AN ABSTRACT OF THE THESIS OF

Kazuo Yamaguchi for the degree of Master of Science in Forest Resources presented on April 6, 1993.
Title: A Tourism Demand Forecast for Japanese Travelers to the USA.

Abstract approved: 

Signature redacted for privacy.

Rebecca Johnson

International tourism is a rapidly growing industry. It is also an important revenue source for certain countries and regions. Therefore, accurate forecasting is called for by those countries and regions. The main purpose of this research is to use multiple regression analysis to estimate equations for forecasting tourism demand by Japanese travelers to the USA.

In the first stage of the analysis, separate equations were estimated for two motivational models: pleasure traveler and business traveler models. In the second stage of the analysis, regional demand forecast equations for Hawaii, mainland USA, and overall USA were estimated based upon the two previous motivational models.

Even though some of the hypothesized independent variables were omitted from the final equations, the estimated models have sufficient accuracy for forecasting future Japanese travel demand to the USA. All of the estimated models are consistent with motivational and socioeconomic factors for Japanese travelers to the USA.
An assessment of the models was carried out by comparing the actual and predicted data for 1991. The 1991 predictions derived from obtained models overestimated Japanese visitation to the USA by 14-23% in comparison with actual figures. This overestimation could be explained by the unexpected incident of the Gulf war. Another forecasting study done by Japan Travel Bureau Inc. also overestimated the number of all outbound Japanese travelers in 1991 by 8%, but did not have forecasts for USA destination. JTB agreed that the reason for overestimation was the Gulf war.
A Tourism Demand Forecast for Japanese Travelers to the USA

by

Kazuo Yamaguchi

A THESIS

submitted to

Oregon State University

in partial fulfillment of the requirements for the degree of

Master of Science

Completed April 6, 1993

Commencement June 1993
ACKNOWLEDGMENTS

I would like to gratefully acknowledge my major professor, Dr. Rebecca Johnson, for her warm advice, help, and patience in all the steps of my study here at Oregon State University. I wish to thank Dr. Bo Shelby and Dr. Courtland Smith for their meaningful suggestions as my committee members. I also would like to express my thanks to Dr. Thomas Adams for his useful suggestions as my graduate representative.

Sincere thanks to Dr. Ashi Yoshimoto, Mr. Kreg Lindberg, Mr. Mike Dubrasich, Mr. Badege Bishaw, Mr. Toyo Naito, and Mr. Ikuo Ota for their help and friendships. Talking and discussing with them were meaningful and unforgettable for me. Thanks also to the other staff and graduate students with whom I shared precious time to learn, talk, play and laugh.

I would like to extend my gratitude to the Department of Forest Resources, the College of Forestry, and Oregon State University for everything they provided me during my three-year stay in Corvallis.

Finally, I greatly appreciate my wife Naoko, daughter Manami, son Youki, and an unnamed coming baby for their encouragement. Without their help, I couldn't have completed my study here at Oregon State University. Thank you again to everybody.
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CHAPTER I : INTRODUCTION

I-1 International Tourism

Among the tourism industries, international tourism is a rapidly growing industry. In 1990 there were approximately 444 million tourists traveling abroad all over the world, an increase of 54% since 1981, and a 5.9% average annual growth (see Table I-1). In terms of tourist expenditures, 255 billion dollars were spent in international tourism in 1990, which was a 70% increase in comparison with the expenditures of 1981. The average annual growth in expenditures was 7.8% for international tourism (Koike and Ashiba, 1988; The Office of Prime Minister, 1992).

Table I-1. Growth of international tourism between 1981 and 1990

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<th></th>
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<th></th>
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<tr>
<td>Number of tourists (1000)</td>
<td>288,848</td>
<td>332,991</td>
<td>443,477</td>
<td>+53.5% (5.9%)</td>
</tr>
<tr>
<td>Tourist expenditures (Real US Mill.$ of 1990)</td>
<td>150,066</td>
<td>133,130</td>
<td>254,767</td>
<td>+70.0% (+7.8%)</td>
</tr>
<tr>
<td>Consumer price Index of the USA</td>
<td>100</td>
<td>118.3</td>
<td>143.7</td>
<td>+43.3% (+4.8%)</td>
</tr>
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Data: Original data are from OECD statistics cited by the Office of Prime Minister (1992) and also by Koike and Ashiba (1988).

In European countries such as Spain, Austria, Switzerland, and Italy, international tourism is an important industry and a major revenue source (see Table I-2). For example, Spain received 8.1 billion dollars from
international tourism in 1985 and this amount was 21.1% of total exports of Spain (Koike and Ashiba, 1988). In the USA, although the receipt from international tourism was only 3.2% (11.7 billion dollars) of its total exports, the receipt was essential to those regions where tourism is a main industry. Countries and regions that are strongly dependent on international tourism always need accurate demand forecasts for their future economic strategies.

Table I-2. International tourism balance of selected OECD countries in 1985

<table>
<thead>
<tr>
<th>Country</th>
<th>Receipt (US mill.$)</th>
<th>Expenditure (US mill.$)</th>
<th>Balance (US mill.$)</th>
<th>Receipt as % among the national exports</th>
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</thead>
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<td>USA</td>
<td>11,655.0</td>
<td>17,043.0</td>
<td>-5,388.0</td>
<td>3.2</td>
</tr>
<tr>
<td>Italy</td>
<td>8,757.7</td>
<td>2,283.4</td>
<td>6,474.3</td>
<td>8.7</td>
</tr>
<tr>
<td>Spain</td>
<td>8,083.7</td>
<td>999.5</td>
<td>7,084.2</td>
<td>21.1</td>
</tr>
<tr>
<td>France</td>
<td>7,928.6</td>
<td>4,551.3</td>
<td>3,377.3</td>
<td>5.1</td>
</tr>
<tr>
<td>UK</td>
<td>6,994.7</td>
<td>6,256.9</td>
<td>737.8</td>
<td>3.2</td>
</tr>
<tr>
<td>W.Germany</td>
<td>5,896.7</td>
<td>14,601.4</td>
<td>-8,704.7</td>
<td>2.6</td>
</tr>
<tr>
<td>Austria</td>
<td>5,046.8</td>
<td>2,784.6</td>
<td>2,262.2</td>
<td>17.9</td>
</tr>
<tr>
<td>Switzerland</td>
<td>3,163.9</td>
<td>2,413.1</td>
<td>750.8</td>
<td>9.0</td>
</tr>
<tr>
<td>Canada</td>
<td>3,101.5</td>
<td>4,125.1</td>
<td>-1,023.6</td>
<td>3.4</td>
</tr>
<tr>
<td>Bergen</td>
<td>1,660.8</td>
<td>2,047.9</td>
<td>-387.1</td>
<td>2.1</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1,497.5</td>
<td>3,116.2</td>
<td>-1,618.7</td>
<td>1.8</td>
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<tr>
<td>Sweden</td>
<td>1,176.3</td>
<td>1,946.7</td>
<td>-770.4</td>
<td>3.0</td>
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<tr>
<td>Japan</td>
<td>1,130.9</td>
<td>4,770.9</td>
<td>-3,640.0</td>
<td>0.5</td>
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<tr>
<td>Australia</td>
<td>1,063.8</td>
<td>1,897.0</td>
<td>-833.2</td>
<td>3.8</td>
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Data source: Original data came from OECD report which were cited by Koike and Ashiba in their book titled "Introduction to tourism study" (1988, P350)

I-2 Japanese Overseas Tourism

I-2-1 Evolution of Overseas Travel in Japan

The number of Japanese overseas travelers has been increasing since the middle of the 1960's, totaling almost 11 million in 1990. During the last 25 years, it has increased by 69 times (See Figure I-1).
Figure I-1. Japanese overseas travelers and exchange rate

In 1990 approximately 85% of total overseas travelers were pleasure oriented and 10% were business travelers. Among the travel destinations, the USA, including Guam and Saipan territories, has been one of the most popular places for Japanese. During the last five years, one third of Japanese overseas travelers visited the USA.

Before World War II, overseas travel was exclusively for those few people who worked for the Japanese government or for large trading companies. This was due to the restrictions on overseas travel posed by the government and extremely expensive travel costs. In that time, transportation for overseas travel was mainly by large ships and traveling abroad was time consuming.

Even for a long time after WW-II, overseas travel was still a dream for ordinary Japanese nationals. From 1945 to 1950, strong overseas travel regulations under the GHQ
(General Headquarters of the Allied Forces) had prohibited Japanese from going abroad with few exceptions for those who had relatives abroad or who had special missions abroad.

Even after 1950 when the GHQ returned the jurisdiction for overseas travel to the Japanese government, regulations were continuously posed by the government for the purpose of preventing the outflow of Japanese currency abroad. The year of 1964 marked the beginning of unrestricted overseas travel, when the Japanese government lifted most restrictions. Even though some of the regulations remained¹, unrestricted overseas tourism took off this year and has grown rapidly since then. In 1965, only 159 thousand Japanese traveled abroad, the number became 2.5 million in 1975 and 11.0 million Japanese traveled abroad in 1990 (see Figure I-1).

According to the Japanese Travel Bureau Inc. (hereafter JTB), there were three "overseas travel booms" in Japan during the period of 1964 to 1990 (JTB Report, 1991). The first overseas travel boom started in 1964 and lasted until 1970. Deregulation encouraged overseas travel and it also stimulated private tour operators to launch commercial package tour businesses.² Travel costs were, however, still expensive for ordinary Japanese³.

A couple of incidents triggered the second overseas travel boom that lasted from 1971 to the end of 1973. In

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¹ Regulations, which limited the maximum amount of Japanese yen brought out by a traveler, were in place until 1978. In 1978 all regulative constraints over international tourism were lifted.

² The first commercial package tour "JAL-PACK", operated by Japan Air Line Inc., took off in 1965 followed by Japan Travel Bureau's "LOOK-TOUR" in 1968. Other miscellaneous package tour operators followed.

³ For example, a Tokyo-Hawaii round trip ticket cost 224,000 yen in 1965 while an average household monthly income after taxes was 65,000 yen.
1970, the introduction of jumbo passenger jet planes made it possible for airline companies to offer "group discount rates" that were extraordinarily cheap tickets in comparison with regular rates. Discount rates averaged 50-60% off the regular rates in almost all routes where jumbo jets were operated (Japan Air Line, 1987). Another driving force for the second boom was the exchange rate. In August of 1971, Japan brought its currency into the floating exchange market. Before 1971, the exchange rate between the Japanese yen and US dollar had been fixed with 1 yen=0.00278 dollars. Since 1971, the yen-dollar exchange rate has been decided in the free exchange market and the Japanese yen has strengthened against not only the US dollar but also other foreign currencies (see figure I-1). A strong yen also gave travelers more purchasing power in foreign countries and therefore encouraged more people to travel abroad than ever.

The first oil crisis of late 1973 shook the Japanese economy. Because of its high dependence on imported oil, the Japanese economy slowed down and this influence lasted the next two years. The number of overseas travelers leveled off during this period and tourism industries suffered. The second oil crisis of 1979 cooled off the economic recovery. In 1980, overseas travel decreased, the first decline from a previous year since 1964.

The third overseas travel boom resulted from the acceleration of Japanese yen value that started in 1986. After the Plaza Accord4 in 1985, the value of Japanese yen dramatically increased (see Figure I-1). As a result, the

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4 The Plaza Accord was the G-5 meeting held in September, 1985 in New York where a cooperative intervention in the exchange market was agreed upon to correct a strong US dollar.
number of Japanese overseas travelers almost doubled during the period between 1985 and 1990.

Besides favorable exchange rates and affordable air tickets, Koike and Ashiba (1988) pointed out several other reasons for the rapid growth in Japanese overseas travelers during the last 25 years. Increasing leisure time makes it possible to have longer vacation trips abroad. Package tours can provide people not only affordable trips, but also easier access to overseas travels that usually require complicated preparation procedures such as visas, booking air tickets and hotel reservations. Koike and Ashiba also indicate that the speed and amenities of air transportation make Japanese feel that traveling abroad does not require long and uncomfortable trips.

I-2-2 Japanese Visitors to the USA

The United States, including Guam and Saipan territories, has been one of the most popular destinations for Japanese tourists. Since 1964 the portion of travelers to the USA among all Japanese overseas travelers has always been between 25 and 33 percent every year (see Figure I-1). For the five-year period between 1986 and 1990, 12.7 million Japanese visited the USA.

Three major characteristics describe Japanese travel to the USA. The first is that the number of Japanese travelers to the USA has increased rapidly during the past years. The growth in the number of Japanese travelers to the USA for the last years matches the growth of all Japanese overseas travel (see Figure I-1). The same forces that caused the overall growth (e.g. deregulation, exchange rates, package tours) were factors in the USA holding their share of the market. It should be mentioned here that the visa
regulations between Japan and USA were drastically reduced in December, 1988, and this regulative relaxation gave potential travelers an advantage by lessening their visa preparation burdens.⁵

The second characteristic is that the majority of Japanese travelers have been pleasure travelers over the past years. During the five year period from 1986 to 1990, 83% of all Japanese visitors to the USA traveled for pleasure while 14% were business travelers. The portion of pleasure travelers has increased in the last two decades (see Figure I-2). Overall, Japanese travelers to the USA can be characterized either as pleasure travelers or business travelers. The remaining are classified as students, returning resident Japanese, international organization employees, etc.

![Figure I-2. Japanese travelers to the USA by motivation](image)

⁵ Until 1988, all Japanese visiting to the USA had to have a visa with them. The regulative relaxation allows those travelers who travel to the USA for less than 90 days to be exempted from a mandatory visa.
The third characteristic is that most Japanese travelers to the USA go to Hawaii and Guam. Forty-nine percent went to Hawaii, 19.2% visited Guam and the remaining 31.8% traveled to the mainland during the past five years (see Figure I-3). It should be mentioned that mainland travelers have increased rapidly over the last few years.

Figure I-3. Japanese travelers to the USA by destinations

I-3 Purpose of Tourism Demand Forecasting

Because of the rapidly growing international tourism industry and the importance of that industry to regional economies, accurate forecasts of international tourism are critical to future planning. For the private tourism industries such as transportation, lodging, food and catering services, and recreation providers, accurate forecasts of tourism demand are indispensable to operate their existing service capabilities efficiently and to plan future investment strategies. For governments, such forecasts help in formulating tourism policy and in
designing public infrastructures such as airport facilities, public transportation and recreation areas to meet future demand.

The purpose of tourism demand forecasting in this research emphasizes accurate overall demand forecasts, and not explanation of the factors that influence individual travel decisions. However, it is good to start to think what kind of factors can influence individual's travel decisions in order to pick up some explanatory variables such as the exchange rates and the airfare rates. Factors such as GNP and trade activities may not come up in the individual travel decision-making process, but these factors that reflect economical and social status of origin countries are still essential for overall demand forecasting.

Explaining individual travel behavior would require a survey asking individual travelers to describe important factors in their travel decisions. These individual behaviors in travel decision making are important for tourism resource managers to understand visitors and to maintain visitors' satisfaction. On the other hand, overall demand forecasting is essential for tourism operators to manage their facilities and labor efficiently. As mentioned before, this thesis is dedicated to estimating overall tourism demand forecasts.
Objectives of the Research

The objectives of this paper are as follows.

(1) To estimate equations for forecasting tourism demand of Japanese travelers to the USA. Separate equations will be estimated for pleasure and business travelers which are so-called motivational models. Then, regional demand forecast equations are estimated for US mainland, Hawaii, and overall USA based upon the previous two motivational equations.

