A TOURIST BEHAVIOR MODEL SYSTEM WITH MULTI-FACETED DEPENDENCIES AND INTERACTIONS

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Abstract

Tourists' travel decisions usually involve a number of choices that are made over time and across space. Since tourists face many aspects of choices and have to deal with spatial and temporal constraints, it is expected that there exists multi-faceted dependencies and interactions in tourist behavior. The term "dependence" refers to the state that tourist's one choice aspect is conditioned on another, while the term "interaction" means tourist's two or more choice aspects are interacted with each other. Such dependencies and interactions have three facets, including dependencies and interactions among different choice aspects; temporal dependencies and interactions; and social interactions. Aiming to gain a thorough understanding of tourist behavior, this study attempts to build a model system, into which all the major choice aspects related to tourist behavior are incorporated and multi-faceted dependencies and interactions are taken into account. Concretely speaking, this study will analyze tourism participation behavior by considering the influence of various factors, including individual and household characteristics, social interactions and constraint effects; investigate tourist multi-stage choice process, including two interrelated choice aspects of destination and travel party, and three interrelated choice aspects of tourism participation, destination choice, and travel mode choice; analyze tourist's multi-destination choice with future dependence; represent tourism participation and tourism expenditure simultaneously; examine tourists' time allocation decisions on various activities during travel.

Several modeling approaches are proposed in this study. Tourism participation choice is analyzed based on a Scobit model, which includes a skewness parameter to relax the assumption made in binary logit model that the sensitivity of individuals to changes in explanatory variables is highest for those who have indifferent preferences over

participation and non-participation. Focusing on the interaction between travel party and destination, the latent class modeling approach is introduced into the nested logit modeling framework to simultaneously represent the heterogeneous nested choice structure. Three level nested logit model is adopted to jointly analyze tourist's three interrelated choice (whether to travel, destination choice, travel mode choice). The model of destination choice that incorporates future dependence is developed to represent the multi-destination choice in a tour trip. A discrete-continuous choice model is developed to represent tourists' two interrelated choice aspects (i.e., tourism participation and expenditure) simultaneously. The multiple discrete-continuous extreme value (MDCEV) model is employed to represent tourist's time use behavior with multiple activities.

In total, this thesis consists of 8 chapters. Chapter 1 describes the research background, problems, objective, methodologies, and expected contributions.

Chapter 2 gives a review of existing studies about tourist behavior analysis. Firstly, studies regarding tourism participation behavior are reviewed. Then, research concerning tourist scheduling behavior is described, which includes several dimensions: spatial choice, temporal choice, monetary expenditure, and social contexts. Next, studies about post-travel evaluation are summarized. Finally, a review of integrated framework in tourist behavior studies is given.

Chapter 3 introduces the data used in this study. Three different types of data sets are used in this study. The first one comes from a web-based questionnaire survey conducted in Japan in April 2010. The survey included very detailed information of individual's tourism behavior in the year 2009 (e.g., how many times they participated in tourism during the whole year, destination choice, timing, travel mode, travel party, duration of stay, expenditure for each trip) and individual characteristics (e.g., gender, age, occupation, education level, annual income, marital status, household composition,

residential area, car ownership, etc.). This data is used to analyze tourism participation behavior, destination choice, travel mode choice, and monetary expenditure. The second data was collected at 29 major tourism destinations in Kyusyu, Chugoku and Shikoku regions in the summer of 2002 based on a face-to-face interview, which is used to analyze interrelated choices of destination and travel party. The third dataset was collected in the prefecture of Tottori in 2007 based on an on-site interview, which provide very detailed information about tourists' on-site behavior. This data is used to analyze tourists' on-site travel pattern and time use behavior.

Chapter 4 analyzes individual's decision on whether or not to participate in tourism. In this chapter, individual's choice of tourism participation is studied based on a Scobit model, which includes a skewness parameter to relax the assumption made in binary logit model that the sensitivity of individuals to changes in explanatory variables is highest for those who have indifferent preferences over participation and non-participation. In addition, two psychological factors, namely, social interactions and constraint effects are incorporated into the model based on the theoretical consideration in the existing literature. The empirical application is conducted using the data stemmed from a web survey conducted in Japan in 2010. Using this data the impacts of several attributes on participation decisions in tourism are investigated.

Chapter 5 deals with tourists' multi-stage choices, which includes two parts. The first part aims to get a better understanding of heterogeneous interaction between destination and travel party choices in tourism. For this purpose, this chapter attempts to simultaneously represent these two choices by integrating the nested logit model with the latent class modeling approach, which is used to accommodate two types of nested model structures. The second part jointly analyzes tourist's three interrelated choice (whether to travel, destination choice, travel mode choice) and examine the influences of state

dependence as well as other factors on these three choices. In this chapter, the joint choice of three components is analyzed using a nested logit (NL) model, which includes three levels: the first level is tourism participation choice, the second one is destination choice and the third one is travel mode choice. The NL model incorporates the interaction between different choice dimensions with the help of an inclusive value, which is the maximal utility of the alternatives in the choice set of the lower level nest. To examine the influence of state dependence, lagged endogenous variables are included into the model.

Chapter 6 is concerned with interrelated choices underlying tourist's multi-destination behavior. A new destination choice model is developed based on the concept of future dependence, which argues that choice of a destination during a tour is influenced by choices of other destinations that will be visited later. The model is built within the universal (or mother) logit model framework and it is especially suitable to represent the choice behavior with many destinations, which are difficult to be represented using traditional nested logit model. The results of analysis empirically confirmed the effectiveness of the proposed modeling approach, using a questionnaire survey data collected in Tottori Prefecture, Japan in 2007. It was also revealed the influential factors that affect the multi-destination choice behavior.

Chapter 7 focuses on tourist resource allocation decisions, which include both long-term and short-term aspects. The long-term decision concerns when to go for a travel, how long and how much to spend on a trip. The short-term decision mainly refers to the decisions during the travel (time and money allocation during travel). This chapter includes two parts. The first part investigates monthly tourism expenditure behavior (long-term aspect). The second part analyzes tourist time allocation on on-site activities (short-term aspect).

The existing research has a lot of problems in representing tourism expenditure as a

decision which is independent from the decision of participation in tourism. The former part of this chapter attempts to represent these two decisions simultaneously. This is done by developing a new type of discrete-continuous choice model which incorporates the correlation between these two decisions and represents them simultaneously. To describe the tourism participation, Scobit model is adopted, which includes a skewness parameter to relax the assumption made in the popular Logit and Probit models that the sensitivity of individuals to changes in explanatory variables is highest for those who have indifferent preferences over participation and non-participation. An empirical analysis is carried out using the data collected from a web-based survey conducted in Japan in 2010. The results confirm the interaction between tourism participation and expenditure. Furthermore, Scobit-based model is proved to be superior to Logit-based model. Finally, influential factors affecting both tourism participation and expenditure are also examined.

In the latter part of chapter 7, tourist's time use behavior involving multiple activities is analyzed by using a multiple discrete-continuous extreme value (MDCEV) model. The MDCEV model is applied because it has several advantages over other existing time use models, including the joint representation of participation in multiple activities and the allocated time, diminishing marginal utilities (satiation effects), and different baseline utilities. Application analysis is carried out using a data collected from tourists in Japan. Influential factors related to time use in 7 activity categories are explored. Concretely speaking, individual attributes including age, employment status, residential area, travel experience, and trip-related attributes including travel mode, travel party, travel season are found to be important influential factors. It is also observed that the level of satiation is high for shopping activities and low for sport and hot spring activities.

Chapter 8 summarizes the findings of this thesis, and directions for future research are discussed.

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Chapter 1 Introduction

1.1 Background

In many countries tourism has been an increasingly important sector of the development. The importance of tourism to a nation can be illustrated by its various economic impacts, such as tourism-generated revenue and employment opportunities. In Japan, according to the survey by the Ministry of Land, Infrastructure and Transport, tourism industry has generated, directly and indirectly, 7.5% of GDP and 9.6% of jobs in the year 2009. In addition to its tremendous economic impact, tourism industry can also contribute to infrastructure development, regional revitalization and cooperation. Especially in these days, rural areas in Japan have been suffering from depopulation for a number of years. The development of tourism industry in these rural areas will support those who have suffered from the negative effects of depopulation.

Given the magnitude and economic effects of tourism industry, a thorough understanding of tourist behavior is essential to provide more appropriate insights for tourism marketing and policy decisions. Concretely speaking, research concerning tourism participation behavior offers useful information about how to encourage people to make full use of their free time to participate in tourism activities. A better understanding of tourist behavior during the travel is essential for policy makers and destination planners to provide tourists with high level services. Experiences during the travel are the major factors to influence tourists' satisfactions and the satisfactions in turn influence their intentions to return and/or to recommend the destinations to other people. Therefore, how to provide tourists with better services is crucial for tourism marketers. At the same time, public sectors are required to provide infrastructures with higher performance (e.g., convenient transportation networks, attractive transit-mall at city center and accessible tourist facilities) and public services with higher quality (e.g., non-congested driving environment, and friendly tourist information

center) that can support the tourist behavior during travel. Thus, understanding the tourist behavior is very important for both public and private sectors.

