEMAND MODEL I

The initial model development was specified to explain demand for each market affected by price, which is endogenous, and two exogenous variables, trade volumes and the number of events.

The structural equations developed from the hypothesized model presented in Chapter 3 were:

Demand: $Lb_i = \beta_0^* + \beta_1 Lp_i + \beta_2 Ltr + \beta_3 Lev + \varepsilon^*$ (4.1)

Price: $Lp_i = \beta_4^* + \beta_5 Lb_i + \beta_6 (Lagp_i)$

$$+\beta_7 Lra_i +\beta_8 Lcp +\beta_9 Lex_i +\beta_{10} Se +\varepsilon^* \qquad (4.2)$$

where variables are as defined in Chapter 3.

The following results were obtained by 2-stage least squares estimation using MicroTSP.[6] The MicroTSP output for each of the models described above is provided in Tables 4.2 - 4.4. The data provided in the following tables represent the second stage results from the 2SLS procedure. Thus, instrument variables are not shown in the outcome of analysis. Since the instrument variables are included to explain the endogeneity of price variable, the demand equations are the major concern at this stage.

[6] MicroTSP Version 7.0, Quantitative Micro Software, Irvine, California, 1990.

Table 4.1. Model Estimation for Deluxe-A Hotels

TSLS // Dependent Variable is LB1
SMPL range: 1992.01 - 1995.12
Number of observations: 48
Instrument list: C LTR LEVENT LAGP1 LEX1 LRA1 LCPI SEASON

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	7.2580046	0.3968216	18.290345	0.0000
LP1	-0.2623846	0.1322912	-1.9833871	0.0536
LEVENT	0.1040690	0.0205490	5.0644240	0.0000
LTR	0.4271759	0.1174063	3.6384403	0.0007

R-squared	0.572309	Mean of dependent var	8.771189
Adjusted R-squared	0.543148	S.D. of dependent var	0.140668
S.E. of regression	0.095079	Sum of squared resid	0.397757
F-statistic	13.92215	Durbin-Watson stat	1.402599
Prob(F-statistic)	0.000002		

(Variables represent: C=intercept, LB1=Demand for Deluxe-A, LTR=Trade volume, LEVENT=Number of events, LAGP1=Price lagged a year, LEX1=Exchange rate, LRA1=Room ratio, LCPI=Consumer price index, SEASON=Dummy for seasonality)

Table 4.2. Model Estimation for Deluxe-B Hotels

TSLS // Dependent Variable is LB2
SMPL range: 1992.01 - 1995.12
Number of observations: 48
Instrument list: C LTR LEVENT LAGP2 LEX2 LRA2 LCPI SEASON

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	6.9259092	0.5571253	12.431511	0.0000
LP2	-0.3369602	0.1629911	-2.0673531	0.0446
LEVENT	0.0802165	0.0261182	3.0712869	0.0036
LTR	0.4472012	0.1753181	2.5507984	0.0143

R-squared	0.468515	Mean of dependent var	8.440576
Adjusted R-squared	0.432278	S.D. of dependent var	0.144326
S.E. of regression	0.108746	Sum of squared resid	0.520326
F-statistic	4.231422	Durbin-Watson stat	1.134119
Prob(F-statistic)	0.010323		

(Variables represent: C=intercept, LB2=Demand for Deluxe-B, LTR=Trade volume, LEVENT=Number of events, LAGP2=Price lagged a year, LEX2=Exchange rate, LRA2=Room ratio, LCPI=Consumer price index, SEASON=Dummy for seasonality)

Table 4.3. Model Estimation for First Class Hotels

TSLS // Dependent Variable is LB3
SMPL range: 1992.01 - 1995.12
Number of observations: 48
Instrument list: C LTR LEVENT LAGP3 LEX3 LRA3 LCPI SEASON

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	4.8906927	0.5219516	9.3700115	0.0000
LP3	-0.8714619	0.3682296	-2.3666267	0.0224
LEVENT	0.0969831	0.0257196	3.7707863	0.0005
LTR	1.0244027	0.2012139	5.0911127	0.0000

R-squared	0.841049	Mean of dependent var	7.871359
Adjusted R-squared	0.830211	S.D. of dependent var	0.274910
S.E. of regression	0.113278	Sum of squared resid	0.564603
F-statistic	23.09349	Durbin-Watson stat	1.638627
Prob(F-statistic)	0.000000		

(Variables represent: C=intercept, LB3=Demand for First class, LTR=Trade volume, LEVENT=Number of events, LAGP3=Price lagged a year, LEX3=Exchange rate, LRA3=Room ratio, LCPI=Consumer price index, SEASON=Dummy for seasonality)

The results of the initial demand model were quite encouraging in that all explanatory variables were significant at the 10% or better significance level and that R-squares were acceptable. The number of observations were reduced from 60 to 48 because lagged price variables were included in the models. The inclusion of this variable actually alleviated the influence of extreme points as stated in the previous section 4.2, as well as the problem of autocorrelation increasing DW statistics. Nonetheless, the DW statistic (1.134) for the Deluxe-B model fell below the lower bound, which is 1.227 at the 1% significance level, indicating the presence of autocorrelation. However, the DW statistic for the Deluxe-A (1.403) fell into the inconclusive range, below the upper bound of 1.482 at the 1% significance level. The DW statistic for the First class model was 1.639, which is above the upper bound at the 1% significant level. It, however, fell into the inconclusive range at 5% the significance level, where the lower and upper bound are 1.405 and 1.670, respectively.

Since the Durbin-Watson test has been found to be quite powerful when compared to others for AR(1) processes (Greene 1990), an alternative test is needed to determine the depth of lags to consider in the models that have autocorrelations. Figures 4.9 - 4.10 illustrate residual tests for three different segments, showing correlograms and Q statistics.

Figure 4.9 shows that the Box-Pierce Q-statistic for Deluxe-A is 12.77 with a probability ratio of 0.386. This statistic allows to retain the null hypothesis that all autocorrelations of errors are equal to zero (0). The test for the demand model of First class hotels illustrated in

Figure 4.11 also indicates that the residuals of the model are distributed as white noise[7] (i.e., residuals are random) because the Q-statistic is 6.91, which is not significant. The Q-statistic for the model of Deluxe-B hotel, however, was significant at the 5% significance level (Figure 4.10). If the Q is significant, the null hypothesis must be rejected and it is necessary to undergo appropriate time dependent processes.

```
=============================================================================
      Autocorrelations          Partial Autocorrelations          ac      pac
=============================================================================
 |          .   |***.      |          .   |***.      |  1  0.213   0.213
 |          .   |**  .     |          .   |**  .     |  2  0.181   0.142
 |          .   |*   .     |          .   |    .     |  3  0.069   0.006
 |          .  *|    .     |          .  *|    .     |  4 -0.053  -0.098
 |          .   |    .     |          .   |    .     |  5 -0.009   0.007
 |          .   |    .     |          .   |    .     |  6 -0.030  -0.006
 |          . **|    .     |          . **|    .     |  7 -0.145  -0.141
 |          ****|    .     |          .***|    .     |  8 -0.290  -0.264
 |          .  *|    .     |          .   |*   .     |  9 -0.089   0.055
 |          . **|    .     |          .  *|    .     | 10 -0.185  -0.092
 |          . **|    .     |          . **|    .     | 11 -0.179  -0.157
 |          .   |    .     |          .   |*   .     | 12 -0.003   0.054
=============================================================================
  Box-Pierce Q-Stat    12.77    Prob    0.3860      SE of Correlations   0.144
  Ljung-Box  Q-Stat    15.50    Prob    0.2154
=============================================================================
```

<u>Figure 4.9. Correlograms and Q-statistics for Deluxe-A</u>

[7] See Footnote 5.

```
==========================================================================
       Autocorrelations          Partial Autocorrelations        ac      pac
==========================================================================
|        .    |*****     |        .    |*****      |  1   0.403   0.403
|        .    |**   .    |        .    |     .     |  2   0.176   0.017
|        .  **|     .    |        .***|     .     |  3  -0.127  -0.243
|        .  **|     .    |        .    |     .     |  4  -0.156  -0.035
|        .***|     .    |        .  **|     .     |  5  -0.261  -0.166
|        .   *|     .    |        .    |*    .     |  6  -0.092   0.073
|        .   *|     .    |        .   *|     .     |  7  -0.085  -0.067
|        .   *|     .    |        .   *|     .     |  8  -0.051  -0.098
|        .  **|     .    |        .  **|     .     |  9  -0.161  -0.168
|        .  **|     .    |        .  **|     .     | 10  -0.178  -0.141
|        ****|     .    |        .***|     .     | 11  -0.277  -0.211
|        .   *|     .    |        .    |*    .     | 12  -0.048   0.090
==========================================================================
 Box-Pierce Q-Stat    21.94    Prob   0.0382     SE of Correlations   0.144
 Ljung-Box  Q-Stat    25.70    Prob   0.0118
==========================================================================
```

Figure 4.10. Correlograms and Q-statistics for Deluxe-B

```
==========================================================================
       Autocorrelations          Partial Autocorrelations        ac      pac
==========================================================================
|        .    |**   .    |        .    |**   .     |  1   0.141   0.141
|        .    |**   .    |        .    |**   .     |  2   0.157   0.140
|        .    |***.      |        .    |***.       |  3   0.248   0.218
|        .    |     .    |        .   *|     .     |  4  -0.021  -0.100
|        .    |*    .    |        .    |     .     |  5   0.056   0.007
|        .    |     .    |        .    |     .     |  6   0.024  -0.024
|        .   *|     .    |        .   *|     .     |  7  -0.067  -0.051
|        .   *|     .    |        .  **|     .     |  8  -0.109  -0.125
|        .    |*    .    |        .    |**   .     |  9   0.060   0.118
|        .   *|     .    |        .   *|     .     | 10  -0.081  -0.049
|        .   *|     .    |        .   *|     .     | 11  -0.081  -0.046
|        .    |     .    |        .    |     .     | 12   0.026   0.008
==========================================================================
 Box-Pierce Q-Stat     6.91    Prob   0.8638     SE of Correlations   0.144
 Ljung-Box  Q-Stat     7.89    Prob   0.7934
==========================================================================
```

Figure 4.11. Correlograms and Q-statistics for First Class

The first-order autoregressive process is merely a crude approximation. Because of its tractability, almost all treatments of autoregressive disturbances focus on the first-order autoregressive process and thereby ignore the possibility that some other process might be generating the disturbances (Ostrom 1990). These processes include higher order autoregressive, AR(p), and moving average, MA(q), processes and the mixed form of the ARMAX (p,q) process.

Even though there is no mechanical method of discovering the time-dependent process that is responsible for the errors, the analysis of ACFs (autocorrelation function) and PACFs (partial autocorrelation function) can be used to make an informed guess in cases where one does not have other a priori information concerning the process (Ostrom 1990).

In Figure 4.9, both ACF and PACF show significant spikes only at the points lagged one. This implies the possibility of mixed process of AR (autoregressive) and MA (moving average), as well as the presence of first order autocorrelation with the significant DW-statistic.

The regression model for Deluxe-B, therefore, was re-estimated with AR(1) and ARMAX(1,1) error processes, because if the autocorrelation is positive, the fit of the model tends to be exaggerated (Ostrom 1990). The output of the AR(1) and ARMAX(1,1) regression models are presented in Tables 4.5 and 4.6. Both estimations seemed to alleviate the problem of autocorrelation. DW-statistics were greater than upper bound of the tabulated statistic. Q-statistics were not significant and therefore the null hypothesis (that the parameters of autocorrelation are zero) was retained. In Table 4.6, however, the coefficient of MA(1) was not significant, while in AR(1) model in Table 4.5, the coefficient of AR(1) was significant. Thus, the AR(1) model for Deluxe-B is retained for the analysis and for further development of the model.