(2) To assess the estimated models of Japanese travelers to the USA by comparing the predicted figures with the actual data of 1991.

(3) To discuss advantages and disadvantages of this research and future research possibilities.
II-1 General Forecasting Methods

A broad range of forecasting methods have been proposed and compared with each other for tourism demand forecasting. Overviews of possible forecasting methods in tourism have been written by many researchers since 1970 and recently done by Archer (1987), Calantone et al. (1987), Uysal and Crompton (1985), Witt and Martin (1987), Bull (1991), and Witt and Witt (1992). Among those researchers, Uysal and Crompton and Calantone et al. provided comprehensive reviews of tourism demand forecasting methods.

Uysal and Crompton (1985) did an excellent overview of the principal quantitative and qualitative approaches that have been used in tourism demand forecasting. Calantone et al. (1987) classified various forecasting methods into four categories; speculative, exploratory, normative and integrative forecasting approaches. Most of the four categories fit into the quantitative and qualitative classification of Uysal and Crompton except a couple of new methods. Bull (1991) followed the classification of Uysal and Crompton in his book. Table II-1 shows a comprehensive summary of the forecasting methods combining the classifications of Uysal/Crompton and Calantone.

Table II-1. Demand forecasting methods in tourism

1. Qualitative methods
   - Judgment aided techniques
   - Traditional approaches
   - Delphi models
   - Scenario writings

2. Quantitative methods
   - Time series models
   - Gravity models
   - Regression models
The following descriptions are mainly from Uysal and Crompton (1985).

**Qualitative methods**

The qualitative forecasting methods are characterized by the use of accumulated experiences of experts. Various kinds of techniques have been developed to extract experts' opinions without biases.

(1) Judgment aided techniques

The most common qualitative approaches are "judgment aided" techniques. They include brain storming, committee meeting, panel discussion, and executive consensus. Uysal and Crompton (1985) state:

> The aim is to generate as much debate and interchange of ideas as possible in order to reach an agreed upon forecasting (Uysal and Crompton 1985, p.9).

Advantages of this technique are its low cost and the ability to reach quick conclusion. Disadvantages are the lack of theoretical supports and the disagreements which arise due to the differences of each expert's experience. Because of its advantages, the judgment aided forecasting is often used for short term tourism forecasting.

(2) Traditional approaches

Two traditional approaches that have been used are; (i) Analysis of secondary data in national or regional vacation surveys to look for changes over time and (ii) Survey inquiries of potential visitors in origin areas. The first approach is similar to the time trend analysis that attempts to derive a forecasting conclusion based upon previous survey data. A careful analysis of several surveys may give
valuable insights into emerging trends. Some surveys already have their own forecasts as well as past data analysis. This technique is less expensive and requires neither much experience in the tourism field nor special skill for analysis. The second approach relies on opinions of non-experts but still needs experts to interpret those opinions and obtain a forecast. Uysal and Crompton say about this method:

Inquiries within a potential generating population may offer useful insights about the attitude or prevailing image of the potential market towards a tourist-receiving destination. This approach may be combined with a survey of the opinions and intentions of tour operators, travel agencies, and/or airlines (Uysal and Crompton 1985, p.8).

Japanese Travel Bureau Inc. used the second technique to forecast future trends of Japanese outbound travelers (JTB, 1991 and 1992). This survey consumes both time and money while the first technique, which is the analysis of secondary survey data, is less expensive and quicker.

(3) Delphi models

The Delphi model was developed in the 1960's to obtain a consensus among experts through administering a series of questionnaires. In this technique, all participating experts are given feedback at each stage of the process and allowed to reconsider their responses before they go to the next round. By repeating this process, the most desirable consensus is eventually obtained from the collective knowledge of the experts. An advantage of this technique is that it eliminates pressures from other participants because respondents are anonymous to each other and face-to-face discussion is avoided. A weakness of the Delphi method is that the results could be affected by how the research
directors interpret the responses from participants and by the way in which information is fed back to the participants. Another disadvantage of this method is "non-responses" from participants due to an anonymous situation. According to the review of Uysal and Crompton (1985), an application of the Delphi method conducted by Bruges (1980) showed that the results were useful because of the high quality of participants and directors, and low "non responses" of participants.

(4) Scenario writing

Scenario writing is a method identified by Calantone et al. (1987). This technique is usually used for medium- and long-term demand forecasting for which market situations are unpredictable. Scenarios attempt to show how a particular future state or a set of alternative future states could occur. They are written for possible future conditions such as a set of "optimistic", "intermediate", or "pessimistic" conditions. Another set of conditions might be "peaceful political climate", "increase political tension", or "unchanged from present situation." Each scenario may be derived from one of the qualitative methods such as "judgment aided" or "Delphi". This technique is frequently used to predict future energy demand and supply (an example is the Northwest Power Planning for 1991 (Northwest Power Planning Council, 1991)). In tourism study, BarOn (1983) used this method to forecast tourism demands in Israel and in Thailand. Scenario writing is also used in the quantitative methods. Smeral et al. (1992) wrote three scenarios in their quantitative analysis for forecasting tourism trends to 2000. In this forecasting, they estimated a regression equation for the "base-line model" assuming that the tourism circumstances will stay the same as present. Then, they imported different predicted figures
corresponding to different future scenarios to obtain quantitative scenarios.

Generally, advantages of the qualitative methods are (1) less expensive, (2) less time consuming, and (3) less technical. Disadvantages, on the other hand, are (1) lack of theoretical supports and (2) disagreement over a conclusion between forecasters and other experts outside the forecasting group. Disagreement occurs because experts' opinions usually reflect their personal experiences, therefore the difference of experiences between forecasters in the forecasting group and other outside experts could result in quite different forecasting.

**Quantitative methods**

The review articles point out that a number of quantitative methods have been employed for tourism demand forecasting. Most of the papers indicate that there are three major quantitative methods; time series, regression, and gravity models (Archer, 1987; Uysal and Crompton, 1985; and Calantone et al, 1987). Several researchers classified the quantitative methods into two categories; causal methods and non-causal methods (Bull, 1991; Witt and Martin, 1987; Witt and Witt, 1992). In this paper, the former three classifications are employed.

---

6 Three different figures of GDP (gross domestic product) were prepared as independent variables for three different scenarios.
(1) Time series models

As defined in this paper, a time series model means an univariate non-causal quantitative technique. In other words, this model has only one independent variable "time".

Time series models attempt to forecast future demand by simply extrapolating the past trend that was obtained from historical data. In a sense, the time series method is somewhat similar to the qualitative predictions of experts who usually use their own time trend scales which they learned through their past experiences. Time series models are available in varying degrees of sophistication from simple trend extrapolation to complicated mathematical models. Naive-1, Naive-2, Exponential smoothing, Trend curve analysis, and Gompertz models are relatively simple forms while Box-Jenkins model is a highly sophisticated but complicated technique (Sturgess and Wilson, 1983). Table II-2 shows the various univariate time series functional forms and the procedure of the Box-Jenkins model. Except the Box-Jenkins model, time series models are relatively easy to use and less expensive than other quantitative methods. Those models can not deal with changes of demand structures because of the simple independent variable of time. The Box-Jenkins model is more complicated and requires the experiences of a forecaster.
Table II-2. Time series models

<table>
<thead>
<tr>
<th>Time series models</th>
<th>Functional forms or Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naive-1</td>
<td>$\hat{V}_{t+1} = V_t$</td>
</tr>
<tr>
<td>Naive-2</td>
<td>$\hat{V}<em>{t+1} = V_t \left[1 + \frac{V_t - V</em>{t-1}}{V_{t-1}}\right]$</td>
</tr>
<tr>
<td>Exponential smoothing</td>
<td>$\hat{V}_{t+1} = \hat{V}_t + k(V_t - \hat{V}_t)$</td>
</tr>
</tbody>
</table>

**Trend curve analysis**
- Linear: $\hat{V}_t = a + bt$
- Constrained hyperbola: $\frac{1}{\hat{V}_t} = a + b \frac{1}{t}$
- Exponential: $\ln\hat{V}_t = a + bt$
- Doublelog: $\ln\hat{V}_t = a + b \ln t$
- Semilog: $\hat{V}_t = a + b \ln t$
- Modified: exponential: $\ln\hat{V}_t = a + b \frac{1}{t}$
- Hyperbola: $\hat{V}_t = a + b \frac{1}{t}$
- Modified hyperbolic: $\frac{1}{\hat{V}_t} = a + bt$
- Quadratic: $\hat{V}_t = a + bt + ct^2$
- Log-quadratic: $\ln\hat{V}_t = a + bt + ct^2$

**Gompertz**
- $\hat{V}_t = MA^t$

**Stepwise autoregression**
- $\hat{V}_{t+1} = a + bV_t + cV_{t-1} + dV_{t-2}$

**Box - Jenkins**
1. Identify a potential model based on expert knowledge and analysis of data.
2. Estimate parameters in the hypothesized model using maximum likelihood methods.
3. Check the model with actual data. If not adequate, return to (1).

where $V_t$ and $V_{t-1}$ denote visitors for the time periods of $t$ and $t-1$, $^\wedge$ denotes a forecast value, $a$, $b$, $c$, and $k$ are coefficients, $M$ is a multiplier, $A$ denotes the asymptote and $G$ is the growth factor.

(2) Regression models

Regression models hypothesize that tourism demand to a particular destination "j" from an origin country "i", expressed as $V_{ij}$, is a function of a factor or factors such
as income per capita \((Y_i)\), population size of the origin country \((\text{Pop}_i)\), travel cost \((C_{i,j})\), the relative level of prices in both countries \((P_i/P_j)\), and exchange rate \((\text{Exch}_{i,j})\). Such a model would be expressed as follows.

\[
v_{i,j} = f(\text{Pop}_i, Y_i, P_i/P_j, \text{Exch}_{i,j}, C_{i,j})
\]

Other factors could be chosen in different situations. Data are usually provided in time series basis and regression techniques are applied to obtain the best fit model. Once the best fit model is derived with past data, a future demand forecasting is simply calculated by inputting estimated explanatory variables into the equation. Simple regression, multiple regression, stepwise regression, and Ridge regression techniques are often used for forecasting. In this paper, the multiple regression technique is employed for analyzing and forecasting tourism demand of Japanese travelers to the USA. Regression models can give researchers more theoretical explanations for their results. They are also more flexible for the structural changes in tourism demand because they contain several factors that affect tourism demand. However, data gathering and computer operation take time and expense.

(3) Gravity model

Gravity models are based on Newton's gravity equation that expressed a pair-wise interaction. The model is somewhat similar in form to a regression model except it focuses on the effect of distance or travel time (Uysal and Crompton, 1985). Van Doren's (1967) gravity model takes the following form.
\[ V_{ij} = G \left( \frac{A_j \text{Pop}_i}{D_{ij}} \right) \]

where

- \( V_{ij} \): number of trips made from origin "i" to destination "j"
- \( G \): gravity constant
- \( A_j \): attraction index of the destination
- \( \text{Pop}_i \): population of the origin
- \( D_{ij} \): the distance between origin and destination
- \( b \): empirically estimated parameter

Population and distance variables in Van Doren's equation could be replaced by some different explanatory factors such as income level and travel cost respectively, and consequently becomes similar to a multiple regression model.
II-2 Multiple Regression Methods

The multiple regression method is one type of regression method and the most popular causal technique used for demand forecasting. In the field of tourism, multiple regression analysis is regularly used by airlines, tour operators, and tourism researchers.

The fundamental idea of the technique is the formulation and testing of a hypothesis which assumes that demand of tourism (a dependent variable) is a function of various factors (independent variables or explanatory variables) such as income, travel costs (destination and substitutable places), exchange rate, etc. A basic model is estimated from a set of data with past values of independent and dependent variables. After obtaining the model equation, a forecast is derived by estimating the independent variables and inputting those into the estimated model. The number of multiple regression models which have been proposed for tourism demand forecasting can be classified two ways; by their functional forms (Uysal and Crompton, 1985; Morley, 1991) or by the explanatory variables contained in the equations (Witt and Martin, 1987; Mitt and Witt, 1991; Morley, 1991). The different classification schemes come from differences in the objectives of each researcher. For those researchers who believe that interpretation of the coefficients of explanatory variables is more important than statistical accuracy, the

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7 The method of multiple regression is sometimes called multivariate regression or econometrics technique. In this paper the term multiple regression will be employed.

8 In a statistical sense, a regression method can show only a relationship between a dependent variable and several independent variables but not a causality of independent variables on a dependent variable. However, regression techniques are known as causal methods because the independent variables are chosen based upon a theoretical causal structure such as economic demand theory.
classification by variables seems to be more appropriate and vice versa.

**Explanatory variables**

Morley (1991) summarized the most important explanatory variables for tourism demand forecasting as follows:

1. disposable income of private household
2. GNP (as a measure of both private household income and total production)
3. private consumption
4. price of consumer goods
5. tourism prices
6. transportation costs
7. consumer economic expectations
8. special factors (such as the Olympic games or social unrest in the destination countries)
9. short-term factors (e.g. school holidays, weather)
10. long-term factors (e.g. length of holidays, age distribution in population, degree of urbanization in origin countries)
11. relative prices between domestic and foreign tourism including tourism to substitute destinations.
12. quality and quantity of tourism service in destinations

Morley listed other factors derived a number of articles. Many of which overlap with the above factors.

13. time trend (which is a long-term factor and is used in Johnson and Swits, 1983; O'Hagan and Marrison, 1984; White, 1985)
14. marketing promotion expenditure (O'Hagan and Harrison, 1984)
15. exchange rate between origin and destination countries (O'Hagan and Marrison, 1984; Rosensweig, 1986; Summary, 1987; Witt and Martin, 1987; Witt and Witt, 1992)
16. consumer perception of safety such as terrorist acts, war and natural disasters like earth quakes or volcanic eruptions. These factors are similar to (8) special factors above (Witt and Witt, 1987; Faulkner, 1988).
17. dummy variables for "on-off events" on international tourism. These variables have similar meanings as (8) and (16). For example, Olympic games and Expo fairs are known as predictable on-off events. Effects of the oil crises in 1973 and 1979 could not be predicted but may be reflected in the process of regression (Witt and Witt, 1992).
Koike and Ashiba (1988) indicated that leisure time in origin countries and tourism policies both in origin and destination countries are important factors. Bull (1991) also pointed out that political controls on tourism influence demand and this idea is supported by several researchers (Witt and Witt, 1991; Fujii and Mak, 1968). A couple of papers (BarOn; 1989, Stabler; 1988) pointed out another important variable, that is attractiveness and/or images of the destinations. This variable is somewhat similar to (14) quality of tourism service in destinations and (10) consumer perceptions of safety, but also reflects overall positive and negative perceptions of travelers toward their destinations. As a result, three more variables should be added as possible explanatory variables.

(18) leisure time in origin countries. This is similar to the length of holidays found in (10).
(19) tourism policies both in origin and destination countries. For example, tourism policies that promote international tourism through passport or visa regulations influence tourism demand.
(20) attractiveness of destinations.

Not all of the explanatory variables can be used in a forecasting model. Sometimes variables such as income, promotion expenditure, and private consumption are used as time-lagged forms. The time-lagged dependent variable has also been involved as an explanatory variable reflecting habit-persistence (repeating visitors), word of mouth advertising, and supply rigidness⁹ (Witt and Martin, 1987).