In addition, a better understanding of tourist behavior could provide useful policy implication to achieve sustainable tourism development. Different tourist behavior aspects have different significance for the sustainability of tourism destination. The temporal imbalance (especially the concentration) of tourism generation usually brings in serious problems such as air pollution, and traffic congestion during peak season. Overcrowding in popular destinations will result in environment pollution, over-exploitation of local resources, and over-use of tourism facilities. Related to destination choice are travel mode and route choices, which can contribute to traffic congestion and air pollution. Once arrived at the destination, tourist on-site activities may also be a source of negative impacts through resource consumption, waste generation, and facility overuse. The overview of the environmental impact of tourist behavior suggests the complexity to achieve sustainable tourism development. In order to get an accurate evaluation of the policy effect, it is necessary to get a comprehensive view over the whole process of tourist behavior before, during and after the travel.

1.2 Conceptual issues

1.2.1 Behavior classification

Tourists' travel decisions usually involve a number of choices that are made over time and across space.

In the first stage, individuals recognize the need and have motivation to participate in tourism. A variety of factors influence such tourism participation behavior, including individual and environmental factors (Crompton & Ankomah, 1993). The former involves

factors such as individual demographics, personality traits, lifestyles and values, emotions, etc, while the latter refers to external factors including social, cultural, and market variables. All of these factors shape individual's tourism motivation and have impacts on their tourism participation decision.

Subsequent to the tourism participation decision is tourist's scheduling behavior, which involves different choice aspects. In order to illustrate these behavior aspects, we classify them into several dimensions: spatial choice, resource allocation, and social contexts.

Spatial choice usually has several different levels based on spatial scale. Some of the choices are made before traveling (e.g., destination, travel mode, accommodation) and others are usually made during travel (e.g., traveling route, during-travel activities such as shopping, dining, etc). As mentioned by Seddighi and Theocharous (2002), spatial choice needs a multi-step decision-making process. A tourist is usually first faced with several destination alternatives when deciding to take a travel trip, and then to choose travel mode after the destination is determined. Although these choices can be made at different timings, they may interact with each other. Outcomes of choices that are made first might influence the choices made sequentially. For example, a tourist first chooses a destination and then makes a choice of accommodation considering prices and available rooms of hotels at the destination.

Time and money are main resources to perform travel activities. Because of the availability and scarcity values of these two resources, participations in various activities are constrained. Resource allocation decisions include both long-term and short-term aspects. The long-term decision concerns when to go for a travel, how long and how much to spend on a trip. The short-term decision mainly refers to the decisions during the travel (time and money allocation during travel). Due to the limited time and financial budget, in order to derive the maximal satisfaction, tourists have to arrange and perform the planned activities in a satisfactory order, at a satisfactory timing and to allocate a satisfactory length of time and

amount of money. Resource allocation behavior can directly constrain or expand the number and range of potential activities and the depth at which individual activities can be experienced (Pearce 1988). Since the planned activities are usually performed at different places, constraint of available time and money may result in various interactions between spatial choice and resource allocation behavior.

Social contexts refer to whether and how tourists decide to travel with other people. In the case of traveling with other people, tourists have to be influenced by coupling constraint, which refers to the fact that people have to stay together with other people at a specific place and a point of time. Another aspect of social context is that tourism decisions usually involve some group decisions, especially in the case of travel with other people (e.g., family members, friends, and colleagues).

After traveling, tourists will give evaluation to their tour trip. Experiences during the travel are the major factors to influence tourists' post-travel evaluation. Such post-consumption evaluation results in the feeling of satisfaction/dissatisfaction (Westbrook & Oliver, 1991), which will strengthen (weaken) the attitudes toward the visited destinations and may in turn affect the expectations for future visits (Kozak, 2001). And the tourists might also communicate some experienced information to the people around them (word-of-mouth information).

In this thesis, we focus on several important behavior aspects in each dimension. In terms of spatial choice, this thesis deals with destination choice and travel mode choice. Concerning with resource allocation, monthly tourism expenditure (long-term aspect) and tourist time allocation on multiple activities (short-term aspect) will be investigated. Regarding social contexts, this study focuses on tourist's travel party choice.

1.2.2 Multi-faceted dependencies and interactions

Since tourists face many aspects of choices and have to deal with spatial and temporal constraints and some uncertainty, tourist choice behavior is a multi-dimensional process, and its decision-making mechanisms are complicated. It is expected that there exists multi-faceted dependencies and interactions in tourist behavior. The term "dependence" refers to the state that tourist's one choice aspect is conditioned on another, while the term "interaction" means tourist's two or more choice aspects are interacted with each other. Such kind of interaction may result from both direct effects (i.e., the choice results have mutual influences) and indirect effects (i.e., different choice aspects may be influenced by the same unobserved factors). Generally speaking, the dependencies and interactions involved in tourist behavior can be classified into three aspects.

First, there exist dependencies and interactions in different behavior aspects. As mentioned above, tourist's travel decisions usually involve a number of choices, including destination choice, choices of accommodation and travel modes, composition of the travel party, departure time, travel routes, activities, dining and retail shopping, etc. Given such complex choice context, it is expected that tourist's decision is a sequential process. Outcomes of choices that are made first might influence the choices made sequentially, which will lead to the dependence of one choice aspect on another. In addition, existing studies suggest that the sequence of decision making varies among tourists and contexts (Bansal & Eiselt, 2004; Dellaert, Ettema, & Lindh, 1998; Fesenmaier & Jeng, 2000; Hyde, 2004; Hyde & Lawson, 2003; Woodside & King, 2001). Therefore, it is argued that there exists interaction between different behavior aspects. In other words, the outcomes of different choices may have mutual influences on each other. On the other hand, tourist behavior usually involve psychological factors (e.g., motivation, taste/liking, attitude), which can

influence different choice aspects simultaneously and result in the interaction between them consequently.

Second, tourist behavior might be also interrelated over time and show temporal dependencies (state dependence and future dependence). It has been recognized in the econometric research that there may exist multiple sources for state dependence (Seetharaman, 2004). One is described as structural state dependence, which implies that previous behavior may influence current behavior. Another source of state dependence is called habit persistence (Heckman, 1981), which means that current preference is influenced by previous preference. For example, if an individual's preference of a tourism destination is high during a time period *t*, such preference is likely to persist at the next time period *t+1* even if the individual does not actually travel to that destination at time *t*. In addition to state dependence, there also exists future dependence in tourist behavior, which suggests that tourist will make decisions based on future expectation.

Third, it has been long recognized that individuals do not exist as independent entities, they interact with each other and their decisions are influenced by other individuals, for example, their family, friends, neighbors, or people with similar characteristics. This kind of influence is called as social interaction. In the context of tourism, social interaction is mainly generated from word-of-mouth (WOM) information. In order to enhance the quality of travel and reduce the risk of travel decisions, many people make their travel decision based on the information provided by their family members or friends, which is known as word-of-mouth (WOM) information. In addition, tourism decisions are influenced by social norms to a great extent. By observing other people's behavior, individuals can learn about the proper behavior of their social group and they may want to maintain the behavior that is common in their social group.

1.3 Objective

Aiming to gain a thorough understanding of tourist behavior, this study attempts to build a model system, into which all the major choice aspects related to tourist behavior are incorporated and multi-faceted dependencies and interactions are taken into account.

One of the biggest difficulties in tourism behavior analysis would be in how to deal with the substantially flexible decision making of tourism activities. Compared to mandatory activities, many elements of tourism activities can be more flexibly decided. This is especially true for tourism participation decision, which involves complex psychosocial processes and a number of personal and environmental factors. This study aims to investigate tourism participation behavior by considering the influence of various factors, including individual and household characteristics, social interactions and constraint effects.

As mentioned above, tourists' travel decisions usually involve different choice aspects, including whether to participate in tourism or not, where to go (destination choice), how to go (travel mode choices), with whom to go (travel party choice), and so on. Some of the choices are made before travel (e.g., destination and travel party) while others are made during travel (e.g., travel routes, shopping, and on-site activities). Although the above choices can be made at different timings, they may interact with each other. Outcomes of choices that are made first might influence the choices made sequentially. Therefore, tourists' choice behavior should be regarded as a multi-stage choice process that consists of a number of separate but interrelated choices. This study aims to investigate such multi-stage choice process, including the interrelated choice of destination and travel party, and joint analysis of tourist's three interrelated choice (whether to travel, destination choice, travel mode choice).

Various studies have been done to represent tourists' destination choice behaviors (e.g., Huybers, 2003; Nicolau & Mas, 2006; Nicolau & Mas, 2008; Seddighi & Theocharous, 2002;

Um & Crompton, 1990). However, interactions among destination choices when two or more destinations are included in a single trip have not been satisfactorily represented. Such interactions could be spatial and temporal. Spatial closeness and similarities of attributes and so on might directly affect the interactions while tourists' personal travel tastes to destinations might be some indirect causes. On the other hand, temporal interactions might occur due to past visits and/or future visits. For example, within a trip involving two or more destinations, it is natural to expect that tourists may not like to re-visit a destination visited several hours/days ago, and when they visit a destination, they have to decide when to leave for next destination, meaning that future behavior may affect their current behavior. This study attempts to investigate such interrelated choices underlying tourist's multi-destination behavior.