Table 4.5. AR(1) Estimation for Deluxe-B

TSLS // Dependent Variable is LB2
SMPL range: 1992.02 - 1995.12
Number of observations: 47
Instrument list: C LTR LEVENT LAGP2 LEX2 LRA2 LCPI SEASON
Convergence achieved after 3 iterations

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	7.3730589	0.7203600	10.235242	0.0000
LP2	-0.2449050	0.1305630	-1.8757614	0.0677
LEVENT	0.0741361	0.0265377	2.7936152	0.0078
LTR	0.3099712	0.1564838	1.9808516	0.0542
AR(1)	0.4552386	0.1471406	3.0939017	0.0035

R-squared	0.529889	Mean of dependent var	8.439358
Adjusted R-squared	0.485117	S.D. of dependent var	0.145636
S.E. of regression	0.104502	Sum of squared resid	0.458667
F-statistic	6.904091	Durbin-Watson stat	2.007251
Prob(F-statistic)	0.000230		

Box-Pierce Q-Stat	12.53	Prob	0.4039
Ljung-Box Q-Stat	15.33	Prob	0.2239

(Variables represent: C=intercept, LB2=Demand for Deluxe-B, LTR=Trade volume, LEVENT=Number of events, LAGP2=Price lagged a year, LEX2=Exchange rate, LRA2=Room ratio, LCPI=Consumer price index, SEASON=Dummy for seasonality, AR(1)=the first order autoregressive term)

Table 4.6. ARMAX(1,1) Estimation of Deluxe-B

TSLS // Dependent Variable is LB2
SMPL range: 1992.02 - 1995.12
Number of observations: 47
Instrument list: C LTR LEVENT LAGP2 LEX2 LRA2 LCPI SEASON
Convergence achieved after 22 iterations

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	7.4972879	0.8271544	9.0639518	0.0000
LP2	-0.1242046	0.1440338	-0.8623294	0.3935
LEVENT	0.0683093	0.0295484	2.3117734	0.0259
LTR	0.2115725	0.1743229	1.2136820	0.2318
MA(1)	-0.0528626	0.3412954	-0.1548882	0.8777
AR(1)	0.5057099	0.2976101	1.6992365	0.0969

R-squared	0.444895	Mean of dependent var	8.439358
Adjusted R-squared	0.377199	S.D. of dependent var	0.145636
S.E. of regression	0.114933	Sum of squared resid	0.541592
F-statistic	4.790027	Durbin-Watson stat	1.972579
Prob(F-statistic)	0.001540		

Box-Pierce Q-Stat	13.50	Prob	0.3340
Ljung-Box Q-Stat	16.26	Prob	0.1798

(Variables represent: C=intercept, LB2=Demand for Deluxe-B, LTR=Trade volume, LEVENT=Number of events, LAGP2=Price lagged a year, LEX2=Exchange rate, LRA2=Room ratio, LCPI=Consumer price index, SEASON=Dummy for seasonality, MA(1)=the first order moving average term, AR(1)=the first order autoregressive term)

4.4. ANALYSIS OF DEMAND MODEL I

The final results of the demand models of each industry segment are presented in Table 4.7. Overall model fit can be explained by the adjusted R-squared. About 54% of variance of demand for Deluxe-A hotels were explained by independent variables included in the study. Even if the DW-statistic fell into the inconclusive range (d_L=1.227, d_U=1.482, at the 1% significance level), strong evidence for serial correlation was not found upon examining the insignificant Q-statistic. For the demand model of Deluxe-B hotels, the adjusted R-squared was .4851, but the model fit was still acceptable. The model was re-estimated through several stages of time dependent error process and the AR(1) model that fitted the data best was retained for the analysis. The DW-statistic was increased from 1.13 to 2.00 to reject the null hypothesis that there was a first-order autocorrelation in the demand equation. The Q-statistic also became insignificant, indicating no further time-dependent error process was needed. The adjusted R-squared for the model of First class hotels was high (0.8302), so that the overall model fit was quite good. The DW-statistic (1.63) indicated there was no first-order autocorrelation at the 1% significance level (d_L=1.227, d_U=1.482). The Q-statistic and the correlogram also showed that errors were random.

Table 4.7. Estimation Results of Demand Model I

	Deluxe-A	Deluxe-B	First
Variable	Coefficients (T-statistic)	Coefficients (T-statistic)	Coefficients (T-statistic)
Intercept	7.2580	7.3730	4.8906
Price	-0.2623[c]	-0.2449[c]	-0.8714[b]
	(-1.9833)	(-1.8757)	(-2.3666)
Event	0.1040[a]	0.0741[a]	0.0969[a]
	(5.0644)	(2.7936)	(3.7707)
Trade	0.4271[a]	0.3099[c]	1.0244[a]
	(3.6384)	(1.9808)	(5.0911)
AR(1)		0.4552[a]	
		(3.0939)	
R^2	0.5723	0.5298	0.8410
Ad. R^2	0.5431	0.4851	0.8302
DW-statistic	1.4025	2.0072	1.6386
Q-statistic	12.77	12.53	6.91
(Prob)	(0.3860)	(0.4039)	(0.8638)

(a: significant at 1% two-tail significance level, b: at 5%, and c: at 10%)

Price variables of all the models had negative signs, as expected. It is in accord with Marshall's "one general law of demand" as quoted by Working (1927):

> There is then one general law of demand: — the greater the amount to be sold, the smaller must be the price at which it is offered in order to find purchasers; or, in other words, the amount demanded increases with a fall in prices and diminishes with a rise in price.

Parameters of own prices estimated were all significant at the 10% significant level. The own price elasticities of demand were -0.26 and -0.24 for the deluxe classes and -0.87 for First class hotels. This result supports the findings of previous studies. In the demand model of Fujii, Khaled and Mak (1985a), the own price elasticity of demand for lodging in Hawaii was -0.95. Whereas Greenberg (1985) estimated a price-elasticity of -0.23, focusing on the high-rate properties only. The higher the prices of hotels, the more price-inelastic is the hotel demand.

The number of international events held in the area was found to be a significant factor that affects the international hotel demand. Coefficients were significant at the 1% significant level, and had positive signs as expected. Events seemed to be an important attribute of the destination that attracted international travelers.

Trade volumes were also found to be positively related to the international hotel demand of all three segments. The index of trade seemed to a good indicator of overall economic condition of the destination that affected the international tourist flow.

In this model, the concern was limited to the demand of each segment and the relationship with its own price and two external variables (trade volume and events). Market performance of hotels, however, is not independent of the other properties. In an aggregate manner, the performance of hotels in one category affects hotels in the other categories. Even if the service of one hotel can be differentiated from the others based on rates, customer profiles and location, the product itself is very similar in a given local market in that they all provide accommodations. In this sense, products in different segments can be substitutes if the services are similar. In the following sections, therefore, discussion will include those market interactions among segments.

4.5. ESTIMATION OF DEMAND MODEL II

The Demand Model II was specified to explain the overall market mechanism which affects demand for each segment. Demand for a segment was hypothesized to be affected by both demand and price of other segments. As specified in the hypothesized Model II in Chapter 3, the structural equations can be written as:

$$Lb_1 = \beta_0 + \beta_1 Lp_1 + \beta_2 Ltr + \beta_3 Lev + \beta_4 Lb_2 + \beta_5 Lp_2 + \beta_6 Lb_3 + \beta_7 Lp_3 + \varepsilon \qquad (4.3)$$

$$Lp_1 = \beta_8 + \beta_9 Lb_1 + \beta_{10}(Lagp_1) + \beta_{11} Lra_1 + \beta_{12} Lcp + \beta_{13} Lex_1 + \beta_{14} Se + \varepsilon \qquad (4.4)$$

$$Lb_2 = \beta_{20} + \beta_{21}Lp_2 + \beta_{22}Ltr + \beta_{23}Lev$$
$$+ \beta_{24}Lb_1 + \beta_{25}Lp_1 + \beta_{26}Lb_3 + \beta_{27}Lp_3 + \varepsilon \qquad (4.5)$$

$$Lp_2 = \beta_{28} + \beta_{29}Lb_2 + \beta_{30}(Lagp_2)$$
$$+ \beta_{31}Lra_2 + \beta_{32}Lcp + \beta_{33}Lex_2 + \beta_{34}Se + \varepsilon \qquad (4.6)$$

$$Lb_3 = \beta_{35} + \beta_{36}Lp_3 + \beta_{37}Ltr + \beta_{38}Lev$$
$$+ \beta_{39}Lb_2 + \beta_{40}Lp_2 + \beta_{41}Lb_1 + \beta_{42}Lp_1 + \varepsilon \qquad (4.7)$$

$$Lp_3 = \beta_{43} + \beta_{44}Lb_3 + \beta_{45}(Lagp_3)$$
$$+ \beta_{46}Lra_3 + \beta_{47}Lcp + \beta_{48}Lex_3 + \beta_{49}Se + \varepsilon \qquad (4.8)$$

Unlike the ones in the hypothesized model (Equations 3.20 - 3.25), in the initial estimation stage, Equation 4.3 includes variables of Lb3 (demand for First class) and Lp3 (price for First class). Equation 4.7 includes variables of Lb1 (demand for Deluxe-A) and Lp1 (Price for Deluxe-A) in order to see if there was an interaction between the market segments of Deluxe-A and First Class hotels. The model was estimated throughout the stages using 2SLS in the system equations estimation option of the MicroTsp program. The summary of the results are presented in Table 4.8.

Table 4.8. Results of Initial Estimation of Demand Model II[8]

	Coefficients (T-stat)					
Variable	Demand1	Price1	Demand2	Price2	Demand3	Price3
intercept	2.701	12.285	0.006	2.947	1.517	0.338
	(1.531)	(1.785)	(0.003)	(0.217)	(0.633)	(0.040)
Price(Own)	-0.747[a]		-0.911[a]		-0.788[a]	
	(-3.089)		(-4.884)		(-3.490)	
Event	0.020		0.015		0.006	
	(0.667)		(0.550)		(0.190)	
Trade	0.735[b]		0.257		0.357	
	(2.122)		(1.407)		(1.446)	
Demand1		-0.194	0.687[b]		-0.025	
		(-0.761)	(2.501)		(-0.051)	
Price1			0.761[a]		-0.388	
			(4.220)		(-0.857)	
Demand2	0.795[b]			0.134	0.704	
	(2.514)			(0.265)	(1.389)	
Price2	0.735[b]				0.858[c]	
	(2.122)				(1.729)	
Demand3	-0.006		0.150			-0.363
	(-0.029)		(0.783)			(-1.204)
Price3	0.280		-0.111			
	(1.215)		(-0.467)			
Lag Price		0.249[b]		-0.095		0.117
		(2.361)		(-0.441)		(1.016)
Exchange		-2.190[a]		-2.222		-0.977
		(-2.805)		(-1.084)		(-0.876)
Room Ratio		0.738		-0.458		-0.665
		(0.665)		(-0.434)		(-0.766)
CPI		1.667[a]		2.880[a]		2.255[a]
		(4.076)		(6.030)		(3.146)
Season		0.163[a]		0.292[a]		0.069
		(3.888)		(3.480)		(1.101)
R-squared	0.759	0.792	0.800	0.676	0.917	0.641
Ad. R-sq	0.717	0.761	0.765	0.628	0.903	0.588
DW-stat	1.975	1.486	1.554	1.14	1.519	1.545

(a: significant at 1% two-tail significance level, b: at 5% and c: at 10%)
(Demand1=demand for Deluxe-A, Demand2=demand for Deluxe-B, Demand3=demand for First class, Price1=price for Deluxe-A, Price2=price for Deluxe-B, and Price3=price for First class)

[8] See Appendix A for complete output.

From the results of initial estimations, the model was revised in some directions. First, there were not any significant interrelationships between demand 1 (Deluxe-A) and demand 3 (First Class). The service or price of Deluxe-A hotels may be positioned to international tourists differently from that of First class hotels. That is, changes in price and demand of hotel rooms for Deluxe-A class do not change the demand pattern for First class hotel rooms directly. Neither do changes in demand and price for First class hotels affect the demand pattern for Deluxe-A class hotels. Therefore, the relationships between the Deluxe-A segment and the First class segment were removed from the model. Secondly, in the equation of price 2 (Deluxe-B), the DW-statistic indicated significant serial correlations. The problem of serial correlation was alleviated from the AR(1) error process. Thirdly, the variables of events and trades were not estimated to be consistently significant throughout the demand equations. This might be due to multicollinearity, since the variables have significant correlations with demand variables in the equations. Therefore, those variables that seemed to be multicollinear with demand variables in the right hand side of the equation were omitted to estimate the model, increasing overall model fit. For this reason, the variable, Ltr (Trade volume), was excluded from each of the demand equations for Deluxe-A and Deluxe-B hotels (Equations 4.3 and 4.5) and Lev (Event) was excluded from demand equations for Deluxe-B and First class hotels (Equations 4.5 and 4.7). And for price equations, the variables of Lra_2 (Room ratio for Deluxe-B) and Lra_3 (Room ratio for First class) were removed from the price equations for Deluxe-B (Equation 4.6) and for First class hotels (Equation 4.8), since these variables were not significant and did not contribute to the overall model fit.

The structural equations of the revised model can be written as:

$$Lb_1 = \beta_0 + \beta_1 Lp_1 + \beta_3 Lev + \beta_4 Lb_2 + \beta_5 Lp_2 + \varepsilon \qquad (4.9)$$

$$Lp_1 = \beta_8 + \beta_9 Lb_1 + \beta_{10}(Lagp_1) + \beta_{11} Lra_1 + \beta_{12} Lcp + \beta_{13} Lex_1 + \beta_{14} Se + \varepsilon \qquad (4.10)$$

$$Lb_2 = \beta_{20} + \beta_{21} Lp_2 + \beta_{22} Ltr + \beta_{24} Lb_1 + \beta_{25} Lp_1 + \beta_{26} Lb_3 + \beta_{27} Lp_3 + \varepsilon \qquad (4.11)$$

$$Lp_2 = \beta_{28} + \beta_{29} Lb_2 + \beta_{30} (Lagp_2) + \beta_{31} Lex_2 + \beta_{32} Lcp + \beta_{34} Se + \varepsilon$$

$$[\ AR(1):\ \varepsilon_t = \rho\varepsilon_{t-1} + u_t\ ] \qquad (4.12)$$

$$Lb_3 = \beta_{35} + \beta_{36} Lp_3 + \beta_{37} Ltr + \beta_{39} Lb_2 + \beta_{40} Lp_2 + \varepsilon \qquad (4.13)$$

$$Lp_3 = \beta_{43} + \beta_{44} Lb_3 + \beta_{45} (Lagp_3)$$

$$+ \beta_{47} Lcp + \beta_{48} Lex_3 + \beta_{49} Se + \varepsilon \qquad (4.14)$$

The estimation results of the revised model are presented in Table 4.9.