⁹ Supply rigidness is defined as inflexibility of supply in the tourism market. For example, capacities of airports and/or air transportation can not be expanded in a short time as demand grows rapidly. Therefore, the previous year's visitation reflects these supply limits.
Functional forms

Morley (1991) discussed five functional forms of multiple regression models found in previous research papers.

(1) Linear model - This is a straightforward and easily applied model. This model is not often used because the model assumes that all independent variables have only linear effects on a dependent variable and is too simple to be realistic for most situations in tourism. Generally, the model is expressed as follows.

\[ V = a + bX_1 + cX_2 + \ldots \]

where \( V \) represents tourism demand, \( X_1 \) and \( X_2 \) denote explanatory variables, \( a \) is constant, and \( b \) and \( c \) are coefficients.

(2) Log-linear model - Even though the term "log-linear model" consists of both semi-logarithmic and double-logarithmic forms, the double logarithmic form is widely acknowledged as the log-linear model in tourism demand forecasting. In the double-log models, the logarithm of demand is a function of logarithm of several explanatory variables. In this paper, the term log-linear model will not be used in order to avoid confusion.

Semi-log models

\[ V = \ln(a) + b \ln(X_1) + c \ln(X_2) \quad \text{or} \quad \ln(V) = a + b X_1 + c X_2 \]

Double-log model

\[ \ln(V) = \ln(a) + b \ln(X_1) + c \ln(X_2) \]

Even though almost all of the previous research papers employed the double logarithmic functional form for their models, only a few papers gave justifications for this
functional form (Witt and Witt, 1992). A possible justification is that the double logarithmic form can provide the elasticity directly from the equation as the coefficients of each independent variable. Another justification can be found in previous experimentation which showed that simple linear regression models yielded inferior results compared with the models in double log-linear forms. These justifications are weak in terms of theoretical explanation. Basically functional forms for multiple regressions should have some theoretical underpinnings.

Justifications should be derived from the viewpoint of theoretical explanation. When you check the simple relationships between a dependent variable and each independent variable, you can see that the relationships between variables are seldom expressed in linear forms. For example, the relationship between visitation and travel cost is usually expressed either in hyperbolic, semi-logarithmic, or double-logarithmic forms rather than in negative linear form. These functional forms are likely derived from income distributions that are not even over the population. Similar relationships apply to leisure time and private consumption. The relative prices between domestic and foreign tourism is more tricky. When the foreign travel cost becomes cheaper than the domestic cost, outbound travelers increase rapidly. Therefore the relationship between overseas travel and relative prices is not expressed by a linear functional form, but rather by semi or double logarithmic forms.

Another justification is that the functional form of double-logarithm is the most flexible form compared with others. It can express not only linear relationships but also non-linear functional forms (see Figure II-1). Besides the above two reasons, the justifications of Witt and Witt (1992) can be employed to enforce the validity of double logarithmic form.
Figure II-1. Flexibility of Double-log form

(3) Logit model... This is applied to demand market share. This model is also not difficult to estimate and has been known to yield reasonable results. A basic multiple Logit model is expressed as follows.

\[ \ln \left( \frac{P_i}{P_j} \right) = a_i + b_{1i}X_1 + c_{ij}X_2 \]

where \( P_i \) and \( P_j \) denote probabilities or market share in terms of i and j items respectively and therefore \( \sum_{i=1}^{k} P_i = 1 \). For instance, i denotes package-tour travelers while j means individual travelers, or in another case, i is travelers to a certain destination while j is travelers to all other destinations. \( X_1 \) and \( X_2 \) are explanatory variables, a, b, and c are coefficients.

(4) Translog model - This model is a flexible functional form giving a quadratic approximation to the unknown true functional form.

\[ \ln(V) = a + b_1X_1 + c_1X_1^2 + b_2X_2 + c_2X_2^2 \]

Figure II-2 shows the general shape of a log-quadratic form that has both increasing and decreasing trends in one equation.
the Box-Cox transformation - This is known as a generalization of the first two model forms; linear and log-linear models. A general form is expressed as follows.

\[
\frac{v^λ - 1}{λ} = a + b\left(\frac{x_1^{λ - 1}}{λ}\right) + c\left(\frac{x_2^{λ - 1}}{λ}\right)
\]

where \(λ\) is an arbitrary number between 0 and 1. When \(λ=0\), the equation becomes \(\log(V) = a + b \log(X_1) + c \log(X_2)\). When \(λ=1\), it turns into \(V = a + bX_1 + cX_2\). Fujii and Mak (1981) reported that a usage of the Box-Cox equation combined with the Ridge regression technique could control effects of multicollinearity among explanatory variables.

Generally speaking, the linear model is used only in limited cases while the log-linear model is frequently used in tourism forecasting because of its flexibility and better statistical performance. The logit model is convenient to analyze the market share and translog model is useful for estimating unknown true functional form. The Box-Cox transformation is the most flexible functional form, but the most complicated.

\[\text{See Appendix A for detail transformation.}\]
II-3 Review of Previous Forecasts of Japanese Travelers

Even though statistical data about Japanese travelers have often been reported by Japanese researchers and private and governmental tourism organizations (Koike and Ashiba, 1988; Japan Leisure Development Center, 1990 and 1991; The Office of Prime Minister, 1992; Japan Travel Bureau, 1991 and 1992), few demand forecasting reports were found (JTB, 1991). The US Travel and Tourism Administration (hereafter USTTA) has also intensively studied foreign travelers coming to the USA, including Japanese, and reported travelers' habits and behavioral patterns. Those reports and papers, however, focused on the descriptive statistical aspects such as the demographics of Japanese travelers, travelers' perceptions, and their behavioral patterns toward traveling to the USA (USTTA, 1972, 1974, 1978, 1986, 1989, and 1990). A couple of research papers (Machlis et al., 1984; Keown, 1989) reported social viewpoints of Japanese travelers, but none provided any tips for future forecasting.

A qualitative forecast for Japanese outbound travelers was found in the JTB report (1991). The report predicts the number of overseas travelers for the time period between 1991 and 2001, with some major predictions of future trends. It appears that this forecast was made by using an integrated forecasting method combining the time trend analysis and expert opinions. The 1992 JTB report, however, didn't mention the predicted numbers in the future. It is assumed that the decrease of outbound Japanese travelers in 1991, which was the first decrease from the previous year during the last decade, made it hard for JTB to use their time trend analysis for future forecasting.

Several quantitative forecasting models for Japanese travelers can be found in international tourism demand
forecasting papers as a part of the more comprehensive models developed there. Little (1967) proposed several multiple regression models for Japanese pleasure travelers to the USA by using the data from 1950 to 1965. His basic model for Japanese pleasure travelers is as follows.

\[
\ln(V) = -7.226 + 0.682 \ln(T) + 2.096 \ln(Y) - 0.102 \ln(C) - 0.0669 \ln(AF)
\]

\[R^2 = 0.989\]

where

\[V = \text{pleasure visitors per million population}\]
\[T = \text{time variable (1950}=1, 1951=2 ...\)]
\[Y = \text{average household income (thousands of 1958's yen)}\]
\[C = \text{currency allowance}^{12} \text{ (thousands of 1958's yen)}\]
\[AF = \text{adjusted weighted airfare (thousands of 1958's yen)}\]

In this equation, the coefficient of currency allowance has a negative sign, which is opposite to that expected, and the airfare coefficient is not significant. He then tried a simpler functional form to improve the statistical results.

\[V = -46.187 + 0.734 Y\]

\[R^2 = 0.934\]

In the second equation, Little found an autocorrelation problem and then used a double-logarithmic form as his best fit model.

---

\[11\] Figures in parenthesis indicate t-statistics.

A problem with Little's model is that during the study period between 1950 and 1965, Japan had been under the strict overseas travel regulation posed by the Japanese government. This regulation was a barrier to Japanese to travel abroad. Since the end of World War II (1945) until 1963, Japanese outbound travel had been strictly regulated by the GHQ and the Japanese government (see the section I-2-1 in this paper).

According to the Japanese National Tourism Organization (JNTA letter, 1992) and Koike and Ashiba (1988), the Japanese government checked all passport applicants and granted passports only to those who were governmental employees, exchange students, emigrants, large trading companies' employees with special economic missions, and people who had relatives abroad. As a result, the governmental permits on overseas travel depended strongly on the status of possible outbound travelers. Income, travel costs, and currency allowance were also problems, but these were secondary problems. Little also didn't give any justifications for using double logarithmic and linear functional forms.

The objective of Leob (1982) was to obtain a regression model for forecasting traveler's expenditure in the USA. He started with an idea that a measure of demand for travel service from an origin to a destination (T) is expressed as a function of per capita income (Y), exchange rate (EXCH), relative price between both countries (RPI), and dummy variables for special events (Dummy): 14

\[
\ln(V) = -12.449 + 3.369 \ln(Y) \quad \ldots (2.3)
\]

\[
R^2 = 0.963 \\
\text{Durbin-Watson statistic} = 1.205^{13}
\]

13 Durbin-Watson statistic indicates whether an autocorrelation problem exists in a model or not.
Assuming that expenditures are directly related to travelers (T), Leob's conclusive equation for Japanese traveler's expenditure (EXPD) in the USA for the study period of 1961-1979 is expressed as follows:

\[
\ln(\text{EXPD}) = -9.703 + 2.617 \ln(\text{RYPC}) + 0.109 \ln(\text{EXCH}) \\
-2.307 \ln(\text{RPI})
\]

\[\text{(2.5)}\]

\[\text{R}^2 = 0.9872\]
\[\text{F-stat} = 359.41\]
\[\text{D.W.}^{15} = 1.1329\]

where \(\text{EXPD} =\) (Japanese travelers expenditure)/(Population of Japan x C.P.I.\(^{16}\) of the USA)

\(\text{RYPC} =\) (Per capita income in Japan)/(C.P.I. of Japan)

\(\text{EXCH} =\) Exchange rate between Japan and the USA

\(\text{RPI} =\) (C.P.I. of the USA)/(Weighted average C.P.I. of Japan and foreign countries)

Even though the t-statistic for the exchange rate coefficient is small, Leob's equation estimates well the effects of income, the exchange rate, and relative prices between USA and Japan from the viewpoint of the tourism receiving country, the USA. But it is still ambiguous why he used double logarithmic forms for his final equation.

Smeral et al. (1992) also focused on the forecasting of international tourism expenditures from the viewpoint of both traveler generating and traveler receiving countries. They obtained the following linear regression model for total expenditures of outbound Japanese travelers.

\(^{14}\) In the equation for Japanese travelers, dummy variables were not significant enough to be employed.

\(^{15}\) D.W. denotes Durbin-Watson statistics.

\(^{16}\) C.P.I. stands for consumer price index.
\[ \text{EXPD} = -4.522 + 0.012(\text{GDP}) - 0.039(\text{RPG}) \quad \ldots (2.6) \]
\[ R^2 = 0.740 \]
\[ \text{D.W.} = 0.80 \]

EXPD represents traveler's expenditures of Japanese and is expressed in 1980's US billion dollars. GDP stands for gross domestic product of Japan and is also expressed in 1980's US billion dollars. RPG represents the relative price index of Japan expressed as the ratio of the price of tourism imports (travelers expenditures) to the price of consumer goods and service including domestic travel. The time span of data is from 1975 to 1988. Smeral et al. concluded that the model for Japan was not so good and suspected that an autocorrelation problem existed. He also tested a dummy variable that represents two oil crises, but could not find it as a significant variable. It is interesting that they used the scenario writing technique in this paper. They made two different forecasts for possible situations by putting different estimated GDP's into the base-line equation (2.6).

Smeral et al. concluded that their equation has an autocorrelation problem because the Durbin-Watson statistic was smaller than its lowest limit. When an autocorrelation problem exists, the regression equation (2.6) is no longer reliable.

All of the previous models include only socioeconomic explanatory variables such as income, travel costs, exchange rate, etc. As mentioned in the previous section, psychological and sociological factors should be more involved in the forecasting models. Unfortunately, these variables are more difficult to measure and data are often not available over time.
CHAPTER III : MODEL

III-1 Basic Concepts for Demand Forecasting Models

There are three steps in constructing a demand forecasting model; (1) selecting appropriate dependent and explanatory variables, (2) specifying a suitable functional form that assembles variables into one equation, and (3) screening the best fit model out of a number of trial models through evaluation based on statistical criteria and suitable reasoning processes.

Because a simple model is preferred for forecasting (fewer independent variables have to be forecasted), simple correlations between the number of all Japanese travelers to the USA (V_{USA}) and a couple of independent variables such as exchange rate or time factor were examined. The equations below are the results of the simple regressions.

\[
V_{USA} = \beta_0 + \beta_1 \text{Year} + \epsilon
\]

where \( V_{USA} \) denotes all Japanese travelers to the USA in millions, "Year" is a time factor such as 1964, 1965..., and the exchange rate is expressed in US $/yen. Figures in parentheses are t-statistics.

The equations indicate that just a single independent variable can explain 87-89% of the variation in the dependent variable from the view point of \( R^2 \). For some
purposes, these results would be sufficient to see a general trend of Japanese travelers over time. However, an Durbin-Watson statistics for these equations indicate that there is the autocorrelation problem in these equations and the accuracy of forecasting is no longer reliable. Therefore, other independent variables will be introduced for more accurate forecasting.

The basic procedure of this research for selecting variables, specifying functional forms, and screening final models are described in the following sections.

III-1-1 Selecting Variables

Dependent variable

The dependent variable for tourism demand chosen in this study is expressed as the number of Japanese travelers to the USA per 1000 Japanese population. Even though "population" was treated as one of the explanatory variables in several studies (Bond and Ladman, 1972; Kliman, 1981; Paraskcaopoulos, 1977; Bruges, 1980), the majority of researchers in this field treat population in the form of tourism demand per capita (Witt and Witt, 1992; Fujii and Mak, 1981; Martin and Witt, 1988; Leob, 1982; Little, 1967). Witt and Witt (1992) suggest that the main justification for not having population as a separate explanatory variable is that its presence as an independent variable may cause multicollinearity problems.

At the first stage of the regression analysis, two dependent variables, "pleasure travelers" and "business travelers", were employed. The two variables were chosen from the viewpoint of travelers' motivations and are called motivational models. More than 95% of all Japanese travelers to the USA are either pleasure travelers (approximately 80%)

\[\text{The autocorrelation problem will be described on P.48 in the section III-1-3.}\]
or business travelers (15%). Therefore, most Japanese travel to the USA can be estimated with those two models (see Figure III-1).

In the second stage of regression analysis, Japanese travelers were split into three regional destinations. The new dependent variables are Japanese travelers to Hawaii, to the mainland of the USA, and to all of the USA. The second stage regression models are called "regional models". Pleasure and business models for each region were not developed in this study because the data of pleasure and business travelers at each destination were not available. The regional models were derived based on the motivational models which were obtained in the previous regression analysis (see Figure III-2).

Independent variables

In this paper, a number of explanatory variables are selected not only from the socioeconomic viewpoint but also from travelers' motivations. Stabler (1988) stated that:

...though motivations and preferences are acknowledged as being important, they tend to be ignored by mainstream economists because they are either assumed to be relatively stable and therefore do not influence the model or are considered too complex to cope with (Stabler, 1988 p.137)

Besides several socioeconomic factors such as disposable income, travel costs, exchange rates, and GNP, three other variables, which are "crowding of Japan", "attractiveness of the USA", and "leisure time", were examined as particular variables for Japanese traveler's models. A pretest of the regression model showed that even with only socioeconomic variables, the model can explain most of the changes in Japanese travelers over past years
Motivational variables, however, were added for more accurate tourism demand forecasting. The explanatory variables employed in this research and their hypothesized relationships with the dependent variables are shown in Figure III-1.