Another importance choice aspect is tourism expenditure. Estimating tourism expenditure can provide detailed information for assessing the economic benefits of tourism. However, the existing research has a lot of problems in representing tourism expenditure as a decision which is independent from the decision of participation in tourism. In fact, these two decisions might be interrelated with each other. The interaction between the decision of participation and expenditure can be explained by observed factors and unobserved factors. As the observed factors, for example, available monetary and time budgets could commonly influence decisions on the participation and expenditure (those who have more money might take tour trip more often and spend more than others). The participation and expenditure could also be jointly affected by psychological factors (e.g., tourism preference). The neglect of such interaction might bring in some serious problems. This paper attempts to represent these two interrelated choice aspects simultaneously.

It has been well recognized that temporal aspect is an important issue in tourism research (Pearce, 1988). Careful reviews suggest that relevant studies are very limited. Most of the existing studies focused on the total time that tourist spend during a tour trip (Alegre & Pou,

2006; Garcia & Raya, 2008; Gokovali, Bahar, & Kozak, 2007). However, few studies investigated what kinds of activities tourists participate in and how they allocate their limited time to different activities. This research aims to fill this gap by investigating the ill-represented temporal aspects of tourism behavior, especially tourists' time allocation decisions on various activities during travel.

　　　To summarize, this research aims to build a model system, into which all the above-mentioned behavior aspects and relevant dependencies and interactions are systematically incorporated. Figure 1-1 shows the framework of this research.
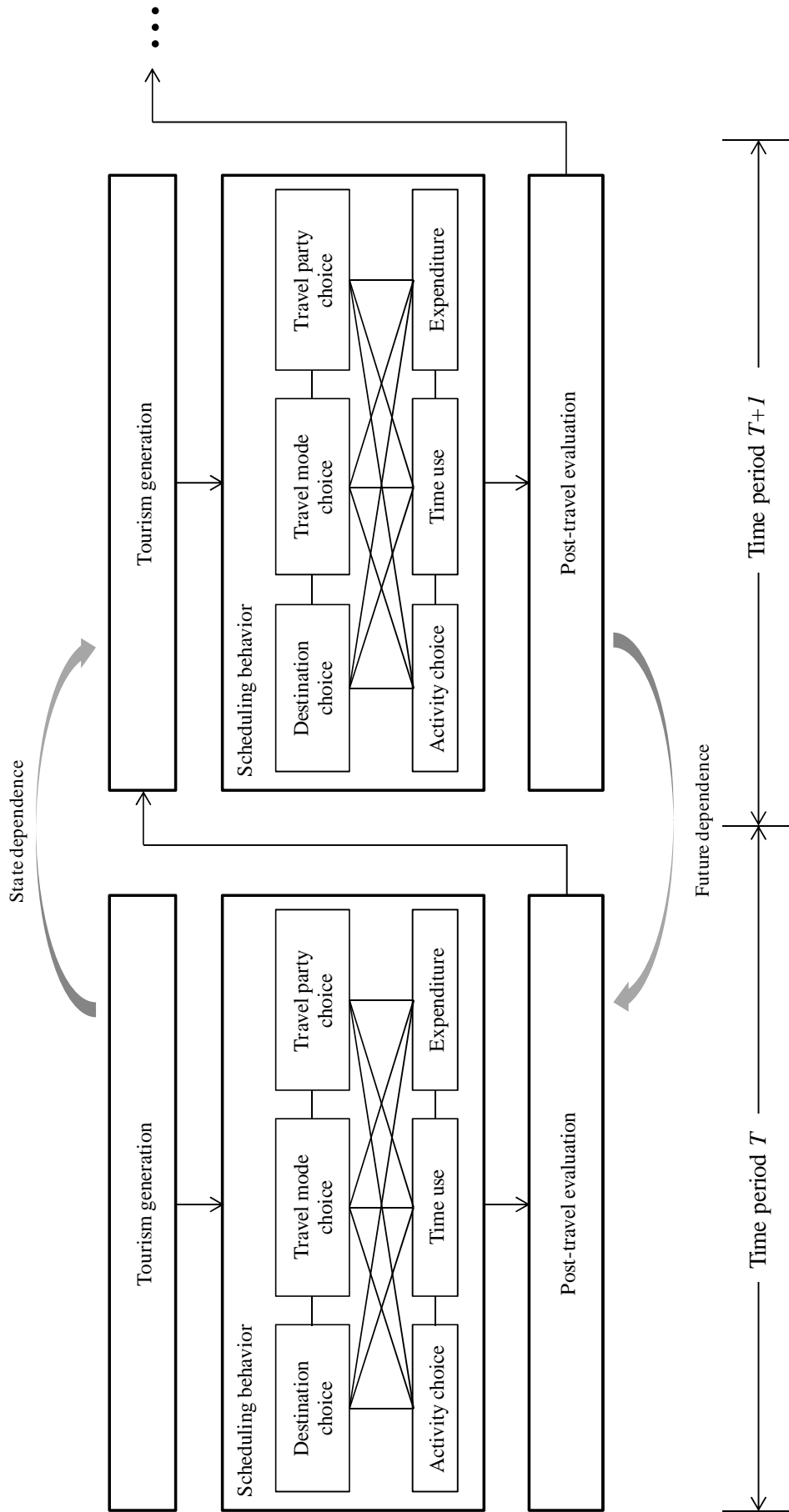
Figure 1-1 Framework of Tourist Behavior Analysis

1.4 Methodology

In this study utility maximization principle is adopted to represent tourist choice behavior. It is assumed that the decision maker maximizes the expected utility subject to budget constraints. Furthermore, several methodologies are proposed in this study to deal with dependencies and interactions between different choice aspects.

(1) Scobit model: In this study, tourism participation choice is analyzed based on a Scobit model, which includes a skewness parameter to relax the assumption made in binary logit model that the sensitivity of individuals to changes in explanatory variables is highest for those who have indifferent preferences over participation and non-participation. Therefore, the Scobit model can represent tourist behavior in a more appropriate way. In addition, it can produce more accurate calculation of elasticities and corresponding measures, which has significant implication in policy evaluation.

(2) Multi-level model: Multi-level model is model with random parameters that vary at multiple levels. In this study, multi-level model is adopted to represent correlated social effects, which refer to the unobserved factors shared by people in the same social group.

(3) Nested logit model: To jointly describe the choices of two or more behavioral elements, the nested logit (NL) model (Ben-Akiva & Lerman, 1985) has been often applied to logically incorporate the interaction among the behavioral elements with the help of expected maximal utility (also called logsum variable or inclusive value) (e.g., Eymann & Ronning, 1992; Seddighi & Theocharous, 2002; Hong, Kim, Jang, & Lee, 2006). In this study, three level nested logit model is adopted to jointly analyze tourist's three interrelated choice (whether to travel, destination choice, travel mode choice).

(4) Latent class model: As mentioned above, the nested logit (NL) model (Ben-Akiva & Lerman, 1985) has been often applied to jointly describe the choices of two or more

behavioral elements. However, in reality, there may be existing different nested choice structures among different tourists. In the case of destination and travel party choice, the NL model can be used to represent these two choices in two ways, depending on how to allocate the choice of travel party (or destination) to either upper or lower level. This study attempts to use the latent class (LC) modeling approach to represent such heterogeneous nested choice structures, by assuming that tourists belong to two different structures at certain probabilities.

(5) Universal logit model: Standard utility maximization choice models, like the MNL model, can be extended to include constants and attributes of other alternatives in the utility function of the alternative in question, as first applied by McFadden, Train, and Tye (1977) who called this extended model the universal logit model. Such additional terms, also called cross effects, can represent corrections on the utilities as predicted by the standard IIA-type model. This study attempts to represent the influence of future dependence on tourists' choice behavior by applying the universal logit model.

(6) A scobit based discrete-continuous choice model: This paper develops a new type of discrete-continuous choice model to represent tourists' two interrelated choice aspects (i.e., tourism participation and expenditure) simultaneously. To describe the tourism participation, Scobit model is adopted, which includes a skewness parameter to relax the assumption that the sensitivity of individuals to changes in explanatory variables is highest for those who have indifferent preferences over participation and non-participation. Tourism expenditure is represented by a regression model. As the unobserved factors in these two behavior aspects might be interrelated with each other, this study adopts Lee's (1983) transformation to transform the error terms of utility functions in the two models into a standard normal distribution, and further develop a scobit based discrete-continuous choice model to represent these two interrelated choice aspects simultaneously.

(7) A multiple discrete-continuous extreme value (MDCEV) model: Bhat (2008) developed a multiple discrete-continuous extreme value (MDCEV) model, which has several advantages over other existing models. It can accommodate different baseline marginal utilities, corner solutions, and satiation effects (diminishing marginal utility). With these advantages, it is expected that MDCEV model might be applicable to the analysis of tourist's time use behavior, which is characterized by the choice of two or more activities simultaneously. Therefore, this study proposes to apply it to represent tourists' time use behavior, aiming to explore the influential factors to tourist's time use behavior in a more convincible way.

The methodologies adopted in this thesis are summarized in Table 1-1.

Table 1-1 Summary of Methodologies

	Scobit model	Multi-level model	Nested logit model	Latent class model	Universal logit model	A Scobit based discrete-continuous choice model	MDCEV model
Tourism participation		Social interaction	Three-stage choices			Interrelated discrete-continuous choice	
Destination choice				Heterogeneous interaction	Future dependence		
Travel mode choice							
Travel party choice				Heterogeneous interaction			
Activity choice							Interrelated multiple discrete-continuous choices
Time use							
Expenditure						Interrelated discrete-continuous choice	

1.5 Contribution

This study contributes by building a model system, into which all the major choice aspects related to tourist behavior, including tourism participation behavior, destination choice, travel mode choice, travel party, activity participation, time use, and tourism expenditure are incorporated. In addition, this study also identifies multi-faceted dependencies and interactions that involved in tourist behavior, and proposes methodologies to represent them in a systematic way.