Table 4.9. Results of Estimation of the Revised Demand Model II[9]

	Coefficients (T-stat)					
Variable	Demand1	Price1	Demand2	Price2	Demand3	Price3
intercept	3.797	12.266	-0.537	-5.393	1.518	3.221
	(3.717)	(1.781)	(-0.457)	(-0.681)	(0.956)	(0.494)
Price(Own)	-0.773[a]		-0.888[a]		-0.691[a]	
	(-5.768)		(-5.352)		(-3.742)	
Event	0.038[a]					
	(3.016)					
Trade					0.364[b]	
					(2.457)	
Demand1		-0.193	0.651[a]			
		(-0.757)	(4.325)			
Price1			0.743[a]			
			(4.995)			
Demand2	0.671[a]			-0.263	0.568[a]	
	(5.005)			(-0.967)	(2.914)	
Price2	0.741[a]				0.526[a]	
	(6.816)				(4.369)	
Demand3			0.344[a]			-0.483[b]
			(2.851)			(-2.215)
Price3			0.118			
			(0.782)			
Lag Price		0.249[b]		0.097		0.096
		(2.361)		(0.719)		(0.989)
Exchange		-2.189[a]		-0.778		-1.228
		(-2.801)		(-0.569)		(-1.324)
Room Ratio		0.736				
		(0.662)				
CPI		1.666[a]		3.425[a]		2.467[a]
		(4.071)		(8.090)		(4.292)
Season		0.163[a]		0.204[a]		0.092[c]
		(3.883)		(3.670)		(1.901)
AR(1)				0.487[a]		
				(3.083)		
R-squared	0.854	0.792	0.832	0.825	0.882	0.721
Ad. R-sq	0.840	0.762	0.813	0.799	0.871	0.688
DW-stat	2.179	1.486	1.806	2.03	1.385	1.352

(a: significant at 1% two-tail significance level, b: at 5% and c: at 10%)
(Demand1=demand for Deluxe-A, Demand2=demand for Deluxe-B, Demand3=demand for First class, Price1=price for Deluxe-A, Price2=price for Deluxe-B, and Price3=price for First class)

[9] See Appendix B for complete output.

4.6. ANALYSIS OF DEMAND MODEL II

4.6.1. Demand Equations

Compared to the demand equations (Table 4.7) that exclude market mechanism, i.e., exclude demand and price of other segments in the function, the overall model fits of the demand equations in Demand Model II (Table 4.9) were increased. The adjusted R-squared of the demand 1 (Deluxe-A) was increased from 0.543 to 0.840; 0.485 to 0.813 for demand 2 (Deluxe-B); and 0.830 to 0.871 for demand 3 (First Class).

In demand equation 1 (Equation 4.9), the demand for Deluxe-A hotels was found to be influenced by the demand and the price of the next luxurious hotel class, which was Deluxe-B class hotels (Table 4.9). The coefficients of those variables were significant at the 1% significance level. However, the influence of the First Class hotels on the demand for Deluxe-A hotels were not found significant. The demand for Deluxe-A hotels went up when the demand and the price of Deluxe-B hotels increased. The own price negatively affects the demand, and events positively influence the demand of Deluxe-A hotels. Both variable were significant at the 1% significance level.

In demand equation 2 (Equation 4.11), the demand of Deluxe-B hotels was found to be significantly affected by the demand and the price of Deluxe-A hotels and the demand of First class hotels, but not significantly by the price of First class hotels. The variables of demand1, price1 (for Deluxe-A) and demand2 (for Deluxe-B) were all significant at the 1% significance level. The coefficient of the variable, Price3 (for First class) was not statistically significant but had a positive sign as expected. Demand for Deluxe-B hotels also increased when demands and prices of other segments increased and vice versa. The own price was significant at the 1% significance level with a negative sign.

In the demand equation 3 (Equation 4.13), like other segments, the demand for First class hotels was significantly affected by the demand and the price of Deluxe-B hotels. Those variables were significant at the 1% significance level. However, the market effect of Deluxe-A hotels was not found to be significant for the demand of the First class hotels. The price was found to affect negatively the demand, as in other hotel segments, and trade volume was also found to be significant.

4.6.2. Price Equations

As presented in Table 4.9, the demand variables in the price equations all have negative signs, even though only the demand3 (-0.483) in the price equation 3 (First class) was statistically significant. This, however, implies that the price is determined within the market system. Price and demand are jointly dependent and determined simultaneously. Signs of lagged (12 months) prices were all positive as expected, and the lagged price (0.249) of the price1 equation was statistically significant. Lodging business is often considered to have a seasonal cycle, so that the market performance in the previous season would affect management decisions at present time. Coefficients of exchange rates were negative. When currency in the destination is depreciated, the price of the product in the area goes down. Actually, most room rates of hotels in Seoul are published and quoted in Korean currency, with a few exceptions, for travel wholesalers. Thus, the depreciation of exchange rates is critical to management, even though the hotel operators try to minimize the impact of fluctuating exchange rates by controlling the percentage of discount less rack rates. The consumer price index, which is one of the indices of general economic conditions of the destination area, was found to affect significantly the level of prices of international tourist hotels. The seasonality was found to be a significant factor that affects prices of hotels in all three segments. During peak season, prices go up yielding maximum profit; during off season the price lowers penetrating the market. Finally, the room availability represented by the ratio of rooms available for the hotels of one segment to total rooms available in the area, was not a significant factor affecting the price level. Even if room supply might change in response to the changes of demand and season, it was not enough to affect the price level because the changes were not significantly detected in the short run.

The overall model fits of price equations by the adjusted R-squared were relatively high, representing 0.762, 0.799 and 0.688 for the Deluxe-A, the Deluxe-B and First class segments, respectively. This implies that the most exogenous variables in the equations successfully acted as instrumental variables for estimating the endogenous variable, which is the price factor. Most of variances (76%, 80%, and 69% variances for each segment) of price were explained by the explanatory variables.

CHAPTER 5. SUMMARY AND CONCLUSION

5.1. INTRODUCTION

The previous chapter presented and analyzed the results of the model estimations. In this chapter, the study findings are summarized with the results of the hypothesis tests. In the following section, the implications of the study findings are discussed. The limitations of this study and suggestions for future research are also presented.

5.2. SUMMARY OF RESULTS: DEMAND MODEL I

The model was developed to examine the relationship between the measures of own price, events and trade in the hotel market of metropolitan Seoul. Three different price segments were applied, since the demand fluctuates by market segment. Two stage least squares (2SLS) estimation with instrument variables was conducted due to the endogeneity of price. Serial correlations were detected and a time dependent error process was performed where applicable.

Three major hypotheses developed from the model were tested to deal with the relationship between demand and its explanatory factors. The following are significant results of the hypotheses tested in this study:

Hypothesis 1.1. The price of accommodation (own price) is a significant factor that determines international demand for each segment. The price affects the demand negatively.

Hypothesis 1.2. The number of events held in the destination area has a positive effect on the international hotel demand for each segment.

Hypothesis 1.3. The total volume of trade in the destination country has a positive effect on the international hotel demand for each segment.

The results of 2SLS revealed that the explanatory factors — which were own price, the number of events and, the volume of trade — had significant impact on the international hotel demand. The research hypotheses 1.1 through 1.3 were supported.

The price elasticities were -0.26, -0.24, and -0.87 for segment of Deluxe-A, Deluxe-B and First class hotels, respectively. Demand for high price segments (Deluxe-A and Deluxe-B) were found to be more price-inelastic than for the low price segment (First class), supporting findings of previous study (Greenberg 1985).

The variable of business activities — such as trade volume and frequency of hosting conventions, meetings and exhibitions — was found to be a significant factor that affects international hotel demand in the metropolitan Seoul area.

5.3. SUMMARY OF RESULTS: DEMAND MODEL II

The Demand Model I was extended to the entire market level based on the hypothesis that the demand of a single market is a function of the entire market mechanism. A structural equation model (Equations 3.6 through 3.11) was initially developed and revised as in the Equations 4.9 through 4.14. For the demand equation six major hypotheses were explored and tested as follows:

Hypothesis 2.1. International hotel demand for Deluxe-A hotels has a positive relationship with the demand for Deluxe-B hotels.

Hypothesis 2.2. International hotel demand for Deluxe-A hotels has a positive relationship with the price of Deluxe-B hotel rooms.

The demand for Deluxe-A hotels was found to be significantly affected by the demand and the price of Deluxe-B hotel rooms, which is the next lower-rate segment in the market. The demand for Deluxe-B had a positive effect on the demand for Deluxe-A hotels. The price for Deluxe-B also had a positive effect, as opposed to the effect of its own price. Cross-segment price elasticity was found to be positive and significant. The research hypotheses 2.1 and 2.2 were retained.

Hypothesis 2.3. International hotel demand for Deluxe-B hotels has a positive relationship with the demand for Deluxe-A and the First class hotels.

The demand for Deluxe-B hotels was found to be significantly affected by demand for both Deluxe-A and First class hotel rooms. The demand for the mid-rate segment is significantly influenced by demand for both high- and low-rate segments. The hypothesis 2.3 was retained.

Hypothesis 2.4. International hotel demand for Deluxe-B hotels has a positive relationship with the price of Deluxe-A and First class hotel rooms.

The demand for Deluxe-B hotels was found to be significantly affected by the price of Deluxe-A hotel rooms. The demand, however, was not significantly affected by the price of First class hotel rooms, even though the sign of the coefficient was positive as expected. The hypothesis 2.4 was partially supported.

Hypothesis 2.5. International hotel demand for First class hotels has a positive relationship with the demand for Deluxe-B hotels.

Hypothesis 2.6. International hotel demand for First class hotels has a positive relationship with the price of Deluxe-B hotel rooms.

The demand for the First class hotels were found to be significantly affected by the demand and the price of Deluxe-B hotel rooms, which is the next higher-rate category in the market. The demand for Deluxe-B hotels had a positive effect on demand for First class hotels, and the price also had a positive effect, as opposed to the effect of its own price. Cross-segment price elasticity of demand for First class hotels was found to be positive and significant. The research hypotheses 2.5 and 2.6 were retained.

From the demand equations, one important finding of this study is that a cross-segment substitution effect on the demand side is quite relevant for the international lodging market in Seoul. The increase of price of a market segment increases the demand for other market segments. Secondly, demand for a market segment fluctuates in the same direction as the total market demand changes.

For the price equations, six hypotheses were developed and tested as follows:

<u>Hypothesis 3.1.</u> The price of international hotel rooms is determined by the demand for the international hotel rooms simultaneously. The price has a negative relationship with the demand.

The signs of coefficients of demand variables were negative as expected in all three price equations. That was just the reverse of the relationship in the demand equation. The significance of coefficients, however, were found only in the price equation for First class hotels. Thus, the hypothesis 3.1 was partially supported.

<u>Hypothesis 3.2.</u> The price of international hotel rooms is positively affected by the price of the previous year.

Lagged price variables were not all significant in the equations, even though the signs were all positive, as expected. The lagged price had a significant influence on the current price level only for the Deluxe-A class. The hypothesis 3.2 was partially supported.

<u>Hypothesis 3.3.</u> The price of international hotel rooms is positively influenced by the change of room availability.

The supply of rooms measured by the ratio of rooms available to the total rooms in the market was not found significant in the short run. The change of available rooms was not flexible enough to influence price in response to demand. The hypothesis 3.3 was not supported.

<u>Hypothesis 3.4.</u> The price of international hotel rooms has a negative relationship with the variables of exchange rates.

The exchange rate was proved to have negative impact on the price of rooms. Significance, however, was found only in the Deluxe-A segment. The hypothesis 3.4 was partially supported.

Hypothesis 3.5. The price of international hotel rooms is positively affected by the consumer price index of the destination area.

The consumer price level of the destination area was found to have significant impact on the price of hotel rooms in all three market segments. The hypothesis 3.5 was retained.

Hypothesis 3.6. The price of international hotel rooms is affected by seasonality.

The price for the hotel room for international guests was found to have significant seasonality of peak- and off-seasons. The hypothesis 3.6 was retained.

From the price equations, some important findings are presented. First, price is determined within the market system. The market price of lodging services is related to demand and supply influences at the same time. This argument is supported by the findings of previous studies (Ismail 1993; Fujii, Khaled and Mak 1985b). Secondly, both lagged price and seasonality have a significant influence on the price of international hotel rooms. That is, the market performance of the previous season would significantly affect current management decisions on international lodging in Seoul.

Thirdly, the economic factors such as exchange rates and consumer price index have direct effects on the price level of international hotel rooms. Unlike previous tourism studies (Moshirian 1993, Uysal 1985, Little 1980) - which included exchange rates as an explanatory variable in the demand equation - the variable was hypothesized to influence price directly and then influence demand indirectly. Even though the hypothesis was only partially supported, it is quite logical that the price of international hotel rooms are affected by exchange rates. The results also support the argument that exchange rate on its own is not an acceptable proxy for the cost of tourism that affects tourism demand (Witt and Witt 1995). The consumer price index has been regarded as a reasonable proxy for the cost of tourism (Witt and Witt 1995; Martin and Witt 1987) and also used as a proxy for shopping and hotel prices (Gunadhi and Boey 1986) in tourism demand studies. This variable, however, might be irrelevant to include in the demand model for international hotel rooms for this study, since it has been found to be a significant factor in the price equation only. But, it appears to have an indirect effect on the demand through changes of price.

Finally, the supply of rooms does not seem to affect the price level of international hotel rooms, which changes in response to changes in demand. Because of rigidity of room supply, the supply side of the lodging industry cannot respond to changes of rooms demanded in the short-run. Therefore, the availability of rooms is not a significant factor that affects the price of international hotel rooms in Seoul. In other words, hotels can only manipulate prices in response to the level of rooms demanded in the short-run, given fixed supply of rooms.

5.4. IMPLICATIONS OF THE MODEL RESULTS

The change in demand is not easy to explain. It cannot be tied to a single variable or a set of indices, since demand fluctuates by market segment based on numerous interrelated variables (Culligan 1990). The findings of this study, however, provide some valuable implications for demand studies in the hospitality and tourism industry. First, significant factors that directly affect the demand were delineated. Those variables were own price, number of events, and total trade volume. Some factors were proved to affect the demand indirectly through adjustment of price in the short run. Further, this study revealed that demand is a function of the entire market mechanism, which is the interrelationship of demand and price among market segments.