**Dependent variable**
- Pleasure Travelers
- Business Travelers

**Independent variable**
- Exchange rates
- Air fare rates
- Recreational expenditure
- Income
- Crowding of Japan
- Leisure time
- Attractiveness of the USA
- Trade activities
- GNP or time-lagged GNP
- Special factors (oil crises and visa deregulation)

Figure III-1. Hypothesized relationships between dependent and independent variables in motivational models
Regional models
All USA traveler
Hawaii traveler
Mainland traveler

Motivational models
Pleasure Travelers
Business Travelers

Figure III-2. Hypothetical relationships between motivational and regional models

The following is an explanation for choosing the selected explanatory variables.

(1) Exchange rate

The exchange rate is one of the important factors for overseas travelers. It influences all kinds of expenditures made by travelers in the destination countries such as lodging, food, transportation, and shopping expenditures. Among those expenditures, shopping is the one which Japanese travelers can most detect an advantage from the exchange rate. This is because most Japanese travelers use package tours (around 80% outbound travelers) and they usually pay airfare, food, and lodging costs in Japanese currency prior to their travels.

According to the JTB report (1992), shopping is the second priority\(^\text{18}\) for outbound Japanese travelers at destinations. The USTTA report (1992) also indicates that the portion of shopping expenditure among all travel

\(^{18}\) The first priority is sightseeing.
Expenditures for Japanese travelers is much higher than other foreign travelers to the USA.

Even though it is questionable whether the exchange rate influences business travelers, the factor will be examined in this paper.

(2) Airfare rates

Because the airfare rates are the largest expenditure among total expenditures, they play a big role in tourism demand. Several researchers point out that introduction of jumbo-jet planes in the early 1970's made it possible to reduce airfare rates drastically and was successful in inducing the rapid growth in tourism demand (Koike and Ashiba, 1988; JAL report, 1988).

It is also indicated by several researchers that travel costs for substitute destinations, including domestic tourism spots, are equally important in the decision-making process of possible overseas travelers (Witt and Witt, 1992). In this paper, however, travel costs of substitute locations are not considered as explanatory variables for the following reasons. The first is that the most likely substitute for the USA for Japanese travelers might be Canada and the airfare rate to Canada from Tokyo is almost the same as that of Tokyo-USA. From the viewpoints of distance, travel cost, and time period needed for a trip, Europe, Australia and Southeast Asian countries could be substitutes of the USA. However, their attributes such as season, nature, and culture are very different from those of the USA. These attributes seem to be important for Japanese travelers and they might not be able to be substituted. Another reason is that the changes in airfare rates over time for alternative destinations of London and Hong Kong are similar to that of the USA.
Domestic transportation costs are sometimes compared with overseas airfare costs. For small countries like Japan, domestic transportation costs are much cheaper than that of overseas travel. In addition to this, attributes of domestic travels are different from those of the USA. As a result it is assumed that the domestic travel market doesn't compete with the overseas travel market. Therefore domestic transportation costs are not employed as a substitute factor in the analysis.

For business travelers, it is likely that more business people would go to the USA as the airfare rates go down. This is partly because Japanese business people prefer face-to-face talk with their business partners to get better communications.

In this paper, different airfare rates are used for different demand forecasting models. For example, almost all pleasure travelers buy group-discount tickets while business persons use regular price tickets with the advantage that they can change their flight schedules as needed. As a result, the airfare rates for the pleasure traveler model (denotes AF\textsubscript{PL}) should be different from that for business travelers model (AF\textsubscript{BS}). The AF\textsubscript{PL} is calculated based on the group-discount rates while AF\textsubscript{BS} is derived from the regular prices. The definitions for AF\textsubscript{PL} and AF\textsubscript{BS} are in the next section.

(3) Recreational expenditure

It is widely known that disposable income is one indicator of people's ability to purchase tourism services. In this research, an average monthly household expenditure on recreation (hereafter "recreational expenditure") is employed as a part of disposable income. In other words, recreational expenditure is a kind of "budget" which people can spend for recreation activities. Travel cost is always
perceived in comparison with this budget. Travel cost changes relative to changes in this budget will have the greatest affect on travel decisions. For instance, if airfare rates are hiked by a certain percent but an increase in recreational expenditure could offset the hike in airfare, travel decisions might stay the same as before. From this point of view, airfare rates and recreational expenditure are examined in a fractional form that is expressed as one variable 

\[
\frac{\text{Airfare}}{\text{Recreational expenditure}}
\]

An additional reason for using the fractional form is to reduce multicollinearity problems.

(4) Income

Instead of recreational expenditure, income is employed to represent a kind of budget for business travelers. "Income" is supposed to be a proxy of workers' wages which companies pay for their employees. In the 1960s, a round trip ticket between Tokyo and the West coast was four times the monthly average income. In those days, sending a business person to the USA was very costly for companies. More recently, the round trip ticket costs only a half of the average monthly income, and it is assumed that the cheaper tickets encourage companies to send more business persons to the USA. Japanese companies like to contact their business associates in a face-to-face environment in order to get closer relationships. Therefore, it is fair to say that airfare rates relative to income affect the number of business travelers.

(5) Crowding of Japan

This is a unique variable in this research. According to several studies on Japanese domestic tourism (The Office of Prime Minister, 1992; Japan Leisure Development Center, 1991; Koike and Ashiba, 1988), "crowding" is the second
biggest complaint of domestic tourists following the first complaint of "expensive travel cost". A report conducted by the Office of the Prime Minister (1992) shows that domestic pleasure travelers complain of "crowding" that includes "traffic jam" (36%) and "crowding at destinations" (31%). These numbers are ranked as the second and third complaint following the complaint of "travel costs were more expensive than expected" (45%)\(^\text{19}\).

Crowding may be thought as a "push factor" according to Goodall (1988). He classified motivations of pleasure travelers into "push factors" and "pull factors". The push factors are related to the home environment such as escape from routine work and respite from every day worries, while pull factors relate to the environment of destinations. Crowding in the origin country could have a role as a push factor in travelers' decision-making process. It is also well known as "displacement behavior" in the area of recreational study, i.e. some recreationists tend to avoid crowded areas and go to other places that are less crowded (Becker, 1981; Anderson and Brown, 1984; Shelby et al., 1988; Hammitt and Paterson, 1991).

In this paper, domestic crowding is represented by visitor density at Japanese national parks. In terms of crowding due to traffic jams, it is hard to measure this factor. If this factor was available, "a composite crowding" combining crowding of destination sites and traffic jams might be a better indicator. For the business traveler model, this variable was not used.

(6) Leisure time

Time constraints are critical for overseas travelers as well as cost constraints. Especially for Japanese, time is

\(^{19}\) The survey includes multiple response questions.
essential because the custom of long-haul vacations has not been widely adopted in Japanese society. This is partly because most Japanese work more than 5 days per week\textsuperscript{20}. According to the report of the Office of the Prime Minister (1992), the time constraint is the second highest obstacle that makes Japanese hesitate to go abroad, following the first obstacle of cost constraint\textsuperscript{21}. Several researchers agree that increasing leisure time among Japanese nationals has encouraged travel overseas (Koike and Ashiba, 1988; JTB report, 1992; the Office of the Prime Minister, 1992).

There are two indicators to measure leisure time; average vacation days in a year and total working hours in a certain time period. Although the former indicator is better than the latter one, the data is not available for the period between 1964 and 1990. The percentage of workers who are under the working condition of so-called "quasi 5-day a week working condition"\textsuperscript{22} was employed as a measure of leisure time. It is expected that this indicator shows not only working hours a week but also how the Japanese society has been adopting the American working system which accommodates long-haul vacations.

For the business travelers, this factor is not relevant.

(7) Attractiveness of the USA

Attractiveness of the USA is difficult to measure. Even though attractiveness of destinations is acknowledged as an

\textsuperscript{20} The proportion of workers who work 5 days a week was approximately 42\% in 1990.

\textsuperscript{21} Sixty three percent of respondents mentioned "overseas travel is expensive", 42\% answered "no time for overseas trips" and 19\% pointed out "language barrier".

\textsuperscript{22} "quasi 5-day a week working condition" means that at least one week with 5 working days is contained in a month. the other 3 weeks could be 6 working days. In other words, the weekly working hours is less than 48 hours (6days/week).
important factor for overseas travelers, most economic researchers ignore it because of the difficulty of obtaining an appropriate proxy for attractiveness. Economists tend to treat all possible tourism destinations as similar products, assuming that they have the same attributes and they give the same experiences to travelers. But each country has different attributes in terms of nature, culture, and history.

According to Goodall (1988), attractiveness is a "pull factor" for travelers. The travelers whose motivations are classified as things such as sightseeing and experiencing different cultures care about the attributes of destinations. For example, when a person wishes to visit the Grand Canyon, there is no other substitute place. Other travelers, however, whose motivations are push factors such as escape from every day environment, don't care much about the attractiveness of destinations. Hence, their decision-making is mostly done under time and cost constraints. It is assumed that pull factors dominate over push factors for Japanese travelers because their travel behavior is very intense to see and to do many things in a short period of time rather than to relax at one destination escaping from their busy every day lives.

There are several possible ways to measure attractiveness of overseas travel destinations. A couple of surveys ask Japanese nationals which country is the most desirable to them for their possible overseas travel destinations. Unfortunately those surveys are not conducted on an annual basis. Numbers of Japanese travelers at each destination sometimes indicate the popularity of destinations. But those numbers are results of many factors and therefore don't represent the true attractiveness of each destination.
In this paper, the attractiveness is represented by the promotional cost spent by US government travel and tourism administration which is the only available data in annual basis. Stabler (1988) showed how an image of the destination is created by a number of factors and indicated that promotional activities influence people's images towards their destinations. This factor will not used for business travelers.

(8) Trade activity
Trade activities between Japan and the USA is an important factor for the business traveler model. Trade activity is represented by the total amount of import and export between Japan and the USA.

(9) GNP or time-lagged GNP
Because economic conditions impact Japanese nationals psychologically as well as economically, GNP is chosen as an important variable. GNP is a proxy for not only economic conditions in Japan, but also for reflecting people's psychological easiness. When economic conditions are in a downward trend or stagnation, an insecure feeling about the future may discourage overseas travel.

A reason for employing time-lagged GNP is as follows. In Japan, most of the salaried workers are secured in their job opportunities through their lifetime\textsuperscript{23} and their annual payments are usually set up every spring through the negotiations between unions and employers. Therefore the impact on incomes of a drop in GNP will be delayed.

For reasons above, GNP impacts not only business travelers but also pleasure travelers.

\textsuperscript{23} Layoffs only happen to Japanese hourly workers.
(10) Special factors

In this research, two dummy variables are used for representing discrete special factors. Dummy variable-1 represents the effects of two oil crises in 1973 and 1979. The first oil crisis happened in November of 1973 and impacted the Japanese economy for the next two years. The impacts of the second oil crisis in 1979 was much smaller than those of the first one. As a result, the effects of the two oil crises were found in the years of 1974, 1975, and 1979. Witt and Witt (1992) employed this dummy variable for their analysis.

Dummy variable-2 reflects the effects of the visa deregulation between Japan and the USA which took place in December of 1988 (see p.7 of Chapter-I). The deregulation has lessened travelers' burdens for visa preparations. Dummy variable-2 represents the years after 1988.

(11) Other possible variables

Safety concern is an important factor for Japanese outbound travelers. Even local incidents such as the terrorist attack in New York, Los Angeles riots, and San Francisco earthquake could affect tourists' decision to travel to the USA. This factor is related to the image or attractiveness of destinations and is hard to estimate.

III-1-2 Forecasting Future Values of Independent Variables

It is always a problem to get accurate figures for independent variables in the future in order to obtain accurate forecasting results using forecasting equations. It is true that you need other forecasting techniques to obtain future explanatory variables such as the exchange rates and GNP in the future and it is not easy to forecast these
values. However, many factors are frequently forecasted by governmental agencies as well as private economic institutes. These forecasting figures can be used for future explanatory variables.

III-1-3 Specifying a Functional Form

Before deciding on a functional form for each model, simple plots between the dependent variable (number of travelers per capita) and each independent variable were viewed. After checking the relationships for each explanatory variable and the dependent variable, several possible functional forms were examined for regression analysis. As mentioned in Chapter-II, not only the linear form but also the semi and double logarithmic forms are possible functional forms for the models.

III-1-4 Evaluation Criteria for the Models

For the ordinary least square (OLS) multiple regression analysis, the following evaluation criteria are considered to obtain the best fit model out of a number of possible equations:

- Correct signs for the coefficients
- t-statistics for the coefficients
- Durbin-Watson statistics for the equations
- F-statistics for the equations
- $R^2$ for the equations
- Mean absolute percentage error
- Appropriate explanations not only for each explanatory variable but also for the whole equation.
- Multicollinearity problems among variables.
(1) Correct signs for the coefficients.

The explanatory variables should have correct signs for their coefficients. Correct signs mean that they are consistent with theoretical expectations. Prior to the regression analysis, researchers may expect signs for their chosen explanatory variables. For example, airfare rates should have a negative coefficient, because visitation usually decreases as travel cost increases. However, there are some variables for which the coefficients' signs are unexpected. For example, income usually will have a positive sign against visitations. But it could have a negative sign in some cases where personal preferences shift from one recreational activity to another as income increases. An example is the relationship between income and domestic tourism. It is usually expected that domestic tourism increases as household income increases. But sometimes tourism preference shifts from domestic to abroad when people get richer. As a result, domestic tourism might stay the same or decrease as average income increases. Therefore, the criterion for the coefficients' sign must be examined carefully. Table III-1 is a summary of expected signs for the models of pleasure and business travelers.
Table III-1. Expected signs for coefficients of each variable in pleasure and business traveler models

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Pleasure traveler model</th>
<th>Business traveler model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exch *</td>
<td>positive</td>
<td>positive</td>
</tr>
<tr>
<td>Airfare or (Airfare/RecExp) or (Airfare/Income)</td>
<td>negative</td>
<td>negative</td>
</tr>
<tr>
<td>GNP or GNP_{t-1}</td>
<td>positive</td>
<td>positive</td>
</tr>
<tr>
<td>Trade</td>
<td>N.A.**</td>
<td>positive</td>
</tr>
<tr>
<td>Crowding</td>
<td>positive</td>
<td>N.A.</td>
</tr>
<tr>
<td>Leisure time</td>
<td>positive</td>
<td>N.A.</td>
</tr>
<tr>
<td>Attractiveness</td>
<td>positive</td>
<td>N.A.</td>
</tr>
<tr>
<td>Dummy-1</td>
<td>negative</td>
<td>negative</td>
</tr>
<tr>
<td>Dummy-2</td>
<td>positive</td>
<td>positive</td>
</tr>
</tbody>
</table>

* The exchange rate is expressed in $/yen
** N.A. denotes that those variables are not examined in regression analysis

(2) t-statistics

$t$-statistics for each coefficient are important to show that the coefficients are significantly different from zero. It is preferable that all coefficients are significant at the 90% level. But this is not always necessary because the main objective of forecasting focuses on the accuracy of the forecasting equation not on understanding the roles of each explanatory variable. It is sometimes possible to compromise this criterion in exchanging for other criteria.
(3) Durbin-Watson statistic

For time series data, autocorrelation is always a possible problem. Autocorrelation exists when error terms\(^{24}\) are correlated over time and it leads a wrong regression result where the confidence intervals, t-tests, and F-test are no longer strictly applicable. The Durbin-Watson (D.W.) statistic shows whether a model has an autocorrelation problem or not. Once you have the autocorrelation problem, the model is no longer reliable as a regression result. Therefore as a criterion for the autocorrelation problem, D.W. statistics for a model should be at least bigger than the lowest limit of the D.W. statistics table.