In terms of dependencies and interactions in different behavior aspects, this study first identified spatial choice interaction (i.e., interaction between destination and travel mode choice). Concretely speaking, tourists might choose destination by considering its accessibility, or they might choose travel mode conditional on the destination choice, which will result in the interaction between destination and travel mode choice. In this thesis, such interactions among different aspects of tourists' travel decisions have been investigated. This study also takes account of the interactions between spatial choice and resource allocation behavior. It is expected that a tourist may decide to participate in multiple kinds of activities within a tour trip to satisfy various needs. Existence of temporal constraints forces tourists to decide how to make effective use of their available and limited time during travel. Therefore, tourists need to decide which activities to participate in and how long to perform each activity. Since the planned activities are usually performed at different places, constraint of available time may result in various interactions between spatial choice and resource allocation behavior. This study clarifies tourist time use behavior by considering the existence of joint decision-making mechanism of tourist's activity participation and time allocation behavior.

Concerning with temporal dependence, this thesis clarifies the influence of state dependence on tourist's three-stage choices: tourism participation, destination choice, and

travel mode choice. Moreover, this study proposed an appropriate method to represent the influence of future dependence on tourist's destination choice.

Regarding social interaction, this study identifies three aspects of social interaction in tourist behavior. From the academic perspective, it develops a methodology to represent social interaction in tourist behavior analysis. From the practical perspective, since social interaction could generate "social multiplier" effect, incorporating it into tourist behavior analysis can provide a more accurate evaluation about the influence of policies on tourist behavior.

Based on the investigation of the interactions among these behavior aspects, this research can provide some implications for the development of a more comprehensive model system, into which all the relevant choice aspects related to tourist behavior are systematically incorporated.

This thesis can also contribute by providing important practical implications. Since tourist behavior plays an important role in influencing tourism development and the extent to which its interaction with the environment is positive or negative, a thorough understanding of tourist behavior can provide more appropriate insights for policy making towards sustainable tourism development. For example, the proposed modeling approach could helpful to policy makers to quantitatively evaluate the effects of tourism policies or marketing activities on tourist choice behavior in a more convincible way.

1.6 Structure of the thesis

This thesis is composed of 8 chapters. The structure is organized as follows.

Chapter 2 gives a review of existing studies about tourist behavior analysis. Firstly, studies regarding tourism participation behavior are reviewed. Then, research concerning

tourist scheduling behavior is described, which includes several dimensions: spatial choice, temporal choice, monetary expenditure, and social contexts. Next, studies about post-travel evaluation are summarized. Finally, a review of integrated framework in tourist behavior studies is given.

Chapter 3 introduces the data used in this study. Three different types of data sets are used in this study. The first one comes from a web-based questionnaire survey conducted in Japan in April 2010. The survey included very detailed information of individual's tourism behavior in the year 2009 (e.g., how many times they participated in tourism during the whole year, destination choice, timing, travel mode, travel party, duration of stay, expenditure for each trip) and individual characteristics (e.g., gender, age, occupation, education level, annual income, marital status, household composition, residential area, car ownership, etc.). This data is used to analyze tourism participation behavior, destination choice, travel mode choice, and monetary expenditure. The second data was collected at 29 major tourism destinations in Kyusyu, Chugoku and Shikoku regions in the summer of 2002 based on a face-to-face interview, which is used to analyze interrelated choices of destination and travel party. The third dataset was collected in the prefecture of Tottori in 2007 based on an on-site interview, which provide very detailed information about tourists' on-site behavior. This data is used to analyze tourists' on-site travel pattern and time use behavior.

Chapter 4 analyzes individual's decision on whether or not to participate in tourism. In this chapter, individual's choice of tourism participation is studied based on a Scobit model, which includes a skewness parameter to relax the assumption made in binary logit model that the sensitivity of individuals to changes in explanatory variables is highest for those who have indifferent preferences over participation and non-participation. In addition, two psychological factors, namely, social interactions and constraint effects are incorporated into the model based on the theoretical consideration in the existing literature. The empirical application is

conducted using the data stemmed from a web survey conducted in Japan in 2010. Using this data the impacts of several attributes on participation decisions in tourism are investigated. This chapter is based on the paper published in *Asian Transport Studies* (Wu, Zhang, Fujiwara, & Chikaraishi, 2012).

Chapter 5 deals with tourists' multi-stage choices, which includes two parts. The first part aims to get a better understanding of heterogeneous interactions between destination and travel party choices in tourism. For this purpose, this chapter attempts to simultaneously represent these two choices by integrating the nested logit model with the latent class modeling approach, which is used to accommodate two types of nested model structures. The second part jointly analyzes tourist's three interrelated choice (whether to travel, destination choice, travel mode choice) and examine the influences of state dependence as well as other factors on these three choices. In this chapter, the joint choice of three components is analyzed using a nested logit (NL) model, which includes three levels: the first level is tourism participation choice, the second one is destination choice and the third one is travel mode choice. The NL model incorporates the interaction between different choice dimensions with the help of an inclusive value, which is, in fact, the maximal utility of the alternatives in the choice set of the lower level nest. To examine the influence of state dependence, lagged endogenous variables are included into the model. This chapter is written based on the papers published in *Tourism Management* (Wu, Zhang, & Fujiwara, 2011a) and *Transportation Research Record* (Wu, Zhang, & Fujiwara, 2012b).

Chapter 6 is concerned with interrelated choices underlying tourist's multi-destination behavior. A new destination choice model is developed based on the concept of future dependence, which argues that choice of a destination during a tour is influenced by choices of other destinations that will be visited later. The model is built within the universal (or mother) logit model framework and it is especially suitable to represent the choice behavior with many

destinations, which are difficult to be represented using traditional nested logit model. The results of analysis empirically confirmed the effectiveness of the proposed modeling approach, using a questionnaire survey data collected in Tottori Prefecture, Japan in 2007. It was also revealed the influential factors that affect the multi-destination choice behavior. The content of this chapter comes from the paper published in *Asia Pacific Journal of Tourism Research* (Wu, Zhang, & Fujiwara, 2012a).

Chapter 7 focuses on tourist resource allocation decisions, which include both long-term and short-term aspects. The long-term decision concerns when to go for a travel, how long and how much to spend on a trip. The short-term decision mainly refers to the decisions during the travel (time and money allocation during travel). This chapter includes two parts. The first part investigates monthly tourism expenditure behavior (long-term aspect). The second part analyzes tourist time allocation on on-site activities (short-term aspect).

The existing research has a lot of problems in representing tourism expenditure as a decision which is independent from the decision of participation in tourism. The former part of this chapter attempts to represent these two decisions simultaneously. This is done by developing a new type of discrete-continuous choice model which incorporates the correlation between these two decisions and represents them simultaneously. To describe the tourism participation, Scobit model is adopted, which includes a skewness parameter to relax the assumption made in the popular Logit and Probit models that the sensitivity of individuals to changes in explanatory variables is highest for those who have indifferent preferences over participation and non-participation. An empirical analysis is carried out using the data collected from a web-based survey conducted in Japan in 2010. The results confirm the interaction between tourism participation and expenditure. Furthermore, Scobit-based model is proved to be superior to Logit-based model. Finally, influential factors affecting both tourism participation and expenditure are also examined.

In the latter part of chapter 7, tourist's time use behavior involving multiple activities is analyzed by using a multiple discrete-continuous extreme value (MDCEV) model. The MDCEV model is applied because it has several advantages over other existing time use models, including the joint representation of participation in multiple activities and the allocated time, diminishing marginal utilities (satiation effects), and different baseline utilities. Application analysis is carried out using a data collected from tourists in Japan. Influential factors related to time use in 7 activity categories are explored. Concretely speaking, individual attributes including age, employment status, residential area, travel experience, and trip-related attributes including travel mode, travel party, travel season are found to be important influential factors. It is also observed that the level of satiation is high for shopping activities and low for sport and hot spring activities. This part is based on the paper published in *Journal of the Eastern Asia Society for Transportation Studies* (Wu, Zhang, & Fujiwara, 2011b).

Chapter 8 summarizes the findings of this thesis, and directions for future research are discussed.

Chapter 2 Literature Review

2.1 Tourism generation

Tourism generation is one of the most important aspects in tourist behavior analysis. Understanding why people travel and what factors influence their travel intention is essential to tourism planning and marketing. A considerable number of studies concerning tourism generation are focusing on tourism motivation. Motivation is an internal drive which pushes the individual to do things in order to achieve something (Harmer, 2001). Dann's (1977) tourism motivation theory argued that there are two factors in a decision on travel: the push factors and the pull factors. The push factors are psychological motives explaining the desire for travel, while the pull factors are motives aroused by the destination. Such "push and pull" motivation theory states that people travel because they are pushed by their internal motives and pulled by external forces of a destination. Crompton (1979) extended Dann's motivation theory by identifying nine motives, seven classified as socio-psychological or push motives and two classified as cultural or pull motives. Similarly, Iso-Ahola (1982) identified two types of push and pull factors: personal and interpersonal factors, and suggested that people are motivated to travel to leave behind the personal or interpersonal problems of their environment and to obtain personal or interpersonal rewards. And another approach developed based on tourist motivation theory is Pearce's (1993, 2005) travel career ladder approach. The travel career ladder describes that tourist motivation consists of five different levels: relaxation needs, safety/security needs, relationship needs, self-esteem and development needs, and self-fulfillment needs.