Price is probably one of the most important variables in the demand study, because market behavior is determined by the interaction of numerous supply and demand determinants, of which price is the one. In addition, from the hotel's perspective, price deserves special attention, since it is one of the few major variables under management's control (Greenberg 1985). The study revealed that both own prices and most of the cross-segment prices were significant factors affecting international hotel demand for the segment estimated. The price elasticities, however, were measured differently when the consumers trading towards the other segments are being considered. The different price- categories of services seem to provide more flexibility to the customers when choosing the hotel service. It is likely that segments of the industry tend to exhibit less price sensitivity than is measured by the manner of the aggregate market (Ismail 1993). Consequently the price elasticities of room demand for high priced properties were estimated higher in their absolute values when the aggregate market was considered rather than estimated from a single market segment.[10]

Even though international tourism products have been generally known as luxurious, tourism is no longer a movement confined to one privileged class (Uysal 1985). It has become a movement in which almost everyone in the industrial and developing countries is able to participate.

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[10] Price elasticities in the single market model (Model I) were -0.26 for Deluxe-A and -0.24 for Deluxe-B (Table 4.8). Elasticities, however, were increased in absolute value to -0.77 and -0.89 (Table 4.6) respectively in the aggregate market model (Model II).

This makes the demand for international hotels in Seoul even more price sensitive. Thus, the prices of lodging in Seoul should remain competitive if the country is to exploit its tourist potential effectively. From a policy maker's point of view, the appropriate market mix of price-segmentation, i.e., Deluxe-A, Deluxe-B, First class, etc., should be well maintained by monitoring the number of rooms supplied and the price level in order to be competitive among countries in the Pacific Rim.

Analysis of external impact factors shows that the attractiveness of events and the level of the nation's trade volume were both found to be highly significant in the demand equations. In previous studies, mega events such as EXPO (Kwack 1972) and the Olympic Games (Loeb 1982; Schulmeister 1979) were examined in various aspects of a tourism context and were found to be significant factors that affect tourist flows. Actually, mega-events such as the 1986 Asian Games, the 1988 Olympic Games, and the 1993 EXPO contributed to the growth of tourism in Seoul and Korea. However, attractiveness of on-going events - such as meetings, conventions, and exhibitions - has been found to be as important as those mega events in Seoul, though these variables have typically been neglected in hospitality and tourism studies. Projected events in an area would be a valuable indicator for hotel management to forecast the lodging demand for the area in the future. Even though the hotel industry has minimum control over the frequency of various events held, they at least try their best to provide a venue for hosting such events by providing quality service, so that the lodging industry in Seoul could implant favorable images on the organizers and the participants of the events.

International business activity - that can be represented as the total volume of import and export - has also rarely been included in previous studies of hospitality and tourism demand. This variable could represent the business travelers better than any other economic variables, such as disposable income, gross national product, etc., because business travelers are less sensitive to changes in income and prices; it also represents the familiarity that arises between the two trading nations, which tends to induce pleasure travelers as well. Therefore, as the results of this study imply, the trend of international trade can be a good indicator of international hotel demand. Recent economic developments in the country are likely to have contributed to the growth of tourism in Korea. Therefore, the government's efforts to keep the country's economy growing is critical factor to the international lodging market of Seoul.

As Fujii, Khaled, and Mak (1985b) argue, the market price of lodging services is assumed to be related to demand and supply influences. This argument was partially supported by the findings of this study. Since demand and supply have reciprocal effects with each other by way of price, the factors that influence price also impact demand indirectly. The demand for tourism products, including lodging, has been known to vary seasonally; and thus price changes seasonally to attract more customers during off-season and to maximize profit during peak season. However, because of a competitive market situation and maximum efforts in marketing strategy to penetrate a new market segment, especially in the off-peak season, the seasonal effect on demand is less clear than the seasonal effect on price, especially in the Seoul lodging market. The price lagged one year was found to be significant. This also implies a seasonal fluctuation of demand, to which prices are adjusted. The level of demand and price in the previous season, therefore, should be reflected in current management decisions.

The economic variables - such as exchange rates and consumer price index - were found to have a significant effect on the price of rooms for foreign travelers. These variables are the ones that can often be found in the demand equations, regardless of their significance. In this study, however, these were found to have a rather indirect effect on demand. This can be justified in that travelers often do not have exact knowledge about the purchasing power of their own currency against currency in the destination country, and about consumer price levels in the destination area. Prices of the tourism products are often the only factors by which the traveler can assume the overall economic condition of the destination area. However, assessing and monitoring the local industry's economic conditions is critical to hotel operators, convention bureau executives, and other local travel and lodging industry decision makers, since they influence the price level of lodging directly. Therefore, it is essential to have a policy which can create and maintain a stable economic environment in the country.

The supply of rooms, measured by the ratio of rooms available in a segment relative to total rooms available in the region, was not found to have a significant effect on price. This implies that the lodging supply cannot be adjusted to changes in demand in the short run. Because of the fixed supply of rooms, the price is the only variable to manipulate the supply side in the short run. It also implies that the fixed supply of rooms could place constraints on the demand for hotel rooms. Hotels in Seoul are managing high occupancy with high rates during peak-season, especially for Deluxe-A class hotels. This peak demand could be spread throughout the year by planning the long-run supply of rooms ahead, as well as pricing.

Demand equations in Model II also imply that the fixed supply of accommodations influences demand patterns and pricing accordingly. Results of demand equations show that demand variables (demand1, demand2, and demand3 in Table 4.9) of other segments were all significant. It implies not only that individual demand is a function of the entire market mechanism, but also that a certain amount of demand flows are directed to and from different market segments. In the peak season, due to the limited supply of rooms in a hotel property, travelers are often turned away to or forced to stay in other hotel properties when the occupancy is full. Sometimes travelers are indifferent to the service (or price) of hotel rooms, especially when the rooms are scarce. In the off-season, hotel operators can react quickly to offer lower rates or special packages, hoping to increase market penetration. Consequently, the demand for each segment changes in the same direction as the overall market demand changes.

This study revealed that demand for international lodging in Seoul appears to be price-inelastic, meaning elasticities found in the study are less than 1 (one) in absolute values. When the demand is inelastic to price, the increase in rooms demanded by decreasing price cannot offset the loss of total revenue due to price cut. If the supply of rooms affects the price level negatively, the increase of supply does not seem to generate additional revenue at an individual property level especially for high-rate segments. However, from policy makers' point of view, it may not be desirable that some groups of hotels in an area may prosper by charging extremely high room rates to international travelers. They may want to promote the country's entire tourism resources equally. Especially for the developing countries, the number of tourists induced to the country would be the first concern, since tourists do not spend money on accommodations only.

There exists a price discrimination in hotel pricing. For individual travelers, hotels may charge maximum rates, and for group travelers, they charge relatively low contracted or discounted rates. Therefore, even if the increase of room supply may decrease the average price of hotels rooms, it could be possible that the price cut would affect more price sensitive customers, given that the industry has a certain amount of controlling power in price differentials. Eventually, the industry could increase total receipts without cutting prices for the most high-priced customer segment.

Other things being equal, the greater the availability of substitutes, the more likely that the demand for the product will be elastic. Conversely, the smaller the availability of substitutes, the more likely that the demand will prove to be inelastic (Shapiro 1985). The hotel industry in Seoul is managing high occupancy and high room rates especially in the peak season for all three segments, implying that there are not many substitutes in accommodation. Even if demand is directed to and from the segments, the market does not look very competitive among segments, suggesting that segments can independently set prices. They seem to be taking advantage of the seller's market. Therefore, they can increase supply of rooms without cutting price to a certain extent. If there is enough demand, total receipts can be increased by increasing supply of rooms, not because of inelasticity of demand but because of a shift of the demand schedule (assuming that the increase of supply would change the demand schedule, in fact this seems possible during the peak season). Once the market is penetrated by shifting the demand level, repeated business can also be expected in the off-season.

Again, the peak demand should be spread throughout the year by controlling long-run supply and price of the hotel rooms in Seoul.

5.5. CONCLUSION

The major goal of this research was to examine the determinants of the demand for international lodging in the Seoul area by developing a model capable of analyzing the market behavior of selected segments. The segments were defined as Deluxe-A, Deluxe-B, and First class hotels. Deluxe-A represents the high-rate segment, Deluxe-B represents the mid-rate segment, and First class, the low-rate segment.

Demand Model I, which accounts for demand for each market segment, was first developed. The model included several constructs which had been ignored by most tourism demand researchers. The effects of business activities (such as trade volume and events), a supply factor (room availability), and a lagged structure of tourism demand were all examined. The model developed to explain actual foreign bednights and price of lodging treated both variables as endogenous. That is to say that both variables are simultaneously determined.

Demand Model I was further expanded to develop an overall market model (Demand Model II) by incorporating segmentation variables into the model. The inclusion of segmentation into the model enabled the analysis of interdependence of market segments that affect demand. Along with the incorporation of a time series structure, a system of equations was employed for Demand Model II.

This study also attempted to show the process of model development and accordingly, the appropriate analytic techniques were applied. Even if each model (Demand Model I and II) has its own implications, some explanations appeared redundant and were carefully treated to avoid duplications.

As Summary (1987) indicated, typical multivariate demand functions estimated by ordinary least squares regression may not represent the optimal technique to use in all hospitality and tourism demand studies. Current tourism flows are determined by the relevant variables indirectly, via past tourism flows, as well as directly. If the impact of past tourism is neglected, the effect of the relevant variables considered will tend to be overestimated. This is quite obvious. When the regression line is fit under the assumption that the error terms are not autocorrelated, the variance will be seriously underestimated. Thus, the regression line appears to fit the data much more accurately than it should. In addition, a single equation econometric model might no longer be valid for explaining market demand, because price - which is the most important variable in the demand function - is believed to change simultaneously with demand. Further, the single equation model cannot explain the mechanism of the entire market behavior, which, in this study, was handled by inclusion of the segmentation variables.

5.6. LIMITATIONS OF THE RESEARCH

The primary limitation of this study is the lack of available data points for the simultaneous analysis. Sixty data points for five years were collected, and twelve data points were removed from the analysis due to inclusion of lagged variable(s). Another data point was lost when the first order autoregressive error process was performed.

Consequently the reciprocal relationship between demand and supply (or price) could only be found to be partially significant. Instead, if data from the individual properties had been available, the analysis could have been more dynamic. In addition the problem of a limited dependent variable that occurs when the room occupancy is full could have been approached. Actually, a non-linear estimation of the limited dependent variable had been attempted, but failed due to the small sample size.

The second limitation of this study is the lack of consumer information. Even though the segmentation was included in the analysis, it was basically from the industry segment that is grouped by the quality of service and thus differentiated by price. It does not account for changes in tastes or preferences that can be accounted for at the consumer demand level.

The final obvious limitation of this study is that the models do not account for supply adjustment to changes in demand in the long run. Long-run supply equations can be developed using factors such as price of lodging over time and the cost of capital and labor. Since it takes years of time to build a hotel, this kind of model requires a longer range of time data then that of the models in this study. Instead, this study concentrated on the short-term analysis using a monthly data set.

5.7. SUGGESTIONS FOR FUTURE RESEARCH

Even though this study revealed information about the role of segmentation to account for market demand, the model can be further expanded to account for the demand shift of consumer segments by the change of market variables and external variables. For example, the incorporation of data from the consumer side, i.e., business vs. pleasure travelers, origin of tourists, preferences of travelers, would enhance the potential of the demand model.

Since the context of this study was limited to the Seoul area, it is suggested to replicate this study for similar areas where both business and pleasure travelers consist of major hotel guests, such as New York, Tokyo, and Hong Kong. Through replication, the generalizability of the findings of this study could be validated and cross-sectional comparison among the city travelers could be possible: This could reveal more factors that significantly shift the lodging demand.

REFERENCES

Arbel, A. and A. Pizam (1977). "Some Determinants of Urban Hotel Location: the Tourists' Inclinations." Journal of Travel Research. 15, 18-22.

Arbel, A. and S. A. Ravid (1983). "An Industry Energy Price Impact Model: The Case of the Hotel Industry." Applied Economics. 15, 705-714.

Arbel, A. and S. A. Ravid (1985) "On Recreation Demand: A Time-Series Approach." Managerial and Decision Economics. 17(6): 979-990.

Archer, B. H. (1980). "Forecasting Demand - Quantitative and Intuitive Techniques." International Journal of Tourism Management. 1(1): 5 -12.

Archer, Brian H. (1976). "Demand Forecasting In Tourism." Bangor Occasional Papers In Economics. Edited By Jack Revell. Vol. 9. University of Wales Press.

Armstrong, C. W. G. (1972). "International Tourism: Coming or Going, The Methodological Problems of Forecasting." Futures, 4(2): 115 - 25.

Barry, Kevin and John O'Hagan (1972). "An Econometric Study of British Tourist Expenditure in Ireland." Economics and Social Review, 3(2): 143-61.

Baum, Tom and Ram Mudambi (1995). "An Empirical Analysis of Oligopolistic Hotel Pricing." Annals of Tourism Research. 22(3): 501-506.

Bechdolt, B. V. (1973). "Cross-Sectional Travel Demand Functions: U. S. Visitors to Hawaii, 1961-70." Quarterly Review of Economics and Business" 13(4): 37-47.

Bond, Marian E. and Jerry R. Ladman (1972). "International Tourism and Economic Development: A Special Case for Latin America." Mississippi Valley Journal of Business and Economics. 8(Fall), 43-55.

Box,George E. P., G. M. Jenkins and G. C. Reinsel (1994). Time Series Analysis: Forecasting and Control. Third Edition. Prentice-Hall.