(4) F-statistic

The F-statistic shows whether all coefficients in an equation are significantly different from zero. Therefore, the F-statistic should be bigger than the table value to reject the hypothesis that a dependent variable is independent from all explanatory variables.

(5) \(R^2\) (Coefficient of multiple determination)

Even though there are specific figures for \(R^2\), 0.80 or bigger \(R^2\) is considered acceptable in terms of accurate forecasting.

(6) Mean absolute percentage error (MAPE)

MAPE is not a criterion for selecting a best fit model among a number of regression trials, but rather an evaluation criterion for forecasting accuracy of the obtained best fit model (Witt and Witt, 1992). MAPE is defined as follows;

\[^{24}\text{Error term means the vertical deviation of an observed value from true regression line.}\]
MAPE = \frac{1}{n} \sum_{t=1}^{n} \left[ \frac{\hat{V}_t - V_t}{V_t} \right] \times 100 \quad \ldots \quad (3.3)

where \( \hat{V}_t \) denotes a predicted visitation calculated with an obtained equation while \( V_t \) is an actual figure. Lewis (1982) states that;

The MAPE is the most useful measure in comparing the accuracy of forecasts between different items or products since it measures relative performance (Lewis 1982, p.40).

Lewis also gave a table containing "typical MAPE values and their interpretation" (see Table III-2). In this thesis, MAPE was calculated for each best fit model, and the Lewis' table was used to evaluate the accuracy of the final models.

Table III-2. Interpretation of typical MAPE

<table>
<thead>
<tr>
<th>MAPE (%)</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10</td>
<td>Highly accurate forecasting</td>
</tr>
<tr>
<td>10-20</td>
<td>Good forecasting</td>
</tr>
<tr>
<td>20-50</td>
<td>Reasonable forecasting</td>
</tr>
<tr>
<td>&gt;50</td>
<td>Inaccurate forecasting</td>
</tr>
</tbody>
</table>

(7) Appropriate explanations for a model

Even if a model has good statistical results in terms of \( t \)-statistics, D.W., F-statistic, and \( R^2 \), there still needs to be an appropriate explanation for interpreting the model. If forecasting accuracy of the model were the only goal, it would not be important to have an explanation for the model besides as an accurate forecasting model. It would be justifiable to introduce theoretically unrelated factors into a model to improve forecasting accuracy. However, one of the advantages of multiple regression is the theoretical support for forecasting models. From this point of view, appropriate explanations are called for.
(8) Multicollinearity problem

The multicollinearity problem is not a criterion, rather a problem with which researchers should be concerned. Multicollinearity itself doesn't hinder accurate forecasting, but does prevent researchers from interpreting the meaning of each coefficient separately. In some cases, this problem can not be avoided. When the model has multicollinearity, the model can be interpreted only as a whole equation.

One of the ways for checking whether the problem exists or not is to see a correlation matrix of all variables. If there are strong correlations between independent variables, multicollinearity problems could exist.

III-2 Pleasure Traveler Model (Basic Model)

As mentioned in the previous section, the basic model of Japanese pleasure travelers to the USA might be expressed as a function of several explanatory variables.

\[
\left( \frac{V_{nl}}{\text{Pop}} \right) = f(\text{Exch}, \text{AF}_{nl}, \text{RecExp}, \text{Crowd}, \text{Leisure}, \text{Attract}, \text{GNP} \text{ or } \text{GNP}_{t-1}, \text{Dummy-1}, \text{Dummy-2})
\]

... (3.4)

where

\( V_{nl} \): Japanese pleasure travelers to the USA per year in thousands (thousand/ year).

\( \text{Pop} \): Population of Japan (in millions)

\( \text{Exch} \): Exchange rate (yen/dollar)

\( \text{AF}_{nl} \): A weighted airfare rate for pleasure travelers is calculated based on the group-discount rates (so called bulk rates) of Tokyo-Hawaii and Tokyo-West Coast\(^{25}\) (1964's yen/ round trip).

\(^{25}\) A definition of \( \text{AF}_{nl} \) is given on p.55 of the next chapter.
Leisure: A proxy for leisure time of Japanese is expressed as percentage of workers who are under quasi 5-day a week working condition\textsuperscript{26} among all workers (\%).

Crowd: Visitor density at Japanese national parks (person/Ha) is a proxy for crowding at Japanese recreation areas.

RecExp: Monthly expenditure of a Japanese household for recreation purposes (1964's 1000 yen/mo). This is a proxy for disposal income.

Attract: Attractiveness of the USA is represented by promotion cost incurred by USTTA for its international tourism promotional program. The past three years' cumulative costs are used as representative figures for attractiveness of the USA (1964's 1000 US dollars).

GNP or GNP\textsubscript{t-1}: GNP\textsubscript{t-1} represents the GNP of the previous year. It is assumed that both GNP's reflect economical and psychological stability among nationals (1964's million yen).

Dummy-1: It represents the years which were influenced by the oil crises of 1973 and 1979. Dummy variables for the years of 1974, 1975, and 1979 equal one, otherwise zero.

Dummy-2: Visa regulations were partially lifted in 1989 by the US government for Japanese travelers who travel to the USA for less than 90 days for the purposes of pleasure and business. The value of one is given for the years of 1989 and 1990 and otherwise zero.

There are several possible functional forms for pleasure travelers. The final best fit model will be chosen based on theoretical explanations and goodness of fit statistics.

\textsuperscript{26} See footnote-22 on p.41.
III-3 Business Traveler Model (Basic Model)

The basic model for Japanese business travelers to the USA is expressed as follows.

\[
\ln(V_{bs}/\text{Pop}) = f(\text{Exch, } AF_{bs}, \text{ Income, Trade, GNP or } \\
\text{ GNP}_{t-1}, \text{ Dummy-1, Dummy-2}) \quad ... (3.5)
\]

\(V_{bs}\) is the annual Japanese business travelers to the USA in thousands. A couple of new variables are employed for this model. \(AF_{bs}\) is a weighted airfare rate for business travelers and is calculated based on the regular economy class rates of Tokyo-Hawaii and Tokyo-West Coast routes\(^27\).

The variable "trade" is considered to be the most important variable for business travelers because their main purposes for travel to the USA is trading.

The crowding, leisure time, and attractiveness variables are omitted for this model as explanatory variables because these are assumed to be unrelated factors for the business travelers. The simple correlation plots were used to estimate the relationships between the dependent variable and each independent variable. Expected signs are listed in Table III-1.

III-4 Models for Regional Travelers

Because the numbers for pleasure and business travelers were not available for each region separately, the data used in the regional models include both pleasure and business travelers. Basic models for all Japanese travelers to the USA (\(V_{usa}\)), US mainland visitors (\(V_{mt}\)), and travelers to Hawaii (\(V_{ha}\)) are estimated based upon the two previous models; pleasure traveler model and business traveler model.

\(^{27}\) A definition of \(AF_{bs}\) is given on p.56 of the next chapter.
Therefore the basic regional models contain all explanatory variables that have been used for pleasure and business traveler models.

\[
\ln(V_{us}/\text{Pop}) \text{ or } \\
\ln(V_{mn}/\text{Pop}) \text{ or } \\
\ln(V_{us}/\text{Pop}) = f \left( V_{us}/\text{Pop}, V_{mn}/\text{Pop} \right) \\
\quad = f \left( \text{Exch, AF, RecExp, Income, Crowd, Leisure, Attract, Trade, GNP or GNP}_t, \right. \\
\left. \text{Dummy-1, Dummy-2} \right) 
\]  

...(3.6)

Only one variable "AF" (airfare rate) is modified for each regional model. For example, The model for Hawaii takes a weighted round-trip airfare rate \( (AF_{us}) \) calculated from regular and bulk prices between Tokyo and Hawaii. The airfare rates for each model are defined as follows.

**Hawaii weighted**

airfare \( AF_{us} = (\text{regular rate of Tokyo-Hawaii}) \times 0.2 + \\
(\text{bulk rate of Tokyo-Hawaii}) \times 0.8 \)  

...(3.7)

**Mainland weighted**

airfare \( AF_{mn} = (\text{regular rate of Tokyo-West Coast}) \times 0.2 + \\
(\text{bulk rate of Tokyo-West Coast}) \times 0.8 \)  

...(3.8)

**USA weighted**

airfare \( AF_{usa} = \frac{(AF_{us} \times V_{us} + AF_{mn} \times V_{mn})}{(V_{us} + V_{mn})} \)  

...(3.9)

where \( V_{us} \): Japanese travelers to Hawaii \\
\( V_{mn} \): Japanese travelers to the US mainland

The coefficients of 0.8 and 0.2 are the rough estimates of the proportions of discount ticket users and regular price ticket buyers reported by JAL (1988).
CHAPTER IV : SOURCES OF DATA AND DATA SETS

IV-1 Source of the Data

The data sets for the time period of 27 years (1964-1990) were obtained from the following sources.

(1) Japanese visitations by motivations and by destinations ($V_{USA}$, $V_{B}$, $V_{ML}$, $V_{PL}$, and $V_{BS}$)

There are two data sources for Japanese visitors to the USA; the annual reports of US Immigration and Naturalization Service (USINS, 1962-1992) and the tourism white papers of the Japanese government (The Office of the Prime Minister, 1964-1990, 1991a, 1992). Although it is generally known that arrival data at destination countries are more reliable than those of origin countries, the Japanese governmental data are employed in this research. The reasons for this are that the US immigration data were incomplete for the years of 1979 to 1982 and the border crossing travelers were not counted in the data. On the other hand, the Japanese government data have been adjusted for those incomplete years. Therefore the numbers of the total Japanese visitors to the USA ($V_{USA}$) and to Hawaii ($V_{B}$) are obtained directly from the Japanese tourism white paper. The Japanese travelers to the mainland ($V_{ML}$) of the USA is calculated by subtracting Hawaii and Guam visitors from the total Japanese visitors to the USA.

The number of pleasure travelers ($V_{PL}$) is calculated by multiplying the $V_{USA}$ by the portion of pleasure travelers among all Japanese visitations which is obtained from the US immigration arrival data. The same thing can be done for the business travelers ($V_{BS}$). Those visitations by motivations and regions are listed in Table IV-1.
(2) Population (Pop) and exchange rates (Exch)

Population (Pop) and annual average exchange rates (Exch) are obtained from the International Financial Statistics Yearbook (IMF, 1992). Population is expressed in millions and the exchange rates are expressed in yen per dollar. They are shown in Table IV-2.

(3) Airfare rates \( \text{AF}_{\text{PL}}, \text{AF}_{\text{BS}}, \text{AF}_{\text{USA}}, \text{AF}_{\text{Hawaii}}, \text{AF}_{\text{PL}} \)

There are four sets of raw data for the airfare rates; bulk rates for Tokyo-Hawaii and Tokyo-West Coast and regular economy class rates for Tokyo-Hawaii and Tokyo-West Coast. They are expressed as \( \text{AF}_{\text{bulk,TK-Hawaii}}, \text{AF}_{\text{bulk,TK-West Coast}}, \text{AF}_{\text{regl,TK-Hawaii}}, \text{AF}_{\text{regl,TK-West Coast}} \). These airfare rates for 1964 to 1987 are found in the report of Japan Air Line Co. (1988). The recent figures for 1988-1990 were obtained through personal requests to the JAL (JAL letter, 1992).

As mentioned in the previous chapter, several airfare rates for different models are defined as the following. The airfare rate for pleasure travelers (\( \text{AF}_{\text{PL}} \)) is obtained by equation (4.1).

\[
\text{AF}_{\text{PL}} = \left( \text{AF}_{\text{bulk,TK-Hawaii}} \times V_{\text{Hawaii,PL}} + \text{AF}_{\text{bulk,TK-West Coast}} \times V_{\text{West Coast,PL}} \right) / \left( V_{\text{Hawaii,PL}} + V_{\text{West Coast,PL}} \right)
\]

(4.1)

\( V_{\text{Hawaii,PL}} \) and \( V_{\text{West Coast,PL}} \) represent Japanese pleasure travelers to Hawaii and to the mainland of the USA, respectively. Those numbers for regional pleasure travelers are calculated under assumptions that the proportion of pleasure travelers to Hawaii is 91.8% and that of mainland travelers is 56.4% over the years. The percentage figures are reported by JTB for the year of 1991 (JTB, 1992).

In the same way, the airfare rates for the business traveler model \( \text{AF}_{\text{BS}} \) are defined as follows.
\[ AF_{BS} = \left( AF_{reg1,TK-H} \times V_{HW,BS} + AF_{reg1,TK-MC} \times V_{ML,BS} \right) / (V_{HW,BS} + V_{ML,BS}) \]

...(4.2)

\[ V_{HW,BS} \text{ and } V_{ML,BS} \text{ represent Japanese business travelers to Hawaii and to the mainland USA respectively. Those numbers for regional business travelers are calculated under assumptions that the proportion of business travelers to Hawaii is 6.5\% and that of mainland travelers is 38.4\% over the years. The percentage figures are reported by JTB for the year of 1991 (JTB, 1992).} \]

Although the airfare rates for regional models have already been defined in the previous section, they are repeated here again\(^{28}\).

\[ AF_{HW} = (AF_{bulk,TK-H} \times 0.8) + (AF_{reg1,TK-H} \times 0.2) \]

...(4.3)

\[ AF_{ML} = (AF_{bulk,TK-MC} \times 0.8) + (AF_{reg1,TK-MC} \times 0.2) \]

...(4.4)

\[ AF_{USA} = (AF_{HW} \times V_{HW} + AF_{ML} \times V_{ML}) / (V_{HW} + V_{ML}) \]

...(4.5)

The coefficients of 0.8 and 0.2 are the rough estimations for the portion of discount ticket users and regular price ticket buyers among JAL customers (JAL, 1988).

(4) Recreation expenditure (RecExp)

The monthly recreational expenditure is obtained from the Nippon Toukei Nenkan (Japan Statistical Yearbook: Statistical Bureau of Japan, 1964-1991). This expenditure includes expenses not only for recreational goods and services but also books and newspaper subscription, transportation, and communication. The raw data of recreational expenditure is expressed in nominal 1000 yen/month and converted into constant yen of 1964 by using the consumer price index.

\(^{28}\) Refer to page 52 for the definitions of airfare rates.
RecExp(Constant) = RecExp(Nominal) \times \frac{100}{CPI_{Japan}} \quad (4.6)

where CPI_{Japan} denotes the consumer price index of Japan based on the year of 1964.

(5) Income

The monthly average Japanese household income is obtained from the Nippon Toukei Nenkan (Statistical Bureau of Japan, 1964-1991). The figures are net income after taxes and expressed in nominal 1000 yen/month. The nominal values are converted into constant values by the following equation and used for regression analysis.

\[ \text{Income(Constant)} = \text{Income(Nominal)} \times \frac{100}{CPI_{Japan}} \quad (4.7) \]

(6) Crowding (Crowd)

Crowding in Japan is represented by the visitor density at Japanese national parks by dividing the number of visitors by the total land area of Japanese national parks. These data are also found in the Japan Statistical Yearbook. Crowding is expressed in persons per Ha.