To understand tourism motivation in a systematic and theoretical way, some studies employ the Theory of Planned Behavior (TPB) (Figure 2-1) to explain travel intention (Ajzen, 1991). The TPB proposes that intentions to perform a certain kind of behavior can be predicted by attitudes, subjective norms, and perceived behavior control. In the context of

tourism, attitudes are the overall evaluation of the tourism participation behavior, which comprise two elements: beliefs about the likely consequence of tourism participation, and values attached to the consequence. Subjective norm is the influence of others about whether to engage in a certain behavior (Ajzen, 1991). Jackson (1991) argued that interpersonal influence plays a significant role in individual's travel intentions. Specifically speaking, what others think or do (social norms) have the potential to influence travel intentions. Similarly, Lam and Hsu (2006) found social norms to be an important factor in influencing tourists' intentions to visit a certain destination. In addition, other tourism research (e.g. Beerli & Martin, 2004) has provided evidence that word-of-mouth (WOM) information derived from sources such as friends or family can affect image perceptions of a destination. The TPB also argues that perceived control over the behavior intention is likely to be important. According to Ajzen (1991), control beliefs can impede or facilitate a certain behavior. Existing research (e.g., Lam & Hsu, 2006) has confirmed that perceived control has significant influence on intention to visit a tourism destination.
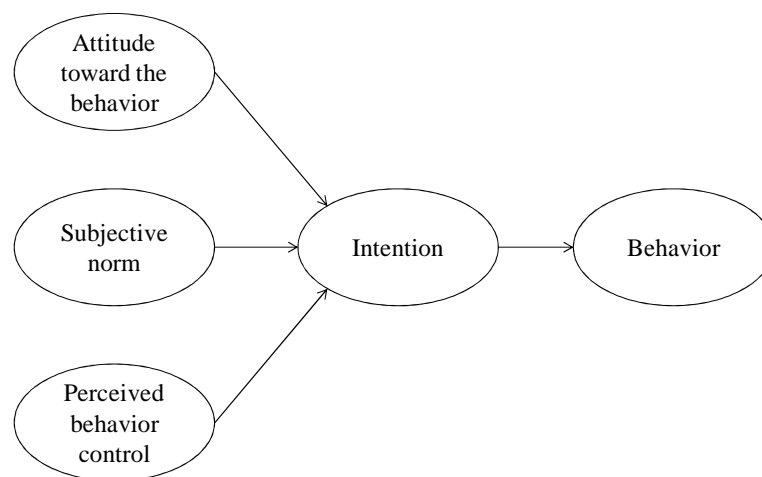
Figure 2-1 Theory of Planned Behavior (Ajzen, 1991)

In addition to the investigation of travel intention, two major approaches have emerged regarding actual tourism participation behavior, namely, constraint models and

microeconomic models.

Constraint models define constraints as factors that are assumed to prohibit participation in tourism (Jackson, 1991). In these models, constraints are classified into three categories: intrapersonal ones, reflecting an individual's psychological state (e.g. stress, anxiety or depression), physical state (physical limitations or illnesses) or cognitive skills; interpersonal ones, which are associated with interaction and interpersonal relations (e.g. being unable to find a travel partner); and, finally, structural ones, which stand between a person's leisure preferences and real participation (tied in with the stage in the family lifecycle, the economic cost of the activity, time etc.). These constraints are ordered sequentially so that each level of a constraint must either not exist or be overcome before going on to the next level (Crawford, Jackson, & Godbey, 1991). In explaining this hierarchy, Crawford *et al*. (1991) contended that there are psychological orientations that may prevent individuals from experiencing higher level constraints. Therefore, individuals who are most affected by intrapersonal difficulties would be less likely to participate in a given leisure activity and thus would not reach higher order constraints (interpersonal and structural). However, there are some studies arguing that these constraints were interactive rather than hierarchical (Daniels, Rodgers, & Wiggins, 2005; Gilbert & Hudson, 2000). Many of these models have been applied to specific tourism activities like skiing, camping, golf, or adventure or risk activities (Gilbert & Hudson, 2000), or to specific segments of the population with characteristics that are potentially restrictive, such as an advanced age, gender-related constraints or illnesses (Daniels *et al.*, 2005). However, most of constraint models only provide theoretical or descriptive perspectives, rather than the methods of behavior modeling and demand forecasting.

Figure 2-2 A Hierarchical Model of Leisure Constraints (Crawford *et al*., 1991)

A different approach to tourism participation, that could be use for tourism demand forecasting, is microeconomic model. These are utility maximizing choice models in which tourists' choice of participation is influenced by several factors. In these studies, factors such as income (Fleischer & Seiler., 2002; Mergoupis & Steuer, 2003), age (Nicolau & Mas, 2005a), education level (Melenberg & Soest, 1996), health condition (Alegre, Mateo, & Pou, 2010), number of children (Hellstrom, 2006), household size (Hellstrom, 2006; Nicolau & Mas, 2005a), residential area (Nicolau & Mas, 2005a), traffic condition (Stemerding, Oppewal, & Timmermans, 1999) are found to be influential to tourism participation. However, most of these studies adopted a binary logit model or probit model to deal with participation choice. The logit or probit model implicitly assumes that the sensitivity of individuals to changes in explanatory variables is highest for those who have indifferent preferences over participation and non-participation. To solve this problem, Wu, Zhang, Fujiwara, and Chikaraishi (2012) adopted an alternative model, named Scobit model, which includes a skewness parameter. They empirically confirmed the effectiveness of the Scobit model in representing tourism participation.

2.2 Spatial choice

Spatial choice usually has several different levels based on spatial scale: destination choices, mode/route choices, during-travel activities such as shopping, dining, etc.

Tourist destination choice is a key element in the travel decision-making process. There are a large number of studies focusing on developing models in tourism to describe how the destination decision is formulated (Hong, Kim, Jang, & Lee, 2006; Morley, 1994; Moutinho, 1986; Nicolau & Mas, 2005a; Seddighi & Theocharous, 2002; Um & Crompton, 1990; Woodside & Lysonski, 1989). Most of these models have developed from the consumer behavior research, such as the Howard and Sheth's model (1969) and Narayana and Markin's model (1975), which suggested the decision making as a narrowing down process that led to the concept of choice sets. In the context of tourism, the destination choice can be understood as a process during which tourists reduce the number of alternatives from their early destination choice set to the consideration set and finally to the late set. Such kind of narrowing down process is affected by both internal and external forces (Crompton, 1992; Um & Crompton, 1990; Woodside & Lysonski; 1989). Recently, Jang, Lee, Lee, and Hong (2007) expanded the individual choice set model to a couple's choice set model that incorporated the interaction between couples when they choose a honeymoon destination.

Instead of modeling destination as a one-stage choice, some studies proposed that tourism decision making is a hierarchical process. For example, Eymann and Ronning (1997) considered a natural hierarchy in destination choice, which distinguished a first stage that differentiates vacation or no vacation; a second stage, where vacation modes can be classified as domestic and foreign; and a third stage where tourists choose a foreign country. Different from Eymann and Ronning's (1997) study, Nicolau and Mas (2008) suggested that tourist choice is a multistage process which includes the decision of whether or not to take a

vacation and type of destination.

In order to understand determinant factor that influence tourist destination choice, most of the existing studies employed discrete choice models under the principle of random utility maximization (Ben-Akiva & Lerman, 1985). In these studies, tourists' destination choice behavior has been examined to be influenced by various factors, which can be generally classified into three categories:

1) Decision maker-specific factors: Existing studies confirm that age, gender, marital status, income, education, occupation, residential city, household size, car ownership and lifestyle have great effects on tourist's destination choice (Ankomah, Crompton, & Baker, 1996; Nicolau & Mas, 2005a; Seddighi & Theocharous, 2002; Van Raaij & Francken, 1984). In addition to such objective factors, some studies show that personal values should be used to explain why consumers choose a particular location (Van Raaij & Francken, 1984), and other studies emphasize the importance of travel motivation on destination choice (Hsu, Cai, & Wong, 2007; Kim & Chalip, 2004).

2) Alternative-specific factors: These factors include the attributes of destinations (e.g. attractiveness of destination, tourism resource, facility fare, quality services) and the accessibility of destinations (e.g. available travel mode, travel distance, travel fare) (Ankomah *et al*., 1996; Awaritefe, 2004; Nicolau & Mas; 2006; Seddighi & Theocharous, 2002; Van Raaij & Francken, 1984).

3) Situational factors: These factors include weather situations: some studies included climate as a factor to influence tourist behavior (Eugenio-Martin & Campos-Soria, 2010; Stemerding *et al*., 1999); cultural situations: Kozak (2002) examined different behavior of tourists with different cultural background; social situations: studies conducted by Seddighi, Nuttall, and Theocharous (2001) investigated the impact of political instability on tourists' destination choice; and so on.