Carey, Kathleen (1991). "Estimation of Caribbean Tourism Demand: Issues in Measurement and Methodology." Atlantic Economic Journal 19(3): 32-40.

Chadee, D. and Z. Mieczkowski (1987). "An Empirical Analysis of the Effects of Exchange Rate on Canadian Tourism." Journal of Travel Research. 26(1): 13-18.

Choy, Dexter J. L. (1985). "Forecasting Hotel-Industry Performance." Tourism Management. (March), 4-7.

Clawson, J and J. L. Knetsch (1966). Economics of Outdoor Recreation. Johns Hopkins Press, Published for Resources for the Future.

Crouch, Geoffrey I. (1992). "Effect of Income and Price on International Tourism." Annals of Tourism Research. 19(4): 643-664.

Crouch, Geoffrey I. (1994a). "The Study of International Tourism Demand: A Survey of Practice." Journal of Travel Research. (Spring), 32(4): 41-55.

Crouch, Geoffrey I. (1994b). "The Study of International Tourism Demand: A Review of Findings." Journal of Travel Research. (Summer), 12-23.

Culligan, P. E. (1990). "Hotel Operations: Looking Up: Lodging Supply and Demand. Cornell Hotel and Restaurant Administration Quarterly. 31(2): 32-35.

Davies, Brian and Jean Mangan (1992). "Family Expenditure On Hotel And Holidays". Annals of Tourism Research. 19, 691-699.

Eadington, William R. and Milton Redman (1991). "Economics and tourism." Annals of Tourism Research. 18, 41-56.

Economist Intelligence Unit (EIU). (1975). "Currency Changes, Exchange Rates and Their Effects on Toiurism." International Tourism Quarterly, Special Article No. 18, 4: 34-45.

Eellerbrock, M. J., J. C. Hite, and G. J. Wells (1984). "Competition and lodging room rate." International Journal of Hospitality Management. 3(1): 11-18.

Faulkner, B. (1988). "Patterns of Tourism Demand in Australia: An Analysis of Recent Trends." BTR Occasional Paper No. 4 Canberra: Bureau of Tourism Research.

Frechtling, D. (1987). "Assessing the Impacts of Travel and Tourism - Measuring Economic Benefits." In Travel, Tourism and Hospitality Research, edited by J. B. Ritchie and C. R. Goeldner.

Fujii, Edwin T. and James Mak (1980). "Forecasting Travel Demand When the Exploratory Variables are Highly Correlated." Journal of Travel Research. 18(4): 31-34.

Fujii, Edwin T., Mohammed Khaled and James Mak (1985a). "An Almost Ideal Demand System for Visitor Expenditures." Journal of Transport Economics and Policy. 19(2): 161-71.

Fujii, E., Mohammed Khaled and James Mak (1985b). "The exportability of hotel occupancy and other tourist taxes." National Tax Journal, 38, 169-177.

Goldberger, Arthur S. (1991). A Course in Econometircs. Harvard University Press, Cambridge, Massachusetts.

Gray, H. Peter (1966). "The Demand for International Travel by the United States and Canada." International Economic Review. 7(1): 83-92.

Greenberg, Carol (1985). "Focus on Room Rates and Lodging Demand." Cornell Hotel and Restaurant Administration Quarterly, 26(November): 10-11.

Greene, William H. (1993). Econometric Analysis. Second Edition. Macmillan.

Gunadhi, Himawan, and Chow Kit Boey (1986). "Demand Elasticities of Tourism in Singapore." Tourism Management 7(4): 239-53.

Gunn, C. (1979). Tourism Planning. Crane Russak, New York.

Guthrie, H. W. (1961). "Demand for Tourists' Goods and Services in a World Market." Papers and Proceedings of the Regional Science Association. 7, 159-75.

Hiemstra, S. J., and J. A. Ismail (1993). "Incidence of the impacts of room taxes on the lodging industry. Journal of travel Research, 31(4): 22-26.

International Monetatry Fund (IMF) (1996). International Financial Statistics.

Ismail, J. A. (1993). Simultaneous Estimation of Supply and Demand for United States Lodging. Ph.D. diss., Purdue University.

Jeffrey, D. And N. J. Hubbard (1988). "Foreign Tourism, the Hotel Industry and Regional Economic Performance." Regional Studies. (August), 22(4): 319-24.

Johnson, Peter and Barry Thomas (1992). "The Analysis of Choice and Demand in Tourism" In Choice and Demand In Tourism. Edited by Peter Johnson and Barry Thomas. pp. 1-12. Mansell Publishing Limited, London, England; New York.

Johnson, Peter and John Ashworth (1990). "Modeling Tourism Demand: A Summary Review." Leisure Studies. 9, 145-160.

Jud, G. D. and H. Joseph (1972). "International Demand for Latin American Tourism" Growth and Change. 245-256.

Jud, G. D. and M. V. Rulison (1983). "An index of North Carolina travel and tourism." Journal of Travel Research. 21(3): 13-15.

Kennedy, Peter (1979). A Guide to Econometrics. The MIT Press. Cambridge, Massachusetts.

Kliman, M. L. (1981). "A Quantitative Analysis of Canadian Overseas Tourism." Transportation Research. 15(6): 487-497.

Korea National Tourism Corporation (KNTC). (1994). Annual Statistical Report on Tourism. Seoul, Korea.

Korea National Tourism Corporation (KNTC). (1991-1995). Korea Convention and Exhibitions Calendar. Vol.11-15, Seoul Korea.

Korea Tourism Association (KTA). (1991-1995). Monthly Report for Hotel Performance. Seoul, Korea.

Kwack, Sung Y. (1972). "Effects of Income and Prices on Travel Spending Abroad, 1960 III-1967 IV." International Economic Review. 13(2): 245-56.

Laber, Gene (1969). "Determinants of International Travel between Canada and the United States." Geographical Analysis. 1(4): 329-36.

Lee, Choong-Ki and Kyung-Sang Kwon (1995). "Importance of Secondary Impact of Foreign Tourism Receipts on the South Korea Economy." Journal of Travel Research. (Fall), 50-54.

Leibenstein, H. (1950). "Bandwagon, Snob, and Veblen Effects in the Theory of Consumers' Demand." Quarterly Journal of Economics 64: 183-207.

Little, Jane Sneddon (1980). "International Travel in the US Balance of Payments." New England Economic Review. (May/June), 42-55.

Loeb, Peter D. (1982). "International Travel to the United States: An Econometric Evaluation." Annals of Tourism Research, 9(1): 7-20.

Lundberg, D. (1976). The Tourist Business. CPI. Boston.

Maddala, G. S. (1983). Limited-Dependent and Qualitative Variables in Econometrics. Cambridge University Press, New York.

Mak, James, James Moncur, and Dave Yonamine (1977). "Determinants of Visitor Expenditures and Visitor Length of Stay: A Cross-Section Analysis of US Visitors to Hawaii." Journal of Travel Research. 15(winter), 5-8.

Martin, Christine A., and Stephen F. Witt (1987). "Tourism Demand Forecasting Models: Choice of Appropriate Variable to Represent Tourists' Cost Of Living." Tourism Management. 8(3): 223-45.

Martin, Christine A. and Stephen F. Witt (1989). "Forecasting Tourism Demand: A Comparison of the Accuracy of Several Quantitative Methods." International Journal of Forecasting. 5, 7-19.

Morley, Clive L. (1991). "Modeling International Tourism Demand: Model Specification and Structure". Journal Of Travel Research. (summer), 40-44.

Morley, Clive L. (1994). "The Use of CPI for Tourism Prices In Demand Modeling." Tourism Management 15(5): 342-346.

Moshirian, Fariborz (1993). "Determinants of International Trade Flows in Travel and Passenger Services." The Economic Record. 69(206): 239-52.

Ostrom, Charles W. Jr. (1990). Time Series Analysis: Regression Techniques. Second Edition. Sage Publications, Inc.

Qiu, Hanqin and Junsen Zhang (1995). "Determinants of Tourist Arrivals and Expenditures in Canada." Journal Of Travel Research. (Fall), 43-49.

Quayson, Jojo and Turgut Var (1982). "A tourism Demand Function For the Okanagan, B.C." Tourism Management. 3(June), 108-15.

Rugg, Donald (1973). "The Choice of Journey Destination: A Theoretical and Empirical Analysis." Review of Economics and Statistics. 55(1): 64-71.

Samuelson, William F. and Stephen G. Marks (1995). Managerial Economics. Second Edition. The Dryden Press.

Seow, Greg (1981). "Economic significance of Tourism in Singapore." Malayan Economic Review. 24(2): 64-79.

Shapiro, M. (1985). Foundations of the Market-Price System. University Press of America. Lanham, Maryland.

Sheldon, Pauline J. (1993). "Forecasting Tourism: Expenditure versus Arrivals." Journal of Travel Research. (Summer), 32(1): 13-20.

Sheldon, Pauline J. and Turgut Var (1985). "Tourism Forecasting: A Review Of Empirical Research". Journal of Forecasting. 4, 183-195.

Schulmeister, Stephen (1979). Tourism and the Business Cycle: Econometric Models for the Purpose of Analysis and Forecasting of Short-term Changes in Demand for Tourism. Vienna: Austrian Institute for Economic Research.

Smeral, Egon (1988). "Tourism Demand, Economic Theory and Econometrics: An Integral Approach." Journal of Travel Research. 26(4): 38-42.

Stone, R. (1954). "Linear Expenditure System and Demand Analysis." The Economic Journal. 64, 511-527.

Summary, Rebecca (1987). "Estimation of Tourism Demand By Multivariable Regression Analysis". Tourism Management. (December), 317-322.

Sunday, A. A. (1978). "Foreign Travel and Tourism Prices and Demand." Annals of Tourism Research. 5(2): 268-273.

Theil, Henry (1971). Principle of Econometrics. New York, John Wiley. p.543.

Truett, Dale B. and Lila J. Truett (1987). "The Response of Tourism to International Economic Conditions: Greece, Mexico, and Spain." Journal of Developing Areas. 21(2): 177-90.

Truett, Lila J. and Dale B. Truett (1982). "Public Policy and the Growth of the Mexican Tourism Industry, 1970 - 79." Journal of Travel Research. 20 (3): 11-19.

Uysal, Muzaffer. (1985). "Construction of a Model Which Investigates the Impact of Selected Variables On International Tourist Flows." In the Battle for Marketing Share: Strategies in Research and Marketing. T.T.R.A. 16th Proceedings, Palm Springs, CA.

Uysal, Muzaffer and John L. Crompton. (1985). "An Overview of Approaches Used to Forecast Tourism Demand." Journal of Travel Research. 23(4): 7-15.

Uysal, Muzaffer and John L. Crompton. (1984a). "Demand for International Tourist Flows to Turkey." Tourism Management. 5(4): 288-297.

Uysal, Muzaffer and John L. Crompton. (1984b). "Identification of Key Variables Explaining International Tourist Flows to Turkey and Suggested Policy Implications." Journal of Turkish Economy and Tourism. 2(12): 4-14.

Uysal, Muzaffer and T. O'Leary. (1986). "A Canonical Analysis of International Tourism Demand." Annals of Tourism Research. 13(4): 651-655.

Van Dijk, J. C. and D. D. van der Stelt-Scheele (1993). "Price Formation in Tourism Industry Branches." Annals of Tourism Research. 20, 716-728.

Van Doorn, Joseph W. M. (1982). "Can Future Research Contribute to Tourism Policy?" Tourism Management (September), 149-166.

van Meerhaeghe, M. A. G. (1969). Price theory and Price Policy. Longmans, Green and Co Ltd.

Vanhove, N. (1980). "Forecasting in Tourism." The Tourist Review. 3, 2-7.

Vellas, Francois and Lionel Becherel (1995). International Tourism: An Economic Perspective. St. Martin's Press. New York.

Williams, A. V. and W. Zelinsky (1970). "On Some Patterns in international Tourist Flows." Economic Geography. 46 (October), 549-567.

Witt, Steven F. (1980a). "An abstract mode - abstract (destination) node model of foreign holiday demand." Applied Economics. 12(2): 163 -180

Witt, Steven F. (1980b). "An Econometric Comparison of U. K. and German Foreign Holiday Behavior." Managerial and Decision Economics. 1(3): 123-131.

Witt, S. F. and C. A. Martin (1987). "International Tourism-Demand Models - Inclusion of Marketing Variables." Tourism Management. 8(1): 33-40.

Witt, Steven F. and Christine A. Witt (1995). "Forecasting Tourism Demand: A Review of Empirical Research." International Journal of Forecasting. 11, 447-475.

Working, E. J. (1927). "What Do Statistical 'Demand Curves' Show?" Quarterly Journal Of Economics. 41(February), 212-235.