(7) Leisure time (Leisure)

Leisure time is represented by the percentages of workers who work under the quasi 5-day working condition. The data were found in the Statistical Handbook of Japan since 1970 (Statistical Bureau of Japan, 1964-1990). For the years of 1964-1969, the data were not available and extrapolated numbers were used in this paper assuming that the figure has been gradually increasing over the years.

(8) Attractiveness of the USA (Attract)

Attractiveness of the USA is represented by the promotional costs spent by the US government's Travel and Tourism Administration (USTTA) that is found in the US
Governmental Budget Report (Office of Management and Budget, 1963-1991)\(^2\). The past three years cumulative costs were taken as each year's representative figures. For example, the figure of attractiveness for 1970 is the summation of three years annual costs of 1968, 1969, and 1970. The nominal dollars were converted into constant dollars by using the consumer price index of the USA.

Because of the three years' cumulative figures, the data were gathered since 1962.

(9) Trade activities (Trade)

US dollar amounts of both export and import between Japan and the USA represent the trade activities. The Statistical Handbook of Japan (Statistical Bureau of Japan, 1964-1990) lists these figures every year. Each year's dollar values are converted into 1964's dollar value by using the consumer price index of the USA.

(10) GNP

GNP is found in the International Financial Statistics Yearbook (IMF, 1992) and converted into 1964's yen value using the consumer price index. One year time lagged GNP\(_{t-1}\) corresponds to the GNP of the previous year. Therefore the data beginning from 1963 were utilized.

IV-2 Data sets

Complete data sets are shown in Tables IV-1, IV-2, IV-3, and IV-4. The data for 1991 will be used later to assess the final models.

\(^2\) The budget reports contain the actual expenses in the previous year.
Table IV-1. Numbers of Japanese travelers by motivations and by destinations

<table>
<thead>
<tr>
<th>YEAR</th>
<th>$V_{NA}$ (1000)</th>
<th>$V_{SW}$ (1000)</th>
<th>$V_{SA}$ (1000)</th>
<th>$V_{SUM}$ (1000)</th>
<th>$V_{SL}$ (1000)</th>
<th>$V_{SP}$ (1000)</th>
<th>$V_{OTHERS}$ (1000)</th>
<th>Pop (MILLION)</th>
</tr>
</thead>
<tbody>
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<td>1964</td>
<td>42</td>
<td>23</td>
<td>18</td>
<td>1</td>
<td>12.84</td>
<td>21.11</td>
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<td>97.83</td>
</tr>
<tr>
<td>1965</td>
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<td>20</td>
<td>1</td>
<td>14.67</td>
<td>20.96</td>
<td>8.37</td>
<td>98.88</td>
</tr>
<tr>
<td>1966</td>
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<td>27</td>
<td>24</td>
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<td>30.67</td>
<td>10.75</td>
<td>99.79</td>
</tr>
<tr>
<td>1967</td>
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<td>29</td>
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<td>13.33</td>
<td>100.83</td>
</tr>
<tr>
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<td>41</td>
<td>12</td>
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<td>46.68</td>
<td>14.08</td>
<td>101.96</td>
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<td>49</td>
<td>67</td>
<td>21</td>
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<td>54.81</td>
<td>19.42</td>
<td>103.17</td>
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<tr>
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<td>77</td>
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<td>78.00</td>
<td>18.91</td>
<td>104.34</td>
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<td>417</td>
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<td>82</td>
<td>110</td>
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<td>85.09</td>
<td>25.10</td>
<td>107.19</td>
</tr>
<tr>
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<td>167</td>
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<td>26.47</td>
<td>108.71</td>
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<td>360</td>
<td>233</td>
<td>170</td>
<td>607.13</td>
<td>127.99</td>
<td>27.88</td>
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<tr>
<td>1975</td>
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<td>172</td>
<td>164</td>
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<td>111.82</td>
<td>28.62</td>
<td>111.57</td>
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<tr>
<td>1976</td>
<td>772</td>
<td>450</td>
<td>182</td>
<td>140</td>
<td>623.89</td>
<td>114.59</td>
<td>33.52</td>
<td>112.77</td>
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<tr>
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<td>157</td>
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<td>609.59</td>
<td>107.71</td>
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<td>1978</td>
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<td>321</td>
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<td>172.08</td>
<td>60.21</td>
<td>115.87</td>
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<tr>
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<td>335</td>
<td>222</td>
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<td>156.04</td>
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<td>116.78</td>
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<tr>
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<td>592</td>
<td>348</td>
<td>225</td>
<td>980.73</td>
<td>146.16</td>
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Note: $V_{SUM}$ and $V_{OTHERS}$ are not used for analysis.
Note: The data for 1991 is only used for assessment of the final models.
Table IV-2. Data set of Exch, Trade, Income, RecExp, GNP and CPI variables

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Exch (US$/YEN)</th>
<th>Trade (Nominal MILLION US $)</th>
<th>Income (Nominal 1000 YEN/Mo)</th>
<th>RecExp (Nominal 1000 YEN/Mo)</th>
<th>GNP (Nominal MILLION US $)</th>
<th>CPI\textsubscript{USA} 1964=100</th>
<th>CPI\textsubscript{JAPAN} 1964=100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1963</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>24962</td>
<td>-</td>
<td>-</td>
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<td>4.8</td>
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<td>100.00</td>
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<tr>
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<td>67.6</td>
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Note: The variables of Trade, Income, RecExp, and GNP are used for analysis after they are converted into 1964's constant dollar values by using CPI\textsubscript{USA} and CPI\textsubscript{JAPAN}.

Note: The data for 1991 is only used for assessment of the final models.
### Table IV-3. Data set of air fare rates

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<th>$AF_{reg}$</th>
<th>$AF_{bulk}$</th>
<th>$AF_{reg}$</th>
<th>$AF_{Yen}$</th>
<th>$AF_{EU}$</th>
<th>$AF_{UL}$</th>
<th>$AF_{Yen}$</th>
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<td></td>
<td>(Nominal YEN/RT.)</td>
<td>(Nominal YEN/RT.)</td>
<td>(Nominal YEN/RT.)</td>
<td>(Nominal YEN/RT.)</td>
<td>(Nominal YEN/RT.)</td>
<td>(Nominal YEN/RT.)</td>
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</table>

Note: $AF_{bulk}$ and $AF_{reg}$ are only used to calculate the airfare rates for region and motivation analysis.

Note: The data set for 1991 is only used to assess the final models.
Table IV-4. Data set of Crowding, Leisure time, Attractiveness, and dummy variables

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Crowd</th>
<th>Leisure</th>
<th>USTTA promotion Cost</th>
<th>Attractive Cost</th>
<th>Dummy-1</th>
<th>Dummy-2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>($ / Ha)</td>
<td>(%)</td>
<td>(Nominal 1000 US $)</td>
<td>(1964's 1000 US $)</td>
<td></td>
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</tr>
<tr>
<td>1962</td>
<td>-</td>
<td>-</td>
<td>1890</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td>2807</td>
<td>-</td>
<td>-</td>
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<td>*(213.97)</td>
<td>*(89.3)</td>
<td>17171</td>
<td>9819.5</td>
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Note: USTTA promotion cost is used only to calculate the variable of attractiveness.

* denotes that these figures were obtained by extrapolating the past trend to the year of 1991.

Note: The data set for 1991 is only used to assess the final models.
CHAPTER V : RESULTS AND DISCUSSION

V-1 Pleasure Traveler Model

The best fit equation for the pleasure traveler model is the following.

$$\ln\left(\frac{V_i}{Pop}\right) = -9.246 + 0.298\ln(\text{Exch}) - 0.430\ln(\text{RecExp})$$

$$+ 0.0077(\text{Crowd}) + 0.0135(\text{Leisure}) + 1.258\ln(GNP_{t-1})$$

$$+ 0.0794(\text{DV2})$$

Adjusted $R^2 = 0.9958$

F-ratio = 1019

D.W. stat. = 1.319

MAPE = 7.46%

Two explanatory variables, "attractiveness" and "Dummy variable-1" or "DV-1" proposed in the basic model, were eliminated from the best fit equation (5.1) due to wrong signs of their coefficients against the expected signs in Table III-1 (see p.47). There could be explanations for the elimination of two variables from the equation. For the elimination of DV-1, it could be assumed that other variables such as exchange rate and GNP$_{t-1}$ had already accounted for the impacts of the oil crises. For the variable of "attractiveness", it is assumed that the data are not a suitable indicator for representing the attractiveness of the USA. Because the data represent all expenditures of the USTTA for it's world wide tourism promotional programs including Japan, only some parts of the

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30 Figures in parentheses are t-statistics and * and ** denote the significance levels at 90% and 95% confidence levels respectively.

31 Dummy variable-1 reflects the impacts of two oil crises of 1973 and 1979. It has the value of 1 for 1974, 1975, and 1979 and 0 otherwise.
expenditure contribute to improve the image of the USA among possible Japanese outbound travelers.

Besides this, the image of the USA has also been promoted by private tour operators through their advertisement activities. Therefore, the governmental promotional program itself is only a part of all promotional activities. Stabler (1988) points out that an image of the destination is created and influenced by not only supply factors such as promotional activities but also travelers' factors such as their experiences and their psychological characteristics. He also mentions that it is difficult to evaluate each factor's contribution in creating an image of the destination among travelers because of its complexity.

Six explanatory variables appear in the best fit equation. Some of them are expressed in logarithmic form and some are not. For each explanatory variable, both logarithmic and linear functional forms were examined in regression analysis. The final selection among several trials was based upon $R^2$ and D.W. statistics. Four explanatory variables; "AF_{pl}/RecExp", "Crowd", "Leisure", and "GNP_{t-1}", are significant at the 95% confidence level. The exchange rate is significant at 90% level and the dummy variable-2 or "DV-2" is out of the 90% significant level. Even though DV-2 has a small t-statistic (=0.786), it was left in the equation. Because there have been only two years of visa deregulation\[32\], it is not clear that the t-statistic is meaningful for this variable. As a result, it is implied that five explanatory variables out of six are significantly correlated to the number of pleasure travelers expressed with "V_{pl}/Pop".

\[32\] DV-2 has one for the years of 1989 and 1990, and 0 otherwise.
The adjusted $R^2$ is extraordinarily high with 0.9958 and the F-ratio is also high enough to reject the null hypothesis that all explanatory variables are independent from the dependent variable. The D.W. statistic is 1.319 meaning that the existence of an autocorrelation problem is undetermined\textsuperscript{33}. The MAPE\textsuperscript{34} for this model is 7.46% indicating that the final model provides a highly accurate forecast according to the interpretation of Lewis (1982). Overall performance of the model is satisfactory (see Table V-1 for the detailed regression results).

It should be mentioned that a multicollinearity problem exists in this equation. The correlation matrix in Table V-1 shows that several explanatory variables are highly correlated with each other. Even though $R^2$ is not affected by the multicollinearity, interpretations of the coefficients of each variable will be quite difficult. In other words, you can not estimate how much each variable is responsible for a change in the dependent variable. This problem was expected because the pretest in regression analysis indicated that the exchange rate could explain most of all the changes in the dependent variable. However, other independent variables were introduced to avoid the autocorrelation problem and to obtain more accurate forecasting models with higher $R^2$, victimizing the interpretations of each coefficient. Other than the multicollinearity problem, the equation (5.1) is quite satisfactory. Figure V-2 shows the actual data and the predicted figures calculated with the equation.

\textsuperscript{33} D.W.'s two limits are $d_L = 1.01$, $d_U = 1.86$ respectively for six explanatory variables and 27 observations at 95% significance level.

\textsuperscript{34} MAPE was defined on P.48 of section III-1-3.
Table V-1. Comprehensive summary of regression results for pleasure traveler model

The best fit equation

\[
\ln\left(\frac{V_r}{Pop}\right) = -9.246 + 0.298 \ln(Exch) - 0.430 \ln(\frac{AF_r}{RecExp}) + 0.0077 (Crowd) + 0.0135 (Leisure) + 1.258 \ln(GNP_{t-1}) + 0.0794 (DV2)
\]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>t-stat.</th>
<th>p-value</th>
</tr>
</thead>
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<td>Constant</td>
<td>-9.246403</td>
<td>5.182973</td>
<td>-1.7840</td>
<td>0.0896</td>
</tr>
<tr>
<td>\ln(Exch)</td>
<td>0.298139</td>
<td>0.156349</td>
<td>1.9069</td>
<td>0.0710</td>
</tr>
<tr>
<td>\ln(\frac{AF_r}{RecExp})</td>
<td>-0.429675</td>
<td>0.145019</td>
<td>-2.9629</td>
<td>0.0077</td>
</tr>
<tr>
<td>Crowd</td>
<td>0.007711</td>
<td>0.002622</td>
<td>2.9407</td>
<td>0.0081</td>
</tr>
<tr>
<td>Leisure</td>
<td>0.013536</td>
<td>0.002623</td>
<td>5.1614</td>
<td>0.0000</td>
</tr>
<tr>
<td>\ln(GNP_{t-1})</td>
<td>1.257791</td>
<td>0.354712</td>
<td>3.5459</td>
<td>0.0020</td>
</tr>
<tr>
<td>DV2</td>
<td>0.079372</td>
<td>0.100982</td>
<td>0.7860</td>
<td>0.4411</td>
</tr>
</tbody>
</table>

\[ R^2 \] : 0.996739  
Adjusted \[ R^2 \] : 0.99576  
Standard error : 0.101614  
Durbin-Watson stat. : 1.3187  
Observation number : 27

Analysis of variance

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of square</th>
<th>DF</th>
<th>Mean square</th>
<th>F-ratio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
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<td>6</td>
<td>10.5192</td>
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<tr>
<td>Error</td>
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<td>20</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>63.3219</td>
<td>26</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Correlation matrix of variables in simple form

\[
\begin{array}{cccccccc}
V_r/Pop & Exch & AF_r/RExp & Crowd & Leisure & GNP_{t-1} & DV2 & V_r/Pop \\
1.0000 & 0.9430 & -0.6008 & 0.6814 & 0.8000 & 0.9396 & 0.6805 & 1.0000 \\
Exch & 1.0000 & & & & & & \\
AF_r/RExp & -0.5211 & 1.0000 & & & & & \\
Crowd & 0.6011 & -0.9615 & 1.0000 & & & & \\
Leisure & -0.5142 & -0.3893 & 0.8444 & 1.0000 & & & \\
GNP_{t-1} & 0.8701 & -0.8186 & 0.8540 & 0.9236 & 1.0000 & & \\
DV2 & 0.5505 & -0.1652 & 0.3031 & 0.2868 & 0.4867 & 1.0000 & \\
\end{array}
\]
Figure V-1. Actual vs. predicted numbers for Japanese pleasure travelers to the USA from 1964 to 1990
**V-2 Business Traveler Model**

The best fit equation for the business traveler model is shown in equation (5.2).

\[ \ln(V/\text{Pop}) = -17.024 + 0.4271\ln(\text{Trade}) + 1.176\ln(\text{GNP}_{t-1}) + 0.2535(DV2) \]

\[ (-8.590)^* \quad (1.985)^* \quad (3.253)^* \quad (2.426)^* \]

Adjusted \( R^2 = 0.9745 \)

F-ratio \( = 332 \)

D.W. stat. \( = 1.295^{35} \)

MAPE \( = 9.26\% \)

For the best fit model, three variables that were hypothesized to be important ("exchange rate", "airfare rate in a ratio with income", and "dummy variable-1") are eliminated from the basic model. Multicollinearity between these variables and others in the models is a potential problem. "Airfare rate" and "DV-1" were eliminated because their signs were not as expected. The effects of DV-1 might already be accounted for by the changes in the trading activities variable. Even though the variable "exchange rate" had a correct sign, its t-statistic was so small (=0.92) that leaving this variable in the final equation improves little on the value of \( R^2 \). The low t-statistic could be a result of multicollinearity.