So far, most of the existing studies concerning with tourist destination choice are based on the assumption that tourists go to a single destination. The attempts to explore multi-destination choice are limited to a few studies. Lue, Crompton, and Fesenmaier (1993) questioned the practice of modeling pleasure trips as single destination trips, and offered a conceptualization of the role and structure of multi-destination pleasure trips. The study developed a four-cell typology of pleasure trips based on number of destinations visited and the trip purpose. Hwang, Cretzel, and Fesenmaier (2006) examined international tourists' multi-city trip patterns within the United States. The study focused on differences in the structure and directionality of tourists' multi-city patterns including what cities, how many of them, what combinations of them. Moreover, the existing research on multi-destination tour trips has mainly been conducted by an inductive methodology, using the mapping or listing of destinations (Lew & McKercher, 2002). There are a few studies dealing with tourist's choice mechanisms in multi-destination trips. An exception is the study by Wu, Zhang and Fujiwara (2012), which adopted the universal logit model framework to accommodate future dependence in tourists' multi-destination choice.

In addition to destination choice, travel mode and route choice is another important aspect of tourist spatial behavior. Considerable studies have been conducted to investigate the determinants of tourists' travel mode choice. Factors that are identified to have great influences include travel distance, presence of children and accommodation type (Van Middlekoop, Borgers, & Timmermans, 2003); cost, convenience, and flexibility of travel modes (Anable & Gatersleben, 2005); congestion of nearby roads (Dallen, 2007); travel time, parking fees, transit costs, and frequency of services (Kelly, Haider, & Williams, 2007). Still, many researchers have recognized that it is not appropriate to model tourists' travel mode choice independently from destination choice. For example, Fukuda and Morichi (2002) found out that there exist interaction between tourists' destination and travel mode choice.

LaMondia, Snell, and Bhat (2010) discussed the necessity to jointly model tourist's travel mode and destination choice.

Tourists' route choices include the routes to the destination and within the destination. Enriching the knowledge of tourists' route choice is important not only to tourism destination management, but also to infrastructure and transport development. However, such an important aspect of tourist behavior is much less studied. According to Lew and McKercher (2002), tourists' route choice can be complex because of the wide diversity of routes from which tourists can choose. To simply such complexity, several studies identified different types of tourists' trip itineraries (Lew & McKercher, 2002; Lue *et al.*, 1993; Mings & McHugh, 1992; Oppermann, 1995). The model attempts to deal with tourists' route choices can be found in a few studies. Fujiwara and Zhang (2005) developed a nested paired combinatorial logit (NPCL) model to represent tourists' destination and route choice that accommodate the similarities between different routes. Kemperman, Borgers, and Timmermans. (2009) developed a model of tourist shopping route choice behavior to investigate differences in various types of tourist shoppers.

Stopping behavior is also one of relevant issue in spatial choice. As argued by Wansink and van Ittersum (2004), travel itself is motivated or initiated by traveler's primary need and in contrast, stopping decisions during the travel result from the identification of secondary needs. Understanding what needs influence a traveler's stopping decision will enable operators of visitor information centers, gas stations, and restaurants to better satisfy these needs by choosing better locations, services, designs, and promotions. The relative importance of an identified need depends on traveler characteristics (Mason, 1975; Muha, 1977; Stewart, Lue, Fesenmaier, and Anderson, 1993), travel characteristics (Perdue & Botkin, 1988; Tierney, 1993), and the primary travel need (McKercher, 2001; Oppermann, 1995). For instance, travelers on their way to an important business meeting may attach less

importance to stretching, than those who travel for the pleasure of traveling. The importance travelers attach to different needs influences the stopping-decision process. To better understand the stopping-decision processes of tourists, consumer behavior theories on purchase decision processes were used (Engel, Blackwell, & Miniard, 1993) as basic guidelines because the stopping-decision processes appear to resemble basic purchase-decision processes. To gain an understanding of tourists' stopping-decision process, Wansink and van Ittersum (2004) proposed a general stopping-decision framework to examine what make tourists interrupt their journey and make a stop at a particular facility. McKercher (2001) pointed out that travelers must make trade-offs between the time they spend traveling and stopping and the time they will eventually spend at their intended destination. The more time they spend on the trip (traveling and stopping), the less time they spend at the destination.

2.3 Resource allocation

Time and money are main resources to perform travel activities. Tourist behavior is constrained due to the availability and scarcity values of these two resources.

(1) Temporal choices

Temporal choices include both long-term and short-term aspects. The long-term decision concerns when to go for a travel and how long to spend on a trip. The earlier researches on the length of stay in holiday destinations are mainly descriptive (Alegre & Pou, 2006). They analyzed the length of stay in different segments of tourists (Oppermann, 1997; Sung, Morrison, Hong, & O'Leary, 2001). Generally, these research show different lengths of stay depending on nationality, age, labor status, the repeat visitation rate and stage in the

family life cycle. Recently, some studies have attempted to adopt survival model to investigate length of stay (Barros & Machado, 2010; Gokovali, Bahar, & Kozak, 2007; Martinez-Garcia & Raya, 2008; Thrane, 2012). These studies identified the significant influence of age, nationality, education, income, experience, familiarity on length of stay.

The short-term decision mainly refers to the decisions made during the travel. Bull (1991) suggested that a tourist can allocate time in three ways: travel to and from destinations, pure tourism activities, and unallocated time. Some studies focused on tourist's travel time which is spent on journey to and from destination. Truong and Hensher (1985) found out that tourists tend to spend less time on journey and visit destinations that are geographically closer. While Nicolau and Mas (2006) argued that the effects of tourists' travel time are moderated by tourists' motivations, which means that travel time can have both positive and negative effects. In terms of time allocation in pure tourism activities, there were some studies that attempt to analyze tourist's time allocation decision using time-budget method (Cooper, 1981; Fennell, 1996), which is a method of measuring the duration and sequence of activities engaged in by an individual during a specific period of time. They recorded activities that tourist participated in and starting time and finishing time of each activity, from which they can derive tourists' space-time patterns. These studies have provided some insights into various aspects of tourist behavior. However, all of these studies focused on some specific activities such as beach-based activities and used statistical method without considering the influential factors to tourist's time use behavior.

To investigate tourist's time use behavior by explicitly incorporating behavioral mechanisms, it is necessary to develop relevant models in tourism, considering the fact that such model development has become more and more active in other fields like transportation (e.g., Bhat, 2005; Kitamura, 1984; Zhang, Timmermans, & Borgers, 2005). Kitamura (1984) developed a model of daily time allocation to discretionary activities and trips, which was a

representative work of the earlier utility-theoretic based studies. Zhang *et al*. (2005) developed a household task allocation and time use model based on a multi-linear group utility function to incorporate the interaction between household members. Such study is relevant to tourism behavior, considering that some types of tourism behavior are decided at a household level and depending on the type of tourism, household members may be involved in joint decisions differently at different life stages. Bhat (2005) generalized earlier utility-theoretic based models and developed a multiple discrete-continuous extreme value (MDCEV) model, which can accommodate different baseline marginal utilities, translation parameters (corner solutions: zero consumption of each activity type), and satiation effects (diminishing marginal utility), in the context of individuals' time allocation in their daily life activities. He applied this model to analyze individual's decision on participation in multiple types of activities (in-home social activities, out-of-home social activities, in-home recreational activities, out-of-home recreational activities, and out-of-home non-maintenance shopping activities) and the duration of time allocated in each activity.

There were some pioneer studies focusing on time use aspect in tourism. Fujiwara and Zhang (2005), for example, integrated Becker's (1965) time allocation theory and a nested paired combinatorial logit (NPCL) model to represent car tourists' scheduling behaviors including destination/route choices and time allocation behavior at each touring site. The advantage of the model developed by Fujiwara and Zhang (2005) is that the influence of time allocation behavior is explicitly incorporated into the destination choice behavior, whereas representing activity participation behavior in the time allocation behavior model is ignored and the number of touring site was also fixed. As a result, factors affecting tourists' time use behavior might be examined in a biased way.

(2) Monetary expenditure

Monetary expenditure has long been recognized as an essential component of tourism

analysis. A number of studies have been conducted to understand what determines the level of tourism expenditure. Many studies examined tourism expenditure related to tourists' socio-demographic and life cycle characteristics. It is found out that income influences tourism consumption patterns (Cai, Hong, & Morrison, 1995; Dardis, Derrick, & Wolfe, 1981). Empirical literature shows a positive relationship between income and expenditure on tourism (Cai *et al*., 1995; Dardis *et al*., 1981). In terms of the relationship between age and tourism expenditures, Dardis *et al.* (1981) show that tourism expenditures decrease with age. With regard to the effect of household size on tourism expenditures, the effect is uncertain. Although large household size might be a constraint for individual to participate in tourism (Nicolau & Mas, 2005a), it is argued that once the initial decision of tourism participation is made, larger households will spend more, given that they may need more services. As a matter of interpersonal constraints, an increase in the number of children in the household is expected to decrease tourism expenditure. The existing studies confirm a negative effect of the number of children on tourism expenditures (Nicolau & Mas, 2005b). Marital status is considered to be a determinant factor in tourism expenditure (Cai *et al.*, 1995). In particular, Dardis *et al*. (1981) and Cai *et al*. (1995) find a positive relationship between tourism expenditures and marriage. In addition, characteristics related to travelling are also found to have important effects on tourism expenditure. The importance of length of stay to tourism expenditures has been shown in various studies (Alegre & Pou, 2004). Distance is an essential aspect of the consumption of tourism products. Leones, Colby, and Crandall (1998) found that long distances tour had a positive impact on expenditures.