Appendix A. MicroTSP Output of Initial Estimation of Demand Model II

```
INST LTR LEVENT LAGP1 LAGP2 LAGP3 LEX1 LEX2 LEX3 LRA1 LRA2 LRA3 LCPI SEASON
 1:LB1=C(1)+C(2)*LP1+C(3)*LEVENT+C(4)*LTR+C(13)*LP2+C(14)*LB2+C(15)*LP3+C(16)*LB3
 2:LP1=C(5)+C(6)*LB1+C(7)*LAGP1+C(8)*LEX1+C(9)*LRA1+C(10)*LCPI+C(11)*SEASON
 3:LB2=C(31)+C(32)*LP2+C(33)*LEVENT+C(34)*LTR+C(42)*LB1+C(43)*LP1+C(44)*LB3+C(45)*LP3
 4:LP2=C(35)+C(36)*LB2+C(37)*LAGP2+C(38)*LEX2+C(39)*LRA2+C(40)*LCPI+C(41)*SEASON
 5:LB3=C(61)+C(62)*LP3+C(63)*LEVENT+C(64)*LTR+C(73)*LB2+C(74)*LP2+C(75)*LB1+C(76)*LP1
 6:LP3=C(65)+C(66)*LB3+C(67)*LAGP3+C(68)*LEX3+C(69)*LRA3+C(70)*LCPI+C(71)*SEASON

 Iteration 1
  C(1)     2.701168    C(2)    -0.747137    C(3)     0.020466    C(4)    -0.166814
  C(13)    0.735885    C(14)    0.795540    C(15)    0.280870    C(16)   -0.006424
  C(5)     12.28517    C(6)    -0.194232    C(7)     0.249407    C(8)    -2.190257
  C(9)     0.738352    C(10)    1.667387    C(11)    0.163639    C(31)    0.006368
  C(32)   -0.911782    C(33)    0.015968    C(34)    0.257121    C(42)    0.687500
  C(43)    0.760533    C(44)    0.150262    C(45)   -0.111799    C(35)    2.947235
  C(36)    0.134710    C(37)   -0.095542    C(38)   -2.222947    C(39)   -0.458545
  C(40)    2.880713    C(41)    0.292746    C(61)    1.517201    C(62)   -0.788335
  C(63)    0.006946    C(64)    0.357189    C(73)    0.704791    C(74)    0.858170
  C(75)   -0.025908    C(76)   -0.388746    C(65)    0.338660    C(66)   -0.363763
  C(67)    0.117404    C(68)   -0.977418    C(69)   -0.665141    C(70)    2.255234
  C(71)    0.069484
 Residual Covariance Matrix
   1,1     0.004663      1,2    0.000731      1,3   -0.003622      1,4     3.21E-05
   1,5     0.001873      1,6   -0.005903      2,2    0.009956      2,3    -0.001697
   2,4     0.000187      2,5    0.001311      2,6   -0.004270      3,3     0.004069
   3,4     0.001582      3,5   -0.002301      3,6    0.004844      4,4     0.024219
   4,5    -0.003120      4,6    0.000866      5,5    0.006075      5,6    -0.001604
   6,6     0.020896
 Determinant(Residual Covariance Matrix)  6.121E-14

 SYS - TSLS
 Date: 10-06-1996 / Time: 21:08
 SMPL range: 1991.01 - 1995.12
 Observations excluded because of missing data.
 Number of observations: 48
 System: TOTAL0 - 6 Equations
 ==========================================================================
                               Coefficients
 ==========================================================================
  C(1)     2.701168    C(2)    -0.747137    C(3)     0.020466    C(4)    -0.166814
  C(13)    0.735885    C(14)    0.795540    C(15)    0.280870    C(16)   -0.006424
  C(5)     12.28517    C(6)    -0.194232    C(7)     0.249407    C(8)    -2.190257
  C(9)     0.738352    C(10)    1.667387    C(11)    0.163639    C(31)    0.006368
  C(32)   -0.911782    C(33)    0.015968    C(34)    0.257121    C(42)    0.687500
  C(43)    0.760533    C(44)    0.150262    C(45)   -0.111799    C(35)    2.947235
  C(36)    0.134710    C(37)   -0.095542    C(38)   -2.222947    C(39)   -0.458545
  C(40)    2.880713    C(41)    0.292746    C(61)    1.517201    C(62)   -0.788335
  C(63)    0.006946    C(64)    0.357189    C(73)    0.704791    C(74)    0.858170
  C(75)   -0.025908    C(76)   -0.388746    C(65)    0.338660    C(66)   -0.363763
  C(67)    0.117404    C(68)   -0.977418    C(69)   -0.665141    C(70)    2.255234
  C(71)    0.069484
 ==========================================================================
                        Residual Covariance Matrix
 ==========================================================================
   1,1     0.004663      1,2    0.000731      1,3   -0.003622      1,4     3.21E-05
   1,5     0.001873      1,6   -0.005903      2,2    0.009956      2,3    -0.001697
   2,4     0.000187      2,5    0.001311      2,6   -0.004270      3,3     0.004069
   3,4     0.001582      3,5   -0.002301      3,6    0.004844      4,4     0.024219
```

4,5	-0.003120	4,6	0.000866	5,5	0.006075	5,6	-0.001604
6,6	0.020896						

Residual Correlation Matrix

1,1	1.000000	1,2	0.107218	1,3	-0.831555	1,4	0.003024
1,5	0.351924	1,6	-0.597999	2,2	1.000000	2,3	-0.266551
2,4	0.012024	2,5	0.168517	2,6	-0.296019	3,3	1.000000
3,4	0.159382	3,5	-0.462744	3,6	0.525303	4,4	1.000000
4,5	-0.257235	4,6	0.038511	5,5	1.000000	5,6	-0.142357
6,6	1.000000						

Determinant(Residual Covariance Matrix) 6.121E-14

SYS - TSLS // Dependent Variable is LB1
Date: 10-06-1996 / Time: 21:08
SMPL range: 1991.01 - 1995.12
Observations excluded because of missing data.
Number of observations: 48
System: TOTAL0 - Equation 1 of 6
Instrument list: C LTR LEVENT LAGP1 LAGP2 LAGP3 LEX1 LEX2 LEX3 LRA1 LRA2 LRA3 LCPI SEASON
LB1=C(1)+C(2)*LP1+C(3)*LEVENT+C(4)*LTR+C(13)*LP2+C(14)*LB2+C(15)*LP3+C(16)*LB3

	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C(1)	2.7011677	1.7634850	1.5317214	0.1335
C(2)	-0.7471365	0.2418123	-3.0897376	0.0036
C(3)	0.0204658	0.0306734	0.6672178	0.5085
C(4)	-0.1668136	0.2179682	-0.7653116	0.4486
C(13)	0.7358851	0.3467408	2.1222918	0.0401
C(14)	0.7955405	0.3164079	2.5142875	0.0161
C(15)	0.2808697	0.2309951	1.2159122	0.2311
C(16)	-0.0064237	0.2170746	-0.0295919	0.9765

R-squared	0.759343	Mean of dependent var	8.771189
Adjusted R-squared	0.717228	S.D. of dependent var	0.140668
S.E. of regression	0.074802	Sum of squared resid	0.223815
F-statistic	18.03022	Durbin-Watson stat	1.975288
Prob(F-statistic)	0.000000		

SYS - TSLS // Dependent Variable is LP1
Date: 10-06-1996 / Time: 21:08
SMPL range: 1991.01 - 1995.12
Observations excluded because of missing data.
Number of observations: 48
System: TOTAL0 - Equation 2 of 6
Instrument list: C LTR LEVENT LAGP1 LAGP2 LAGP3 LEX1 LEX2 LEX3 LRA1 LRA2 LRA3 LCPI SEASON
LP1=C(5)+C(6)*LB1+C(7)*LAGP1+C(8)*LEX1+C(9)*LRA1+C(10)*LCPI+C(11)*SEASON

	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C(5)	12.285170	6.8800911	1.7856116	0.0816
C(6)	-0.1942317	0.2550230	-0.7616242	0.4506
C(7)	0.2494073	0.1056350	2.3610295	0.0231
C(8)	-2.1902572	0.7808007	-2.8051423	0.0077
C(9)	0.7383520	1.1099776	0.6651954	0.5097
C(10)	1.6673866	0.4090328	4.0764125	0.0002
C(11)	0.1636389	0.0420835	3.8884311	0.0004

R-squared	0.792185	Mean of dependent var	4.587491
Adjusted R-squared	0.761773	S.D. of dependent var	0.221194
S.E. of regression	0.107961	Sum of squared resid	0.477883
F-statistic	26.04852	Durbin-Watson stat	1.486793
Prob(F-statistic)	0.000000		

SYS - TSLS // Dependent Variable is LB2
Date: 10-06-1996 / Time: 21:08
SMPL range: 1991.01 - 1995.12
Observations excluded because of missing data.
Number of observations: 48
System: TOTAL0 - Equation 3 of 6
Instrument list: C LTR LEVENT LAGP1 LAGP2 LAGP3 LEX1 LEX2 LEX3 LRA1 LRA2 LRA3 LCPI SEASON
LB2=C(31)+C(32)*LP2+C(33)*LEVENT+C(34)*LTR+C(42)*LB1+C(43)*LP1+C(44)*LB3 +C(45)*LP3

	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C(31)	0.0063684	1.9831454	0.0032113	0.9975
C(32)	-0.9117822	0.1866583	-4.8847656	0.0000
C(33)	0.0159679	0.0290201	0.5502353	0.5852
C(34)	0.2571205	0.1826380	1.4078154	0.1669
C(42)	0.6875004	0.2748795	2.5010976	0.0166
C(43)	0.7605331	0.1802170	4.2200975	0.0001
C(44)	0.1502620	0.1917649	0.7835737	0.4379
C(45)	-0.1117986	0.2393783	-0.4670374	0.6430

R-squared	0.800491	Mean of dependent var	8.440576
Adjusted R-squared	0.765576	S.D. of dependent var	0.144326
S.E. of regression	0.069879	Sum of squared resid	0.195321
F-statistic	22.92740	Durbin-Watson stat	1.554586
Prob(F-statistic)	0.000000		

SYS - TSLS // Dependent Variable is LP2
Date: 10-06-1996 / Time: 21:08
SMPL range: 1991.01 - 1995.12
Observations excluded because of missing data.
Number of observations: 48
System: TOTAL0 - Equation 4 of 6
Instrument list: C LTR LEVENT LAGP1 LAGP2 LAGP3 LEX1 LEX2 LEX3 LRA1 LRA2 LRA3 LCPI SEASON
LP2=C(35)+C(36)*LB2+C(37)*LAGP2+C(38)*LEX2+C(39)*LRA2+C(40)*LCPI+C(41)*SEASON

	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C(35)	2.9472347	13.562259	0.2173115	0.8290
C(36)	0.1347098	0.5079227	0.2652171	0.7922
C(37)	-0.0955421	0.2163873	-0.4415331	0.6611
C(38)	-2.2229467	2.0501812	-1.0842684	0.2846
C(39)	-0.4585449	1.0542939	-0.4349309	0.6659
C(40)	2.8807132	0.4777089	6.0302685	0.0000
C(41)	0.2927462	0.0841177	3.4801990	0.0012

R-squared	0.676048	Mean of dependent var	3.696379
Adjusted R-squared	0.628641	S.D. of dependent var	0.276318
S.E. of regression	0.168386	Sum of squared resid	1.162505
F-statistic	14.26036	Durbin-Watson stat	1.146011
Prob(F-statistic)	0.000000		

SYS - TSLS // Dependent Variable is LB3
Date: 10-06-1996 / Time: 21:08
SMPL range: 1991.01 - 1995.12
Observations excluded because of missing data.
Number of observations: 48
System: TOTAL0 - Equation 5 of 6
Instrument list: C LTR LEVENT LAGP1 LAGP2 LAGP3 LEX1 LEX2 LEX3 LRA1 LRA2 LRA3 LCPI SEASON
LB3=C(61)+C(62)*LP3+C(63)*LEVENT+C(64)*LTR+C(73)*LB2+C(74)*LP2+C(75)*LB1+C(76)*LP1

	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C(61)	1.5172014	2.3936408	0.6338467	0.5298
C(62)	-0.7883345	0.2258456	-3.4905902	0.0012
C(63)	0.0069455	0.0364350	0.1906272	0.8498
C(64)	0.3571888	0.2468888	1.4467598	0.1558
C(73)	0.7047907	0.5072489	1.3894378	0.1724
C(74)	0.8581699	0.4960829	1.7298922	0.0914
C(75)	-0.0259078	0.4988337	-0.0519367	0.9588
C(76)	-0.3887456	0.4535303	-0.8571547	0.3965

R-squared	0.917902	Mean of dependent var	7.871359
Adjusted R-squared	0.903534	S.D. of dependent var	0.274910
S.E. of regression	0.085384	Sum of squared resid	0.291617
F-statistic	63.88854	Durbin-Watson stat	1.519153
Prob(F-statistic)	0.000000		

```
SYS - TSLS // Dependent Variable is LP3
Date: 10-06-1996 / Time: 21:08
SMPL range: 1991.01 - 1995.12
Observations excluded because of missing data.
Number of observations: 48
System: TOTAL0 - Equation 6 of 6
Instrument list: C LTR LEVENT LAGP1 LAGP2 LAGP3 LEX1 LEX2 LEX3 LRA1 LRA2
 LRA3 LCPI SEASON
LP3=C(65)+C(66)*LB3+C(67)*LAGP3+C(68)*LEX3+C(69)*LRA3+C(70)*LCPI+C(71)*S
EASON
```

	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C(65)	0.3386599	8.3815722	0.0404053	0.9680
C(66)	-0.3637625	0.3020758	-1.2042092	0.2354
C(67)	0.1174039	0.1154510	1.0169148	0.3152
C(68)	-0.9774180	1.1152607	-0.8764031	0.3859
C(69)	-0.6651406	0.8677490	-0.7665127	0.4478
C(70)	2.2552340	0.7167534	3.1464575	0.0031
C(71)	0.0694835	0.0630629	1.1018121	0.2770

R-squared	0.641058	Mean of dependent var	3.543852
Adjusted R-squared	0.588530	S.D. of dependent var	0.243832
S.E. of regression	0.156408	Sum of squared resid	1.003007
F-statistic	12.20411	Durbin-Watson stat	1.545373
Prob(F-statistic)	0.000000		