The following is an interpretation for the whole equation (5.2). It is theoretically acceptable that the variable "Trade" is correlated with business visitation even though it can not be said which one causes another. The GNP of the previous year or "\( \text{GNP}_{t-1} \)" represents the Japanese economic situation and likely influences the following

---

35 D.W.'s two limits are \( d_L = 1.16 \), \( d_U = 1.65 \) respectively for three explanatory variables and 27 observations at 95% significance level.
year's business activities. Since GNP is defined as summation of consumption, investments, and trade, it is expected that there might be correlation between trade and GNP\(_{t-1}\). Dummy variable-2 is significantly correlated with business visitation. Before the visa deregulation in 1989, business persons had to wait at least a week to get a business visa in order to travel to the USA and this frustrated business travelers with fear of losing their business opportunities. After the deregulation, they don't have to wait for visa and can go to the USA anytime they want as long as they have tickets. The deregulation brought more advantages to the business travelers than the pleasure travelers who usually plan their trips in advance.

Although there is a multicollinearity problem in this model as expected, the overall performance of this model is acceptable as an accurate forecasting model because R\(^2\) is high (0.9745) and MAPE is less than 10% (9.26%). Table V-2 shows the detailed statistical data and Figure V-2 is a graph showing the actual numbers and predicted figures calculated with the equation (5.2).
Table V-2. Comprehensive summary of regression results for business traveler model

The best fit equation

\[ \ln(V_{\text{BB}}/\text{Pop}) = -17.024 + 0.427\ln(\text{Trade}) + 1.176\ln(\text{GNP}_{t-1}) + 0.254(\text{DV2}) \]

<table>
<thead>
<tr>
<th>variable</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>t-stat.</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-17.023880</td>
<td>1.981923</td>
<td>-8.5896</td>
<td>0.0000</td>
</tr>
<tr>
<td>\ln(\text{Trade})</td>
<td>0.427290</td>
<td>0.215276</td>
<td>1.9848</td>
<td>0.0592</td>
</tr>
<tr>
<td>\ln(\text{GNP}_{t-1})</td>
<td>1.176201</td>
<td>0.361530</td>
<td>3.2534</td>
<td>0.0035</td>
</tr>
<tr>
<td>DV2</td>
<td>0.235308</td>
<td>0.096988</td>
<td>2.4262</td>
<td>0.0235</td>
</tr>
</tbody>
</table>

\[ R^2 : 0.977459 \]
\[ \text{Adjusted } R^2 : 0.974519 \]
\[ \text{Standard error} : 0.121986 \]
\[ \text{Durbin-Watson stat.} : 1.2948 \]
\[ \text{Observation number} : 27 \]

Analysis of variance

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of square</th>
<th>DF</th>
<th>Mean square</th>
<th>F-ratio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>14.8412</td>
<td>3</td>
<td>4.9471</td>
<td>332.45</td>
<td>0.0000</td>
</tr>
<tr>
<td>Error</td>
<td>0.3423</td>
<td>23</td>
<td>0.0149</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>15.1835</td>
<td>26</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Correlation matrix of variables in simple form

\[
\begin{array}{c|cccc}
V_{\text{BB}}/\text{Pop} & 1.0000 & \ & \ & \\
\text{Trade} & 0.9636 & 1.0000 & \ & \\
\text{GNP}_{t-1} & 0.9341 & 0.9704 & 1.0000 & \\
\text{DV2} & 0.6584 & 0.4958 & 0.4867 & 1.0000 \\
\end{array}
\]

\[
\begin{array}{cccc}
V_{\text{BB}}/\text{Pop} & \text{Trade} & \text{GNP}_{t-1} & \text{DV2} \\
\text{Trade} & & & \\
\text{GNP}_{t-1} & & & \\
\text{DV2} & & & \\
\end{array}
\]
Figure V-2. Actual vs. predicted numbers for Japanese business travelers to the USA from 1964 to 1990.
V-3 USA Visitor Model

All explanatory variables that have appeared in the final pleasure and business traveler models were examined for regional traveler models. The final model for all Japanese travelers to the USA is somewhat similar to the pleasure traveler model.

\[
\ln \left( \frac{V_{\text{US}}}{\text{Pop}} \right) = -8.503 + 0.391 \ln (\text{Exch}) - 0.286 \ln (\text{AF}_{\text{US}}/\text{RecExp}) + 0.0044 \text{(Crowd)} + 0.0091 \text{(Leisure)} + 1.236 \ln (\text{GNP}_{t-1}) + 0.123 (\text{DV2})
\]

\[
\begin{align*}
\text{Adjusted } R^2 &= 0.9957 \\
\text{F-ratio} &= 1003 \\
\text{D.W. stat.} &= 1.800^{36} \\
\text{MAPE} &= 7.44 \%
\end{align*}
\]

It is assumed that the similarity between the pleasure traveler model and the all USA visitor model is caused by the fact that the majority of all Japanese travelers to the USA are pleasure travelers. As mentioned in the earlier section, more than 80% of all Japanese travelers to the USA are pleasure oriented. A comprehensive statistical summary is shown in Table V-3. The comparison between the actual data and predicted figures is shown in Figure V-3.

\[36\] D.W.'s two limits are \(d_l = 1.01, d_0 = 1.86\) respectively for six explanatory variables and 27 observations at 95% significance level.
Table V-3. Comprehensive summary of regression results for USA visitor model

The best fit equation

\[ \ln(V_{USA}/\text{Pop}) = -8.503 + 0.391 \ln(\text{Exch}) - 0.286 \ln(\frac{\text{AF}_{USA}}{\text{RecExp}}) + 0.0044 (\text{Crowd}) + 0.0091 (\text{Leisure}) + 1.236 \ln(\text{GNP}_{t-1}) + 0.123 (DV2) \]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>t-stat.</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-8.503160</td>
<td>4.657322</td>
<td>-1.8258</td>
<td>0.0829</td>
</tr>
<tr>
<td>\ln(\text{Exch})</td>
<td>0.391319</td>
<td>0.121933</td>
<td>3.2093</td>
<td>0.0044</td>
</tr>
<tr>
<td>\ln(\frac{\text{AF}_{USA}}{\text{RecExp}})</td>
<td>-0.285732</td>
<td>0.139088</td>
<td>-2.0543</td>
<td>0.0532</td>
</tr>
<tr>
<td>Crowd</td>
<td>0.004366</td>
<td>0.001959</td>
<td>2.2285</td>
<td>0.0375</td>
</tr>
<tr>
<td>Leisure</td>
<td>0.009144</td>
<td>0.002182</td>
<td>4.1900</td>
<td>0.0005</td>
</tr>
<tr>
<td>\ln(\text{GNP}_{t-1})</td>
<td>1.236482</td>
<td>0.311475</td>
<td>3.9698</td>
<td>0.0008</td>
</tr>
<tr>
<td>DV2</td>
<td>0.122721</td>
<td>0.080049</td>
<td>1.5331</td>
<td>0.1409</td>
</tr>
</tbody>
</table>

R² : 0.996688
Adjusted R² : 0.995695
Standard error : 0.080758
Durbin-Watson stat. : 1.7995
Observation number : 27

Analysis of variance

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of square</th>
<th>DF</th>
<th>Mean square</th>
<th>F-ratio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>39.2557</td>
<td>6</td>
<td>6.5426</td>
<td>1003.19</td>
<td>0.0000</td>
</tr>
<tr>
<td>Error</td>
<td>0.1304</td>
<td>20</td>
<td>0.0065</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>39.3862</td>
<td>26</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Correlation matrix of variables in simple form

\[ \begin{array}{cccccccc}
\frac{V_{USA}}{\text{Pop}} & 1.0000 & & & & & & \\
\text{Exch} & 0.9458 & 1.0000 & & & & & \\
\frac{\text{AF}_{USA}}{\text{RecExp}} & -0.6300 & -0.5457 & 1.0000 & & & & \\
\text{Crowd} & 0.6880 & 0.6011 & -0.9627 & 1.0000 & & & \\
\text{Leisure} & 0.7973 & 0.7142 & -0.8683 & 0.8444 & 1.0000 & & \\
\ln(\text{GNP}_{t-1}) & 0.9411 & 0.8701 & -0.8375 & 0.8540 & 0.9236 & 1.0000 & \\
DV2 & 0.6796 & 0.5505 & -0.1781 & 0.3031 & 0.2868 & 0.4867 & 1.0000 \\
\end{array} \]
Figure V-3. Actual vs. predicted numbers for all Japanese visitors to the USA from 1964 to 1990
V-4 Hawaii Visitor Model

Although the proportion of pleasure travelers among all Japanese travelers to Hawaii is higher than that of all USA visitors\(^3\), the two variables of domestic crowding and visa deregulation (DV-2) are not in the model of Japanese travelers to Hawaii. The DV-2 was eliminated because its sign was not as expected. The variable of crowding had a correct sign but it was eliminated because its t-statistic was small (=0.07).

\[
\ln\left(\frac{V}{\text{Pop}}\right) = -3.401 + 0.385 \ln(\text{Exch}) - 0.481 \ln(\text{AF/RecExp}) \\
+ 0.0135(\text{Leisure}) + 0.913 \ln(\text{GNP}_t) 
\]  
\[(-0.556) (2.414)** (2.791)** (4.769)** (2.447)** \]

Adjusted \(R^2\) = 0.9913  
F-ratio = 746  
D.W. stat. = 1.309\(^3\) \(\text{MAPE} = 8.76 \% \)

The elimination of the two variables could be explained as follows. It is assumed that Japanese travelers who go to Hawaii expect crowding because crowding at famous tourism spots like Hawaii is widely known by travelers. Therefore the behavior of traveling abroad to avoid domestic crowding is no longer a factor for travelers to Hawaii.

Because Hawaii travelers are more pleasure oriented in comparison with overall Japanese travelers to the USA, the dummy variable-2 becomes less important in this model. The comprehensive statistical summary and the actual-predicted plots are shown in Table V-4 and Figure V-4 respectively.

\(^3\) According to a report of JTB (1992), the portion of Japanese pleasure travelers among all Japanese traveling to Hawaii was 92% in 1992 while the figure was 56% for Japanese travelers to the US mainland.

\(^3\) D.W.'s two limits are \(d_u=1.08, d_d= 1.76\) respectively for four explanatory variables and 27 observations at 95% significant points.
Table V-4. Comprehensive summary of regression results for Hawaii visitor model

The best fit equation

\[ \ln(V_{j,\text{Pop}}) = -3.401 + 0.385 \ln(\text{Exch}) - 0.481 \ln(\text{AF/RecExp}) \\
+ 0.0135 \text{(Leisure)} + 0.913 \ln(\text{GNP}_{t-1}) \]

Analysis of variance

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of square</th>
<th>DF</th>
<th>Mean square</th>
<th>F-ratio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>42.0323</td>
<td>4</td>
<td>10.5081</td>
<td>745.78</td>
<td>0.0000</td>
</tr>
<tr>
<td>Error</td>
<td>0.3100</td>
<td>22</td>
<td>0.0141</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>42.3422</td>
<td>26</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Correlation matrix of variables in simple form

\[
\begin{array}{cccccc}
V_{j,\text{Pop}} & 1.0000 & & & & \\
\text{Exch} & 0.9426 & 1.0000 & & & \\
\text{AF/RecExp} & -0.6644 & -0.5405 & 1.0000 & & \\
\text{Leisure} & 0.8448 & 0.7142 & -0.8618 & 1.0000 & \\
\text{GNP}_{t-1} & 0.9606 & 0.8701 & -0.8331 & 0.9236 & 1.0000 \\
\end{array}
\]
V-5 Mainland Visitor Model

The best fit equation for US mainland visitors is expressed by equation (5.5).

\[
\ln\left(\frac{V_{\text{US}}}{\text{Pop}}\right) = -9.180 + 0.600 \ln(\text{Exch}) - 0.339 (\text{AF}_{\text{US}}/\text{RecExp}) \\
+ 1.452 \ln(\text{GNP}_{t-1}) + 0.513 (\text{DV2}) \quad \ldots (5.5)
\]

Adjusted $R^2 = 0.9788$
F-ratio = 301
D.W. stat. = 1.649
MAPE = 11.42%

Elimination of three variables, trade activities, crowding, and leisure time, were executed based upon the criteria of high $R^2$ and high D.W. statistic. The signs were as expected but t-statistics for each coefficient were small and elimination of these variables could improve adjusted $R^2$ and D.W. statistic slightly.

It is assumed that mainland visitors are more business oriented in comparison with Hawaii visitors. As a result, the variable of "Leisure time" becomes less important for mainland travelers than for those who travel to Hawaii, while "DV-2" (visa deregulation) is more important. The factor of airfare rate in ratio with recreational expenditure falls out of 90% significance level in this model. It is also assumed that this is caused by more business oriented travelers among the mainland visitors.

The MAPE for this model is slightly over 10% indicating that the forecasting accuracy is on the edge of "highly

---

39 D.W.'s two limits are $d_L=1.08$, $d_u=1.76$ respectively for four explanatory variables and 27 observations at 95% significance level.
40 The JTB report 1992 shows that the breakdown of pleasure/business/other-purpose travelers among all Japanese travelers to the mainland were 56%/36%/8% in comparison with the same breakdown of 92%/7%/1% for Hawaii visitors.
accurate." Combining MAPE with high $R^2$, it is fair to say that overall performance of the model is satisfactory.

Table V-5. Comprehensive summary of regression results for US mainland visitor model

The best fit equation

$$\ln(V_{\text{m}}/\text{Pop}) = -9.180 + 0.600 \ln(\text{Exch}) - 0.339 \ln(\text{AF}_{\text{m}}/\text{RecExp}) + 1.452 \ln(\text{GNP}_{t-1}) + 0.513 \text{(DV2)}$$

<table>
<thead>
<tr>
<th>variable</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>t-stat.</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-9.180318</td>
<td>8.613974</td>
<td>-1.0657</td>
<td>0.2981</td>
</tr>
<tr>
<td>$\ln(\text{Exch})$</td>
<td>0.600479</td>
<td>0.195418</td>
<td>3.0728</td>
<td>0.0056</td>
</tr>
<tr>
<td>$\ln(\text{AF}_{\text{m}}/\text{RecExp})$</td>
<td>-0.339091</td>
<td>0.225331</td>
<td>-1.5049</td>
<td>0.1466</td>
</tr>
<tr>
<td>$\ln(\text{GNP}_{t-1})$</td>
<td>1.452284</td>
<td>0.561925</td>
<td>2.5845</td>
<td>0.0169</td>
</tr>
<tr>
<td>DV2</td>
<td>0.512540</td>
<td>0.153279</td>
<td>3.3438</td>
<td>0.0029</td>
</tr>
</tbody>
</table>

- $R^2$ : 0.9821
- Adjusted $R^2$ : 0.97885
- Standard error : 0.159031
- Durbin-Watson stat. : 1.6492
- Observation number : 27

Analysis of variance

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of square</th>
<th>DF</th>
<th>Mean square</th>
<th>F-ratio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>30.5280</td>
<td>4</td>
<td>7.6320</td>
<td>301.77</td>
<td>0.0000</td>
</tr>
<tr>
<td>Error</td>
<td>0.5564</td>
<td>22</td>
<td>0.0253</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>31.0844</td>
<td>26</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Correlation matrix of variables in simple form

<table>
<thead>
<tr>
<th>$V_{\text{m}}/\text{Pop}$</th>
<th>Exch</th>
<th>$\text{AF}_{\text{m}}/\text{RecExp}$</th>
<th>GNP$_{t-1}$</th>
<th>DV2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0000</td>
<td>0.8974</td>
<td>-0.5206</td>
<td>0.8419</td>
<td>0.8383</td>
</tr>
<tr>
<td>Exch</td>
<td>1.0000</td>
<td>-0.5562</td>
<td>0.8701</td>
<td>0.5505</td>
</tr>
<tr>
<td>$\text{AF}_{\text{m}}/\text{RecExp}$</td>
<td>-0.5206</td>
<td>1.0000</td>
<td>-0.8447</td>
<td>-0.1855</td>
</tr>
<tr>
<td>GNP$_{t-1}$</td>
<td>0.8419</td>
<td>-0.8447</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>DV2</td>
<td>0.8383</td>
<td>-0.1855</td>
<td>0.4867</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

$V_{\text{m}}/\text{Pop}$ Exch $\text{AF}_{\text{m}}/\text{RecExp}$ GNP$_{t-1}$ DV2
Figure V-4. Actual and predicted numbers for Hawaii visitor model from 1964 to 1990.