Most of the existing studies concerning tourism expenditure looked at tourists who had already participated in tourism, in other words, they do not include non-participation behavior. Although these studies provided some insight about the determinants of tourism expenditure, they do not consider how people decide whether to spend a certain amount of

money on tourism or not. If the model is applied in the whole population, estimates of parameters will be biased. For example, the conclusion derived from these kinds of studies that large household size has positive effect on tourism expenditure may not be necessarily true in the whole population. As revealed by Dolnicar *et al*. (2008), the effect of explanatory variable on expenditure behavior is different among different segmentations of the general population. We cannot generalize the conclusion from people who have participated in tourism into all population.

Morley (1992) has pointed out that the decisions of whether to travel or not and the level of spending are interrelated. These two decisions should be model simultaneously. Although there are many studies concerning these kind of discrete–continuous choice behavior in other fields, such as transportation (Bhat, 2005; Habib, Carrasco, & Miller, 2008) and marketing (Henemann, 1984), the relevant research in tourism remains limited. Although Jang and Ham (2009) present tourists' two-step decisions: decision to travel and how much to spend on travel, it still treats these two decisions as independent behavior and failed to incorporate the correlation between them.

As argued by some studies, there might exist interaction between tourists' time and money allocation. For instance, a number of studies included the length of stay as an explanatory variable to estimate the determinants of monetary expenditure (Davies & Mangan, 1992; Mok & Iverson, 2000; Mules, 1998). Their findings suggested that the length of stay would have positive influence on monetary expenditure. However, no study has jointly modeled time use and expenditure behavior, except for that of Zhang, Zhang, Wu, and Fujiwara (2009), who built a utility-maximizing time use and expenditure behavior model based on a multi-linear utility function. The result confirmed the significant time-to-expenditure interactions.

2.4 Social contexts

Social contexts refer to the influence of social groups on tourist behavior. In tourism research, many studies have been conducted on family decision-making. The husband-wife relationship has attracted considerable interest. A study by Davis (1976) showed that husbands play predominant role in mentioning the initial idea to take a trip, suggesting a destination and selecting an airline, while the decision on where to go is a mutual decision. Van Raaij and Francken (1984) also emphasized the importance of family members' influences on decision-making process of tourism service purchases, and incorporated the interaction of household-related variables with individual-related factors. Cosenza and Davis (1981) showed that household members' involvement appears to vary across stages in household life cycle, and the husband in a household with dependent child have the highest relative influence in joint decisions, for the household with old childless couple, the husband and wife have almost the equal influence. For pre-travel decisions, the wives are highly involved in selection of a destination and collection of information (Zalatan, 1998). Thornton, Shaw, and Williams (1997) found that children influence the behavior of travel parties either through their physical needs (e.g. arrangement of meal times, need for sleep) or through their ability to negotiate with parents. Thus, household members interact in household travel decision-making process. On the other hand, Moutinho (1987) argued that travel decisions are also affected by the behavior of reference groups. Friends and relatives sometimes provide information to the individual decision-making process (Gitelson & Kerstetter, 1994). Coupling constraint, which is a concept proposed in time-space geography (Hagerstrand, 1970) and indicates that a person has to be together with other people at a place in certain time period, is also a source of social contexts. Crompton (1981) conducted an interview about tourist's interpersonal association in pleasure vacation, from which he derived four

kinds of influence of travel party on individual's selection of a destination. March and Woodsides (2005) studied the influence of travel party composition and size on tourist behavior. Basala and Klenosky (2001) pointed out that preference for choosing a destination could differ according to travel party composition.

2.5 Post-travel evaluation

Tourist satisfaction is important to successful destination marketing because it may affect expectations for the next visit (Kozak, 2001), and may also have some learning effects on tourists' future decisions. Another outcome from the post-evaluation of travel is word-of-mouth information. The importance of word-of-mouth information in travel decisions has been long recognized by both researchers and marketers (Boulding, Kalra, Staelin, & Zeithaml, 1993; Zeithaml, Berry, & Parasuraman, 1996). Given the vital role of tourist satisfaction, it is necessary to get a better understanding of it.

So far, there are a large number of studies focusing on measurement of tourist satisfaction. Kozak (2001) gave a comprehensive review of the existing research and identified four approaches: expectation-performance, importance-performance, disconfirmation approach and performance-only approaches. Expectation-performance approach proposes that tourists are likely to have expectation regarding the tourism service. They are expected to be dissatisfied if obtained performance is less than expected and be satisfied when expectations are met or exceeded (Moutinho, 1987; Schofield, 1999). Importance-performance analysis is to determine which attributes tourists consider most important and how well the destination performs in attributes that are considered important to tourists. Poor performance on important attributes may lead to dissatisfaction (Go & Zhang, 1997; Leong & Tan, 1992). Disconfirmation approach considers that a tourist's satisfaction

would be determined by the discrepancy between the outcome and a comparison level (Francken & Van Raaij, 1981; Oliver, 1980; Patterson, 2000). Performance-only approach suggests that a tourist is likely to be satisfied when a service performs at a desired level, regardless of the existence of any previous expectations (Tse & Wilton, 1988).

In addition to the analysis of the overall level of tourist satisfaction, more and more research has been devoting to investigating attribute-level satisfaction recently (Chi & Qu, 2008; Hasegawa, 2010; Oliver, 1993). Since every tourism destination is composed of diversified components, understanding tourists' satisfaction with each component is thus essential to destination managers for improving products and services. A number of studies have been carried out to investigate tourists' satisfaction with the attractions (Bigne, Andreu, & Gnoth, 2005; Martin-Ruiz, Castellanos-Verdugo, & Oviedo-Garcia, 2010; Rojas & Camarero, 2008), the transportation (Kim & Shin, 2001), the accommodation (Tsaur, Chiu, & Huang, 2002), the shopping facilities (Chang, Yang, & Yu, 2006; Wong & Law, 2003).

Furthermore, some studies attempt to examine the influence of attribute-level satisfaction on the overall satisfaction. As pointed out by Veloutsou, Gilbert, Moutinho, and Goode (2005), tourists' overall satisfaction is an aggregation of satisfaction with each service aspect. According to Oliver (1993), attribute satisfaction has significant, positive, and direct effects on overall satisfaction. Likewise, many other studies also found out that tourists' satisfaction with individual component of the destination leads to their overall satisfaction (Chi & Qu, 2008; Hsu, 2003; Mayer, Johnson, Hu, & Chen, 1998). Following this idea, Pizam and Ellis (1999) represent tourists' overall satisfaction as a function of satisfaction with the individual elements of the destination, such as accommodation, weather, natural environment, social environment, etc. Similar idea is also adopted in some studies to develop tourist satisfaction index (e.g., Song, Veen, Li, & Chen, 2012).

Another focus in tourists' satisfaction research is to clarify the influence of

satisfaction on loyalty. Repeat visit or positive word-of-mouth (WOM) information are usually referred to as tourist loyalty in the existing literature. Researches regarding the relationship between tourist satisfaction and revisit behavior suggest mixed results. Some studies confirmed that tourist satisfaction has significant positive influence on revisit behavior (Bigne, Sanchez, & Sanchez, 2001; Bowen 2001; Kozak 2001; Kozak & Rimmington, 2000), while others recognized that many tourists indicated no intention to pay second visit even though they were satisfied with their experience (Decrop, 2001; Gitelson & Crompton, 1984; Lee, Petrick, & Crompton, 2007). As explained by Plog (1994), novelty seeking is an important motivation of tourist, many tourists might be unwilling to revisit the same destination due to time and cost constraints. However, compared with ordinary products, where the repeat purchaser expects exactly the same item, destinations have several unique aspects (Lehto, O'Leary, & Morrison, 2004). Revisit behavior does not necessarily mean tourists tend to repeated exactly same tourism attractions. Word-of-mouth (WOM) recommendation is another result of tourist satisfaction. It is generally believed that satisfaction leads to positive WOM recommendation. In tourism industry, there are empirical evidences that tourists' satisfaction is a strong indicator of their intentions to recommend the destination to other people (Bramwell, 1998; Kozak, 2001; Kozak & Rimmington, 2000; Ross, 1993; Yoon & Uysal, 2005). If tourists are satisfied, they are more likely to share their positive traveling experience with their friends and relatives. Word-of-mouth (WOM) recommendation is especially critical in tourism marketing because recommendations by previous visits can be taken as the most reliable information sources for potential tourists (Yoon & Uysal, 2005).

2.6 Integrated analysis framework

Since tourist choice behavior is composed of so many choice aspects and have to deal with spatial and temporal constrain and some uncertainty, it is argued that tourist choice behavior is a multi-dimensional process, and its decision-making mechanisms are complicated. It is expected that decisions about these dimensions of behavior are interrelated from contexts to contexts. To systematically and logically represent these interactions and dynamics across space and over time, some integrated approaches are needed.

As mentioned by Sirakaya and Woodside (2005), one of the first foundational models of travel decision-making is that of Clawson and Knetsch (1966), who proposed an outdoor recreation experience model with five-phase decision-making process starting with the anticipation phase, followed by travel to actual site, on-site experiences and activities, travel back, and concluding with recollection of experiences.