Appendix B. <u>Complete Output of MicrTSP Estimation of the Revised Demand Model II.</u>

```
INST LTR LEVENT LAGP1 LAGP2 LAGP3 LEX1 LEX2 LEX3 LRA1 LRA2 LRA3 LCPI SEASON
1:LB1=C(1)+C(2)*LP1+C(3)*LEVENT+C(13)*LP2+C(14)*LB2
2:LP1=C(5)+C(6)*LB1+C(7)*LAGP1+C(8)*LEX1+C(9)*LRA1+C(10)*LCPI+C(11)*SEASON
3:LB2=C(31)+C(32)*LP2+C(42)*LB1+C(43)*LP1+C(44)*LB3+C(46)*LP3
4:LP2=C(35)+C(36)*LB2+C(37)*LAGP2++C(38)*LEX2+C(40)*LCPI+C(41)*SEASON+[AR(1)=C(45)]
5:LB3=C(61)+C(62)*LP3+C(64)*LTR+C(72)*LB2+C(73)*LP2
6:LP3=C(65)+C(66)*LB3+C(67)*LAGP3+C(68)*LEX3+C(70)*LCPI+C(71)*SEASON
Observations excluded because of missing data.


Iteration 1
 C(1)      3.797120    C(2)    -0.773557    C(3)      0.038723    C(13)     0.741463
 C(14)     0.671609    C(5)     12.26654    C(6)     -0.193215    C(7)      0.249640
 C(8)     -2.188605    C(9)     0.736079    C(10)     1.666499    C(11)     0.163535
 C(31)    -0.537499    C(32)   -0.888208    C(42)     0.651932    C(43)     0.743335
 C(44)     0.344876    C(46)    0.118042    C(35)    -1.541038    C(36)    -0.070276
 C(37)    -0.012084    C(38)   -1.463802    C(40)     3.198744    C(41)     0.279311
 C(61)     1.518522    C(62)   -0.691720    C(64)     0.364032    C(72)     0.568768
 C(73)     0.526889    C(65)    3.221665    C(66)    -0.483752    C(67)     0.096587
 C(68)    -1.228587    C(70)    2.467030    C(71)     0.092093
Residual Covariance Matrix
   1,1     0.002826     1,2     0.000109     1,3     -0.001629     1,4    -0.001803
   1,5    -7.98E-05     1,6     0.001439     2,2      0.009967     2,3    -0.001472
   2,4     0.000718     2,5    -0.001701     2,6     -0.003713     3,3     0.003407
   3,4     0.000267     3,5    -0.002536     3,6      0.002845     4,4     0.019601
   4,5     0.002378     4,6     0.001779     5,5      0.008687     5,6    -0.001184
   6,6     0.016190
Determinant(Residual Covariance Matrix)   4.507E-14

Iteration 2
 C(1)      3.797120    C(2)    -0.773557    C(3)      0.038723    C(13)     0.741463
 C(14)     0.671609    C(5)     12.26654    C(6)     -0.193215    C(7)      0.249640
 C(8)     -2.188605    C(9)     0.736079    C(10)     1.666499    C(11)     0.163535
 C(31)    -0.537499    C(32)   -0.888208    C(42)     0.651932    C(43)     0.743335
 C(44)     0.344876    C(46)    0.118042    C(35)    -4.974705    C(36)    -0.010104
 C(37)     0.019779    C(38)   -1.084998    C(40)     3.260457    C(41)     0.256569
 C(61)     1.518522    C(62)   -0.691720    C(64)     0.364032    C(72)     0.568768
 C(73)     0.526889    C(65)    3.221665    C(66)    -0.483752    C(67)     0.096587
 C(68)    -1.228587    C(70)    2.467030    C(71)     0.092093    C(45)     0.444102
Residual Covariance Matrix
   1,1     0.002826     1,2     0.000109     1,3     -0.001629     1,4    -0.001803
   1,5    -7.98E-05     1,6     0.001439     2,2      0.009967     2,3    -0.001472
   2,4     0.000714     2,5    -0.001701     2,6     -0.003713     3,3     0.003407
   3,4     0.000114     3,5    -0.002536     3,6      0.002845     4,4     0.016892
   4,5     0.001817     4,6     0.000308     5,5      0.008687     5,6    -0.001184
   6,6     0.016190
Determinant(Residual Covariance Matrix)   4.004E-14

Iteration 3
 C(1)      3.797120    C(2)    -0.773557    C(3)      0.038723    C(13)     0.741463
 C(14)     0.671609    C(5)     12.26654    C(6)     -0.193215    C(7)      0.249640
 C(8)     -2.188605    C(9)     0.736079    C(10)     1.666499    C(11)     0.163535
 C(31)    -0.537499    C(32)   -0.888208    C(42)     0.651932    C(43)     0.743335
 C(44)     0.344876    C(46)    0.118042    C(35)    -7.363239    C(36)    -0.200146
 C(37)     0.104085    C(38)   -0.653498    C(40)     3.434546    C(41)     0.198764
 C(61)     1.518522    C(62)   -0.691720    C(64)     0.364032    C(72)     0.568768
```

C(73)	0.526889	C(65)	3.221665	C(66)	-0.483752	C(67)	0.096587
C(68)	-1.228587	C(70)	2.467030	C(71)	0.092093	C(45)	0.513827

Residual Covariance Matrix

1,1	0.002826	1,2	0.000109	1,3	-0.001629	1,4	-0.001569
1,5	-7.98E-05	1,6	0.001439	2,2	0.009967	2,3	-0.001472
2,4	0.001357	2,5	-0.001701	2,6	-0.003713	3,3	0.003407
3,4	0.000101	3,5	-0.002536	3,6	0.002845	4,4	0.013242
4,5	0.001665	4,6	-0.000370	5,5	0.008687	5,6	-0.001184
6,6	0.016190						

Determinant(Residual Covariance Matrix) 3.161E-14

Iteration 4

C(1)	3.797120	C(2)	-0.773557	C(3)	0.038723	C(13)	0.741463
C(14)	0.671609	C(5)	12.26654	C(6)	-0.193215	C(7)	0.249640
C(8)	-2.188605	C(9)	0.736079	C(10)	1.666499	C(11)	0.163535
C(31)	-0.537499	C(32)	-0.888208	C(42)	0.651932	C(43)	0.743335
C(44)	0.344876	C(46)	0.118042	C(35)	-6.007056	C(36)	-0.262083
C(37)	0.101986	C(38)	-0.779173	C(40)	3.436656	C(41)	0.199431
C(61)	1.518522	C(62)	-0.691720	C(64)	0.364032	C(72)	0.568768
C(73)	0.526889	C(65)	3.221665	C(66)	-0.483752	C(67)	0.096587
C(68)	-1.228587	C(70)	2.467030	C(71)	0.092093	C(45)	0.508602

Residual Covariance Matrix

1,1	0.002826	1,2	0.000109	1,3	-0.001629	1,4	-0.001544
1,5	-7.98E-05	1,6	0.001439	2,2	0.009967	2,3	-0.001472
2,4	0.001508	2,5	-0.001701	2,6	-0.003713	3,3	0.003407
3,4	0.000155	3,5	-0.002536	3,6	0.002845	4,4	0.012337
4,5	0.001725	4,6	-0.000393	5,5	0.008687	5,6	-0.001184
6,6	0.016190						

Determinant(Residual Covariance Matrix) 2.908E-14

Iteration 5

C(1)	3.797120	C(2)	-0.773557	C(3)	0.038723	C(13)	0.741463
C(14)	0.671609	C(5)	12.26654	C(6)	-0.193215	C(7)	0.249640
C(8)	-2.188605	C(9)	0.736079	C(10)	1.666499	C(11)	0.163535
C(31)	-0.537499	C(32)	-0.888208	C(42)	0.651932	C(43)	0.743335
C(44)	0.344876	C(46)	0.118042	C(35)	-5.737480	C(36)	-0.270579
C(37)	0.098461	C(38)	-0.798405	C(40)	3.424624	C(41)	0.202664
C(61)	1.518522	C(62)	-0.691720	C(64)	0.364032	C(72)	0.568768
C(73)	0.526889	C(65)	3.221665	C(66)	-0.483752	C(67)	0.096587
C(68)	-1.228587	C(70)	2.467030	C(71)	0.092093	C(45)	0.492377

Residual Covariance Matrix

1,1	0.002826	1,2	0.000109	1,3	-0.001629	1,4	-0.001545
1,5	-7.98E-05	1,6	0.001439	2,2	0.009967	2,3	-0.001472
2,4	0.001514	2,5	-0.001701	2,6	-0.003713	3,3	0.003407
3,4	0.000174	3,5	-0.002536	3,6	0.002845	4,4	0.012219
4,5	0.001760	4,6	-0.000323	5,5	0.008687	5,6	-0.001184
6,6	0.016190						

Determinant(Residual Covariance Matrix) 2.867E-14

Iteration 6

C(1)	3.797120	C(2)	-0.773557	C(3)	0.038723	C(13)	0.741463
C(14)	0.671609	C(5)	12.26654	C(6)	-0.193215	C(7)	0.249640
C(8)	-2.188605	C(9)	0.736079	C(10)	1.666499	C(11)	0.163535
C(31)	-0.537499	C(32)	-0.888208	C(42)	0.651932	C(43)	0.743335
C(44)	0.344876	C(46)	0.118042	C(35)	-5.770012	C(36)	-0.265591
C(37)	0.096952	C(38)	-0.795465	C(40)	3.419572	C(41)	0.204446
C(61)	1.518522	C(62)	-0.691720	C(64)	0.364032	C(72)	0.568768
C(73)	0.526889	C(65)	3.221665	C(66)	-0.483752	C(67)	0.096587
C(68)	-1.228587	C(70)	2.467030	C(71)	0.092093	C(45)	0.486650

Residual Covariance Matrix

1,1	0.002826	1,2	0.000109	1,3	-0.001629	1,4	-0.001549
1,5	-7.98E-05	1,6	0.001439	2,2	0.009967	2,3	-0.001472
2,4	0.001494	2,5	-0.001701	2,6	-0.003713	3,3	0.003407

3,4	0.000176	3,5	-0.002536	3,6	0.002845	4,4	0.012287
4,5	0.001769	4,6	-0.000289	5,5	0.008687	5,6	-0.001184
6,6	0.016190						

Determinant(Residual Covariance Matrix) 2.883E-14

Iteration 7

C(1)	3.797120	C(2)	-0.773557	C(3)	0.038723	C(13)	0.741463
C(14)	0.671609	C(5)	12.26654	C(6)	-0.193215	C(7)	0.249640
C(8)	-2.188605	C(9)	0.736079	C(10)	1.666499	C(11)	0.163535
C(31)	-0.537499	C(32)	-0.888208	C(42)	0.651932	C(43)	0.743335
C(44)	0.344876	C(46)	0.118042	C(35)	-5.840435	C(36)	-0.262206
C(37)	0.096632	C(38)	-0.789273	C(40)	3.419896	C(41)	0.204813
C(61)	1.518522	C(62)	-0.691720	C(64)	0.364032	C(72)	0.568768
C(73)	0.526889	C(65)	3.221665	C(66)	-0.483752	C(67)	0.096587
C(68)	-1.228587	C(70)	2.467030	C(71)	0.092093	C(45)	0.486242

Residual Covariance Matrix

1,1	0.002826	1,2	0.000109	1,3	-0.001629	1,4	-0.001551
1,5	-7.98E-05	1,6	0.001439	2,2	0.009967	2,3	-0.001472
2,4	0.001485	2,5	-0.001701	2,6	-0.003713	3,3	0.003407
3,4	0.000173	3,5	-0.002536	3,6	0.002845	4,4	0.012335
4,5	0.001768	4,6	-0.000283	5,5	0.008687	5,6	-0.001184
6,6	0.016190						

Determinant(Residual Covariance Matrix) 2.896E-14

Iteration 8

C(1)	3.797120	C(2)	-0.773557	C(3)	0.038723	C(13)	0.741463
C(14)	0.671609	C(5)	12.26654	C(6)	-0.193215	C(7)	0.249640
C(8)	-2.188605	C(9)	0.736079	C(10)	1.666499	C(11)	0.163535
C(31)	-0.537499	C(32)	-0.888208	C(42)	0.651932	C(43)	0.743335
C(44)	0.344876	C(46)	0.118042	C(35)	-5.886377	C(36)	-0.261576
C(37)	0.096714	C(38)	-0.784552	C(40)	3.421730	C(41)	0.204748
C(61)	1.518522	C(62)	-0.691720	C(64)	0.364032	C(72)	0.568768
C(73)	0.526889	C(65)	3.221665	C(66)	-0.483752	C(67)	0.096587
C(68)	-1.228587	C(70)	2.467030	C(71)	0.092093	C(45)	0.486970

Residual Covariance Matrix

1,1	0.002826	1,2	0.000109	1,3	-0.001629	1,4	-0.001550
1,5	-7.98E-05	1,6	0.001439	2,2	0.009967	2,3	-0.001472
2,4	0.001484	2,5	-0.001701	2,6	-0.003713	3,3	0.003407
3,4	0.000172	3,5	-0.002536	3,6	0.002845	4,4	0.012346
4,5	0.001766	4,6	-0.000286	5,5	0.008687	5,6	-0.001184
6,6	0.016190						

Determinant(Residual Covariance Matrix) 2.900E-14

Iteration 9

C(1)	3.797120	C(2)	-0.773557	C(3)	0.038723	C(13)	0.741463
C(14)	0.671609	C(5)	12.26654	C(6)	-0.193215	C(7)	0.249640
C(8)	-2.188605	C(9)	0.736079	C(10)	1.666499	C(11)	0.163535
C(31)	-0.537499	C(32)	-0.888208	C(42)	0.651932	C(43)	0.743335
C(44)	0.344876	C(46)	0.118042	C(35)	-5.923821	C(36)	-0.262025
C(37)	0.096873	C(38)	-0.779641	C(40)	3.423376	C(41)	0.204653
C(61)	1.518522	C(62)	-0.691720	C(64)	0.364032	C(72)	0.568768
C(73)	0.526889	C(65)	3.221665	C(66)	-0.483752	C(67)	0.096587
C(68)	-1.228587	C(70)	2.467030	C(71)	0.092093	C(45)	0.487431