Figure V-5. Actual and predicted numbers for US mainland visitor model from 1964 to 1990.
V-6 Assessment of the Models by Using the Data of 1991

The most recent data for the year of 1991 was not used in the regression analysis because two explanatory variables, "crowding" and "leisure time", were not available. When the data for these two variables are provided and the data set for 1991 is completed, it will be possible to assess the accuracy of each final model by comparing the actual data and the predicted numbers calculated by the final equations.

A tentative data set for 1991 has been listed in Tables IV-1, IV-2, IV-3, and IV-4 with the figures of crowding and leisure time that were obtained by extrapolating the past trends to the year of 1991. Figures V-6, V-7, V-8, V-9, and V-10 show again the actual and predicted numbers of each model with the figures of 1991. Even though all Japanese travelers to the USA increased in 1991 in comparison with the previous year, it was much less than expected (see Figure V-8). Hawaii visitors decreased in 1991 while the mainland travelers increased (see Figures V-9 and V-10). The pleasure travelers gained a little in 1991 while the business travelers decreased (see Figures V-6 and V-7). The forecasting figures in all models show increases in Japanese visitation in 1991. The differences between the actual and predicted data for 1991 are summarized in Table V-6.

As seen in Table V-6, the differences between the actual and predicted numbers for the year of 1991 lie in a range of 14% - 23%, except for the model for mainland travelers. These differences are much bigger than those expected from the value of R² as well as MAPE (Mean absolute percentage error) for each model and actually two times

41 Those figures for 1991 were announced by the Japanese government in April, 1993.
42 The actual Japanese visitations to the USA for 1991 are tentative numbers and will be revised in April, 1993.
bigger than MAPE. The forecasting of Japan Travel Bureau Inc. also overestimated all outbound Japanese travelers in 1991 by 8\% (JTB report, 1991). There should be explanations for these differences.

Table V-6. Comparison of the actual and predicted figures for 1991.

<table>
<thead>
<tr>
<th></th>
<th>Pleasure model</th>
<th>Business model</th>
<th>All USA model</th>
<th>Hawaii model</th>
<th>Mainland model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Difference</strong>= Predicted - Actual</td>
<td>+3.9512 (+17.18%)</td>
<td>+0.4658 (+14.75%)</td>
<td>+3.8463 (+14.36%)</td>
<td>+2.4983 (+22.93%)</td>
<td>-0.2668 (-2.38%)</td>
</tr>
</tbody>
</table>

Note: Figures are in visits per 1000 capita. Figures in parenthesis indicate the differences in percentages.

There are two possible explanations for the overestimation in 1991. The first explanation could be the impacts of the Gulf war that lasted from December 1990 to February 1991. A couple of annual reports of Japanese tourism industries (JTB report, 1992; Tourism white paper of Japan, 1992) point out that the Gulf war resulted in a 3.3\% decrease in overall outbound Japanese travelers in 1991 with a 22.6\% decrease during the first quarter in comparison with the previous year.

Japanese, who are very sensitive to safety of their outbound travel, hesitated to travel abroad because of potential indiscriminate terrorist attacks related to the Gulf war. Airlines connected to the USA were especially possible targets during the Gulf war. For instance, there were two anecdotes showing Japanese hesitation for traveling abroad during the war. The first one is that a Japanese hawk politician criticized the Japanese government's diplomacy toward the Gulf war by saying "Japanese youngsters are playing around on Waikiki beach while other countries' youth
are claimed with their blood in the Gulf war" (JAL letter, 1993). This criticism was severe enough to make Japanese restrain themselves from having fun outside the country. The second anecdote is a rumor that Iraqi terrorists have poisoned a reservoir on a Hawaiian island and this encouraged possible Hawaii visitors to quit their travels (JAL letter, 1993). These are only a tip of the iceberg that terrified and discouraged Japanese to go abroad.

A Japanese researcher points out that the impacts of the Gulf war continued until the summer of 1991 because people hesitated to purchase advanced package tours for summer during the war (JAL letter, 1993). This explanation is able to account for the slow down of Japanese travels to the USA and the differences between the actual and predicted data in 1991. The forecasting error for Japanese travelers to the USA were 14-23% in this study and worse than the forecasting of JTB for overall outbound travelers (8%) in 1991. It is possible that tourism to the USA was more impacted by the Gulf war than other regions.


However, it is suspicious that the economic descent affected the decrease of Japanese outbound travelers in 1991. Even though the economic descent started in early 1991, the Japanese economy still kept its vitality until the end of 1991. In addition to this, there is usually a time lag between an economic situation and the frequency of
outbound travel due to the delay of response in income and travel reservations that are made several months prior to the actual travel. As a result, it is assumed that the impacts of the "Disappearance of the Bubble economy" might come in early 1992. A couple of Japanese travel researchers support this interpretation (JAL letter, 1993; JTB letter, 1993).

Another reason to discount the influence of the Bubble economy in 1991 is that even if there was an impact of the economic depression on Japanese travelers to the USA, it should have been revealed in the model. Japan has experienced several economic stagnations after World War II. The first economic stagnation came at the end of 1970 when 57 months of economic boom, so called "Izanagi boom" which was the longest economic boom after WW-II, ended in July of 1970. The two oil crises brought economic jeopardy into Japan in 1973 and 1979. Those three economic downturns have already been accounted for in the models through several variables such as exchange rate, trade and GNP. As a matter of fact, exchange rate, GNP, and trade activities declined in these years. Therefore it is expected that future economic downturns will also be accounted for by the models. For the year 1991, these indicators show that the economy was still in good shape. As a result, it is implied that the differences between the actual and forecasted data in 1991 could be explained by the impacts of the unexpected Gulf war, except for the mainland model.

There should be another interpretation for the US mainland model because the result for the mainland model is inconsistent with the explanation above. Japanese travelers to the US mainland increased in 1991 while other regions such as Hawaii and Guam decreased. It is generally believed that the increment in the mainland travelers in 1991 is due
to the increment of business travelers because the Japanese economy was still enjoying its prosperity in 1991 (JAL letter, 1993). This is not true. The increment was due to the increment of pleasure travelers as can be seen in the Figures V-6 through to V-10.

Consequently, it is very hard to explain why only the mainland pleasure travelers increased in 1991 although other regions had fewer travelers in comparison with previous years. The only explanation for this is that travelers to the US mainland couldn't change their travel schedule because traveling to the US mainland requires long vacations and then it is hard for them to change their vacation time even though the war happened. In other words, Japanese who traveled to the US mainland ignored the risk of terrorist attacks.
Figure V-6. Actual vs. predicted numbers for Japanese pleasure travelers with the 1991’s figure.

Figure V-7. Actual vs. predicted numbers for Japanese business travelers with the 1991’s figure.
Figure V-8. Actual vs. predicted numbers for all Japanese visitors to the USA with the 1991's figure.

Figure V-9. Actual vs. predicted numbers for Hawaii visitors with the 1991's figure.
Figure V-10. Actual vs. predicted numbers for US mainland visitors with the 1991's figure.
CHAPTER VI : CONCLUSION

The equations for forecasting tourism demand of Japanese travelers to the USA were estimated in this thesis. At the first step, separate equations for pleasure and business travelers were estimated. At the second step, regional demand forecasting equations were obtained based upon the previous two equations for pleasure and business travelers. The final equations for each model are summarized in Table VI-1.

Two explanatory variables, which are "attractiveness of the USA" and "DV-1 (impacts of oil crises)" in the hypothesized models, didn't appear in any final equations while others such as "exchange rate", "airfare rates", "recreation expenditure", "domestic crowding", "leisure time", "trade activities", and "GNP_{t-1}" were significantly correlated with the number of Japanese travelers.

Besides the R², the MAPE (Mean absolute percentage error) was employed to evaluate the forecasting accuracy. The Lewis evaluation table was used in this thesis. Even though every model has multicollinearity problems, accurate forecasting models were obtained with high R²'s as well as good MAPE for the final models. The multicollinearity problem can possibly be reduced through several techniques such as factor analysis and Ridge regression techniques. However, it is important to avoid the problem only when researchers are interested in how each explanatory variable affects the dependent variable and not when overall forecasting accuracy is the goal.

It should be mentioned that all models obtained in this thesis describe the common factors significant to travel demand, but don't completely show how individuals behave in travel decision making processes. Even though some
explanatory variables were chosen from the view point of individual travel decision-making process, data on different variables at the individual level would have been necessary to describe individual's decisions.

Table VI-1. Summary of the final equations for each Japanese traveler model

<table>
<thead>
<tr>
<th>DEP. VARI.</th>
<th>PLEASURE-TRAVELERS</th>
<th>BUSINESS-TRAVELERS</th>
<th>U.S.A. TRAVELERS</th>
<th>HAWAII TRAVELERS</th>
<th>MAINLAND TRAVELERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>log(Vm/Pop)</td>
<td>log(Vm/Pop)</td>
<td>log(Vm/Pop)</td>
<td>log(Vm/Pop)</td>
<td>log(Vm/Pop)</td>
</tr>
<tr>
<td></td>
<td>(-1.724)</td>
<td>(-1.826)</td>
<td>(-0.556)</td>
<td>(-1.066)</td>
<td></td>
</tr>
<tr>
<td>ln(Exch)</td>
<td>0.296</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.907)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln(Airfare /RecExpd.)</td>
<td>-</td>
<td>-0.206</td>
<td>-0.339</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-1.054)</td>
<td>(-2.054)</td>
<td>(-1.505)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>USA weighted rate</td>
<td></td>
<td>West Coast</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>weighted rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(reg./bulk)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crowding</td>
<td>N.A.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Leis.time</td>
<td>0.028</td>
<td>N.A.</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ln(Trade)</td>
<td>N.A.</td>
<td>0.427</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ln(GNPc)</td>
<td>0.225</td>
<td>0.228</td>
<td>0.228</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.983)</td>
<td>(1.983)</td>
<td>(1.983)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DV2</td>
<td>0.0794</td>
<td>0.079</td>
<td>0.123</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.786)</td>
<td>(1.533)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAPE (%)</td>
<td>7.46</td>
<td>9.27</td>
<td>7.44</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Definitions of the variables are shown in the chapter-IV. N.A. means that those variables have not been employed in the regression analysis while the sign "-" denotes variables which were examined but were not significant.

Note: Figures in parentheses are t-statistics, the darker and lighter shadows denote that coefficients are at 95% and 90% significant levels respectively.
In an assessment of the models using the data of 1991, the models couldn't estimate accurately forecasting because of the unexpected factor of the Gulf war. However, as seen in the figures of the actual and predicted plots, the estimated models successfully reproduce the actual tendency in tourism demand for the time period of the past 27 years. In addition to this the MAPE indicate that the models provide highly accurate forecasting over these years. Therefore, it is expected that the models obtained in this thesis can be useful for long term forecasting.

There are a couple of possibilities for future research. The first possibility is that the model could be simplified without impairing the accuracy of the forecasting. This is possible because several explanatory variables are correlated with each other (multicollinearity) and therefore some of those variables could be eliminated from the models. For example, the time-lagged GNP could be eliminated from the best fit model while \( R^2 \) and D.W. statistic will be slightly worse (\( R^2 \) becomes from 0.9958 to 0.9934 and D.W. stat. becomes from 1.319 to 1.071). It is expected that the MAPE for this will not have a big difference from that of the original model. By simplifying the models, it becomes easier to predict independent variables for future years and consequently future demand forecasting will be easier. This is also helpful for avoiding the multicollinearity problem. Even after the simplification of models, there are still questions about how to get accurate figures for future independent variables and how to control them. These questions point out a weakness of simultaneous forecasting models that include explanatory variables having the same time dimension as the dependent variables. A possible answer for these questions is to use time-lagged explanatory variables in regression.
analysis. For example, for the purpose of forecasting for the next five years, five years time-lagged or older explanatory variables are employed regardless of theoretical reasoning.

Some researchers emphasize that an image of a destination is becoming increasingly important in the Japanese outbound travel demand (Stabler, 1988; JAL letter, 1993; JTB letter, 1993). Especially for the repeat travelers\(^4\), the images or attractiveness of the destinations through their previous experiences are important. Besides the socioeconomic factors, better attractiveness factors might be considered in future forecasting.

\(^4\) The JTB report (1991) indicates that overseas travel experienced persons have a greater desire to travel abroad again in comparison with the desire of non-experienced persons for traveling abroad.
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APPENDICES
Appendix A : Box-Jenkins Transformation

A basic Box-Jenkins model with one explanatory variable $X$ is expressed as follow.

$$\frac{V^{\lambda-1}}{\lambda} = a + b\left(\frac{X^{\lambda-1}}{\lambda}\right)$$  \hspace{1cm} (1)

where $V$ is a dependent variable such as tourism demand and $V^\lambda$ can be expanded as

$$V^\lambda = \exp(\lambda \ln V) = 1 + \lambda \ln V + \frac{1}{2}(\lambda \ln V)^2 + \ldots$$  \hspace{1cm} (2)

Thus, the left term of the equation (1) can be rewritten as following.

$$\frac{V^{\lambda-1}}{\lambda} = \ln V + \frac{1}{2}(\ln V)^2 + \ldots$$  \hspace{1cm} (3)

When $\lambda = 0$, $\frac{V^{\lambda-1}}{\lambda} = \ln V$ and same for $X$ as $\frac{X^{\lambda-1}}{\lambda} = \ln X$.

As a result, when $\lambda = 0$, the equation (1) can be transformed as

$$\ln V = a + b \ln X$$  \hspace{1cm} (4)

It is obvious that when $\lambda = 1$, the equation (1) becomes equation (5).

$$V = a + bX$$  \hspace{1cm} (5)
Appendix B: Time Trends of Selected Variables

Figure B-1. The trends of the exchange rate and Japanese travelers to the USA from 1964 to 1991

Figure B-2. The trends of Japanese GNP and Trade between Japan and USA from 1964 to 1991
Figure B-3. The trends of monthly average income and recreation expenditure of a Japanese household.

Figure B-4. The trends of airfare rates for pleasure and business models from 1964 to 1991.
Figure B-5. The trends of the expenditures on USTTA's promotional program.