Residual Covariance Matrix

1,1	0.002826	1,2	0.000109	1,3	-0.001629	1,4	-0.001549
1,5	-7.98E-05	1,6	0.001439	2,2	0.009967	2,3	-0.001472
2,4	0.001486	2,5	-0.001701	2,6	-0.003713	3,3	0.003407
3,4	0.000171	3,5	-0.002536	3,6	0.002845	4,4	0.012343
4,5	0.001765	4,6	-0.000289	5,5	0.008687	5,6	-0.001184
6,6	0.016190						

Determinant(Residual Covariance Matrix) 2.899E-14

Iteration 10

C(1)	3.797120	C(2)	-0.773557	C(3)	0.038723	C(13)	0.741463
C(14)	0.671609	C(5)	12.26654	C(6)	-0.193215	C(7)	0.249640
C(8)	-2.188605	C(9)	0.736079	C(10)	1.666499	C(11)	0.163535
C(31)	-0.537499	C(32)	-0.888208	C(42)	0.651932	C(43)	0.743335
C(44)	0.344876	C(46)	0.118042	C(35)	-5.939270	C(36)	-0.262535
C(37)	0.096822	C(38)	-0.777886	C(40)	3.425071	C(41)	0.204674
C(61)	1.518522	C(62)	-0.691720	C(64)	0.364032	C(72)	0.568768
C(73)	0.526889	C(65)	3.221665	C(66)	-0.483752	C(67)	0.096587
C(68)	-1.228587	C(70)	2.467030	C(71)	0.092093	C(45)	0.487592

Residual Covariance Matrix

1,1	0.002826	1,2	0.000109	1,3	-0.001629	1,4	-0.001548
1,5	-7.98E-05	1,6	0.001439	2,2	0.009967	2,3	-0.001472
2,4	0.001488	2,5	-0.001701	2,6	-0.003713	3,3	0.003407
3,4	0.000171	3,5	-0.002536	3,6	0.002845	4,4	0.012339
4,5	0.001765	4,6	-0.000290	5,5	0.008687	5,6	-0.001184
6,6	0.016190						

Determinant(Residual Covariance Matrix) 2.899E-14

SYS - Iterative TSLS
Date: 9-19-1996 / Time: 22:14
SMPL range: 1991.01 - 1995.12
Observations excluded because of missing data.
Number of observations: 48
System: CHECK - 6 Equations
Convergence achieved after 10 iterations

Coefficients

C(1)	3.797120	C(2)	-0.773557	C(3)	0.038723	C(13)	0.741463
C(14)	0.671609	C(5)	12.26654	C(6)	-0.193215	C(7)	0.249640
C(8)	-2.188605	C(9)	0.736079	C(10)	1.666499	C(11)	0.163535
C(31)	-0.537499	C(32)	-0.888208	C(42)	0.651932	C(43)	0.743335
C(44)	0.344876	C(46)	0.118042	C(35)	-5.939270	C(36)	-0.262535
C(37)	0.096822	C(38)	-0.777886	C(40)	3.425071	C(41)	0.204674
C(61)	1.518522	C(62)	-0.691720	C(64)	0.364032	C(72)	0.568768
C(73)	0.526889	C(65)	3.221665	C(66)	-0.483752	C(67)	0.096587
C(68)	-1.228587	C(70)	2.467030	C(71)	0.092093	C(45)	0.487592

Residual Covariance Matrix

1,1	0.002826	1,2	0.000109	1,3	-0.001629	1,4	-0.001548
1,5	-7.98E-05	1,6	0.001439	2,2	0.009967	2,3	-0.001472
2,4	0.001488	2,5	-0.001701	2,6	-0.003713	3,3	0.003407
3,4	0.000171	3,5	-0.002536	3,6	0.002845	4,4	0.012339
4,5	0.001765	4,6	-0.000290	5,5	0.008687	5,6	-0.001184
6,6	0.016190						

Residual Correlation Matrix

1,1	1.000000	1,2	0.020485	1,3	-0.524942	1,4	-0.262118
1,5	-0.016096	1,6	0.212770	2,2	1.000000	2,3	-0.252529
2,4	0.134185	2,5	-0.182771	2,6	-0.292313	3,3	1.000000
3,4	0.026448	3,5	-0.466106	3,6	0.383016	4,4	1.000000
4,5	0.170510	4,6	-0.020498	5,5	1.000000	5,6	-0.099803
6,6	1.000000						

Determinant(Residual Covariance Matrix) 2.899E-14

SYS - Iterative TSLS // Dependent Variable is LB1
Date: 9-19-1996 / Time: 22:14
SMPL range: 1991.01 - 1995.12
Observations excluded because of missing data.
Number of observations: 48
System: CHECK - Equation 1 of 6
Instrument list: C LTR LEVENT LAGP1 LAGP2 LAGP3 LEX1 LEX2 LEX3 LRA1 LRA2 LRA3 LCPI SEASON
LB1=C(1)+C(2)*LP1+C(3)*LEVENT+C(13)*LP2+C(14)*LB2
Convergence achieved after 10 iterations

	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C(1)	3.7971202	1.0214417	3.7174126	0.0006
C(2)	-0.7735570	0.1341056	-5.7682672	0.0000
C(3)	0.0387225	0.0128363	3.0166362	0.0043
C(13)	0.7414634	0.1087802	6.8161585	0.0000
C(14)	0.6716091	0.1341868	5.0050314	0.0000

R-squared	0.854150	Mean of dependent var	8.771189
Adjusted R-squared	0.840582	S.D. of dependent var	0.140668
S.E. of regression	0.056165	Sum of squared resid	0.135643
F-statistic	62.95568	Durbin-Watson stat	2.179055
Prob(F-statistic)	0.000000		

SYS - Iterative TSLS // Dependent Variable is LP1
Date: 9-19-1996 / Time: 22:14
SMPL range: 1991.01 - 1995.12
Observations excluded because of missing data.
Number of observations: 48
System: CHECK - Equation 2 of 6
Instrument list: C LTR LEVENT LAGP1 LAGP2 LAGP3 LEX1 LEX2 LEX3 LRA1 LRA2 LRA3 LCPI SEASON
LP1=C(5)+C(6)*LB1+C(7)*LAGP1+C(8)*LEX1+C(9)*LRA1+C(10)*LCPI+C(11)*SEASON
Convergence achieved after 10 iterations

	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C(5)	12.266542	6.8840261	1.7818849	0.0822
C(6)	-0.1932150	0.2551689	-0.7572043	0.4533
C(7)	0.2496403	0.1056954	2.3618842	0.0230
C(8)	-2.1886055	0.7812473	-2.8014247	0.0077
C(9)	0.7360790	1.1106124	0.6627686	0.5112
C(10)	1.6664992	0.4092668	4.0719141	0.0002
C(11)	0.1635349	0.0421076	3.8837391	0.0004

R-squared	0.791947	Mean of dependent var	4.587491
Adjusted R-squared	0.761501	S.D. of dependent var	0.221194
S.E. of regression	0.108023	Sum of squared resid	0.478430
F-statistic	26.01094	Durbin-Watson stat	1.486601
Prob(F-statistic)	0.000000		

SYS - Iterative TSLS // Dependent Variable is LB2
Date: 9-19-1996 / Time: 22:15
SMPL range: 1991.01 - 1995.12
Observations excluded because of missing data.
Number of observations: 48
System: CHECK - Equation 3 of 6
Instrument list: C LTR LEVENT LAGP1 LAGP2 LAGP3 LEX1 LEX2 LEX3 LRA1 LRA2 LRA3 LCPI SEASON
LB2=C(31)+C(32)*LP2+C(42)*LB1+C(43)*LP1+C(44)*LB3+C(46)*LP3
Convergence achieved after 10 iterations

	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C(31)	-0.5374988	1.1740486	-0.4578165	0.6494
C(32)	-0.8882083	0.1659570	-5.3520402	0.0000
C(42)	0.6519322	0.1507038	4.3259185	0.0001
C(43)	0.7433348	0.1488153	4.9950156	0.0000
C(44)	0.3448761	0.1209555	2.8512651	0.0067
C(46)	0.1180420	0.1507701	0.7829268	0.4381

R-squared	0.832964	Mean of dependent var	8.440576
Adjusted R-squared	0.813078	S.D. of dependent var	0.144326
S.E. of regression	0.062398	Sum of squared resid	0.163530
F-statistic	41.88848	Durbin-Watson stat	1.806218
Prob(F-statistic)	0.000000		

SYS - Iterative TSLS // Dependent Variable is LP2
Date: 9-19-1996 / Time: 22:15
SMPL range: 1991.01 - 1995.12
Observations excluded because of missing data.
Number of observations: 47
System: CHECK - Equation 4 of 6
Instrument list: C LTR LEVENT LAGP1 LAGP2 LAGP3 LEX1 LEX2 LEX3 LRA1 LRA2 LRA3 LCPI SEASON
LP2=C(35)+C(36)*LB2+C(37)*LAGP2++C(38)*LEX2+C(40)*LCPI+C(41)*SEASON+[AR(1)=C(45)]
Convergence achieved after 10 iterations

	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C(35)	-5.9392705	8.7117480	-0.6817542	0.4993
C(36)	-0.2625352	0.2713822	-0.9674002	0.3392
C(37)	0.0968219	0.1345682	0.7195007	0.4760
C(38)	-0.7778863	1.3667294	-0.5691590	0.5724
C(40)	3.4250711	0.4233637	8.0901392	0.0000
C(41)	0.2046744	0.0557568	3.6708438	0.0007
C(45)	0.4875918	0.1581313	3.0834618	0.0037

R-squared	0.825384	Mean of dependent var	3.707267
Adjusted R-squared	0.799191	S.D. of dependent var	0.268696
S.E. of regression	0.120407	Sum of squared resid	0.579917
F-statistic	31.51232	Durbin-Watson stat	2.032920
Prob(F-statistic)	0.000000		

SYS - Iterative TSLS // Dependent Variable is LB3
Date: 9-19-1996 / Time: 22:15
SMPL range: 1991.01 - 1995.12
Observations excluded because of missing data.
Number of observations: 48
System: CHECK - Equation 5 of 6
Instrument list: C LTR LEVENT LAGP1 LAGP2 LAGP3 LEX1 LEX2 LEX3 LRA1 LRA2 LRA3 LCPI SEASON
LB3=C(61)+C(62)*LP3+C(64)*LTR+C(72)*LB2+C(73)*LP2
Convergence achieved after 10 iterations

	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C(61)	1.5185223	1.5870486	0.9568216	0.3440
C(62)	-0.6917197	0.1848381	-3.7423015	0.0005
C(64)	0.3640321	0.1481035	2.4579566	0.0181
C(72)	0.5687680	0.1951803	2.9140637	0.0056
C(73)	0.5268886	0.1205698	4.3699876	0.0001

R-squared	0.882609	Mean of dependent var	7.871359
Adjusted R-squared	0.871688	S.D. of dependent var	0.274910
S.E. of regression	0.098474	Sum of squared resid	0.416979
F-statistic	80.82397	Durbin-Watson stat	1.385158
Prob(F-statistic)	0.000000		

SYS - Iterative TSLS // Dependent Variable is LP3
Date: 9-19-1996 / Time: 22:15
SMPL range: 1991.01 - 1995.12
Observations excluded because of missing data.
Number of observations: 48
System: CHECK - Equation 6 of 6
Instrument list: C LTR LEVENT LAGP1 LAGP2 LAGP3 LEX1 LEX2 LEX3 LRA1 LRA2 LRA3 LCPI SEASON
LP3=C(65)+C(66)*LB3+C(67)*LAGP3+C(68)*LEX3+C(70)*LCPI+C(71)*SEASON
Convergence achieved after 10 iterations

	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C(65)	3.2216650	6.5195133	0.4941573	0.6238
C(66)	-0.4837523	0.2243507	-2.1562323	0.0368
C(67)	0.0965870	0.0975676	0.9899497	0.3279
C(68)	-1.2285873	0.9275692	-1.3245237	0.1925
C(70)	2.4670299	0.5747024	4.2927085	0.0001
C(71)	0.0920934	0.0484381	1.9012586	0.0641

R-squared	0.721892	Mean of dependent var	3.543852
Adjusted R-squared	0.688784	S.D. of dependent var	0.243832
S.E. of regression	0.136026	Sum of squared resid	0.777129
F-statistic	21.80414	Durbin-Watson stat	1.352749
Prob(F-statistic)	0.000000		

VITA

Youngtae Kim was born in Seoul, Korea in March of 1958. He graduated from the Hankuk University of Foreign Studies in 1982 with a Bachelor of Arts degree in English. He went on to the Graduate School of the University of Massachusetts, Amherst where he earned a Master of Science in Hotel, Restaurant and Travel Administration in September of 1985. Following this he started his over-eight-year professional experience as he entered Seoul Hilton International as a Management Trainee. He worked as a Marketing Research Manager for the hotel and as a Sales Manager for the Ramada Renaissance Hotel Seoul. Then he co-owned and operated a consulting firm and travel agency for four years. During his career, he was invited by the Ministry of Transportation, Republic of Korea, to serve on a team to inspect and assign five-star ratings of luxury hotels in Korea. In the Fall of 1993, he joined the Doctoral Program of Hospitality and Tourism Management at the Virginia Polytechnic Institute and State University where he anticipates earning his Doctor of Philosophy degree in Hospitality and Tourism Management in December of 1996.

Youngtae Kim