Woodside and MacDonald (1994) introduced a concept of trip frame, which described a set of interrelated travel choices (i.e., destination, route/mode, accommodation, activity performance, and visiting shops) that are made at different points in time.

Dellaert, Ettema, and Lindh (1998) proposed a conceptual framework to represent and understand multi-faceted tourist travel decisions that involve subsequent choices for different facets of a single trip as well as the constraints that may limit the number of feasible travel alternatives, and empirically identified some interactions in the following choice process after deciding to go travel: (1) pre-travel choices (destination, accommodation, travel party, travel mode, departure time for and duration of travel), and (2) during-travel choices (special attractions to visit, travel route to follow, day-to-day expenditure, and rest and food stop locations and timing). Dellaert *et al.* (1998) argued that to account for the above interactions, multidimensional choice models like the nested logit or probit type models can be applied.

Since these choice models cannot directly incorporate timing decisions, they further suggested applying hazard-based duration models (e.g., Hensher & Mannering, 1994). Their suggestion is very operational and practical, but those duration models are statistically oriented and cannot properly reflect the behavioral mechanisms in timing decisions.

King and Woodside (2001) made a qualitative comparative analysis of travel and tourism purchase-consumption system, which is the sequence of mental and observable steps a consumer undertakes to buy and use several products for which some of the products purchased lead to a purchase sequence involving other products and conclude that travelers' decision-making behaviors have various behavioral aspects in relationships that are interactive rather than linear. King and Woodside (2001) also conceptualized a framework of purchase-consumption system in leisure travel (Figure 2-3), which starts with information search and use, followed by three sequential levels: level 1 with choices of destination, activity and attraction, level 2 with choices of accommodation and mode/route to destination, and level 3 related to on-site shopping and dinning behavior, and choice of mode/route in and around destination. Post-travel evaluation is also included in the proposed purchase-consumption system in leisure travel. Woodside and Dubelaar (2002) extended the King and Woodside's model by defining a tourism consumption system as the set of related travel thoughts, decisions, and behaviors by a discretionary traveler prior to, during, and following a travel, and showed that there exist behavioral patterns among visitors to one destination.
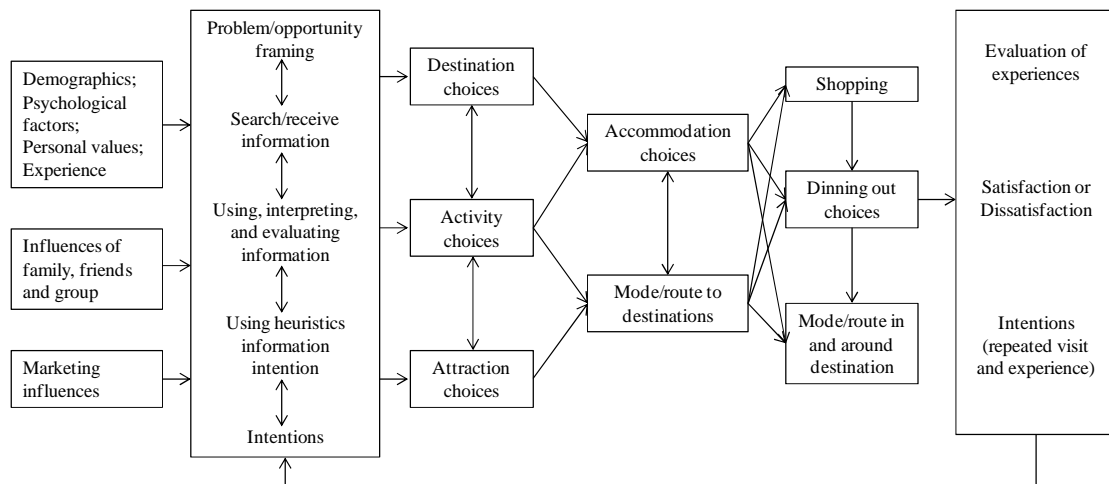
Figure 2-3 Framework of Purchase-Consumption System in Leisure Travel
(King and Woodside, 2001)

2.7 Position of this thesis

To date, various models describing a certain aspect of tourist behavior have been proposed. However, research about the simultaneous representation of multi-faceted choice aspects remains limited. This study aims at filling in this gap by systematically representing the dependencies and interactions in tourist behavior, and incorporating all the important choice aspects of tourist behavior into a model system. Concretely speaking, this study will analyze tourism participation behavior by considering the influence of various factors, including individual and household characteristics, social interactions and constraint effects; investigate tourist multi-stage choice process, including two interrelated choice aspects of destination and travel party, and three interrelated choice aspects of tourism participation, destination choice, and travel mode choice; analyze tourist's multi-destination choice with future dependence; represent tourism participation and tourism expenditure simultaneously; examine tourists' time allocation decisions on various activities during travel.

Several modeling approaches are proposed in this study. Tourism participation choice is analyzed based on a Scobit model, which includes a skewness parameter to relax the

assumption made in binary logit model that the sensitivity of individuals to changes in explanatory variables is highest for those who have indifferent preferences over participation and non-participation. Focusing on the choice interaction between travel party and destination, the latent class modeling approach is introduced into the nested logit modeling framework to simultaneously represent the heterogeneous nested choice structure. Three level nested logit model is adopted to jointly analyze tourist's three interrelated choice (whether to travel, destination choice, travel mode choice). The model that incorporates future dependence is developed to represent the multi-destination choice in a tour trip. A discrete-continuous choice model is developed to represent tourists' two interrelated choice aspects (i.e., tourism participation and expenditure) simultaneously. The multiple discrete-continuous extreme value (MDCEV) model is employed to represent tourist's time use behavior with multiple activities.

The research content of this thesis is summarized in Figure 2-4.
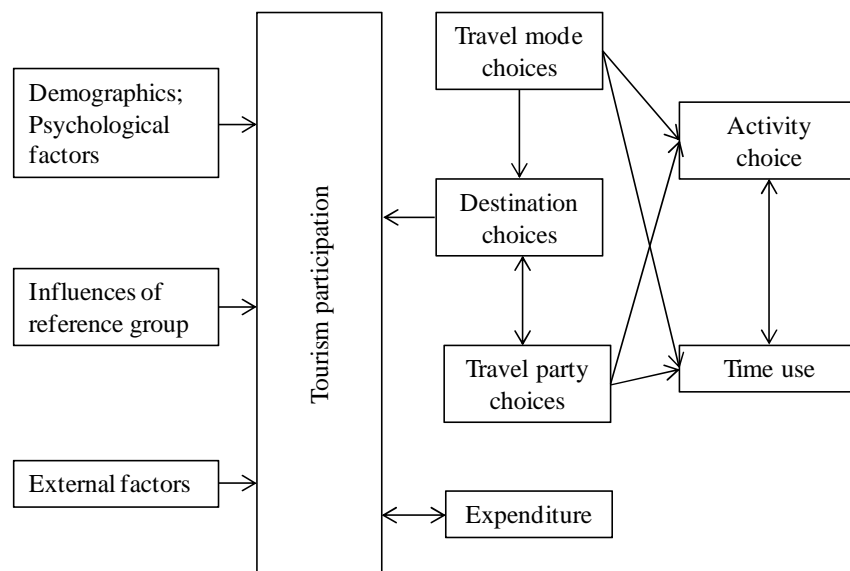
Figure 2-4 Research Content of the Thesis

Chapter 3 Data

In order to analyze multi-faceted tourist travel decisions, different types of data sets are needed. Concretely speaking, a representative sample of the whole population, including participants and non-participants, is required to investigate tourism generation; to understand tourists' scheduling behavior, it is necessary to obtain information about actual tourism trips, including where to go (destination choice), when and how to go (travel season and travel mode choices), with whom to go (travel party choice), and so forth; to understand tourist' on-site behavior, the detailed information about tourists' on-site choice is needed, including visited attractions, within destination route choice, time and money allocation, etc. Obviously, it is difficult to include all the information in a single survey. Therefore, three data sets are used in this study. The first one is derived from a web-based questionnaire survey conducted in Japan during April 2010, which included information of individual's tourism behavior in the year 2009. This data set will be used in Chapter 4, the second section in Chapter 5, and the first section in Chapter 7. The second one was collected at 29 major tourism destinations in Kyusyu, Chugoku and Shikoku regions in the summer of 2002 based on a face-to-face interview. This data set will be used in the first section in Chapter 5. The third one was collected in the prefecture of Tottori in 2007 based on an on-site interview, which provide very detailed information about tourists' on-site behavior. This data set will be used in Chapter 6 and the second section in Chapter 7.

3.1 A web-based questionnaire survey in Japan

For the purposes of this study, we conducted a web-based questionnaire survey in Japan in April 2010 with the help of an Internet survey company, who had more than 1.4 million registered panels at the time of survey. Respondents were randomly selected from the registered panels by considering the distributions of age, gender, and residential areas (here,

refer to prefectures) across the whole population in Japan. We argue that such web-based survey is the most effective way to control the sample composition which can hardly be achieved by other methods. We cannot deny the fact there are some sample selection biases; however, considering that the Internet usage rate in Japan reached 75.5% in 2010, the Internet is an acceptable media to conduct such survey. The survey included very detailed information of individual's tourism behavior in the year 2009. Respondents were first asked whether or not they went on holiday trip of more than one night in the year 2009. If the answer is yes, the respondents were asked specific questions about every trips they took, including destination choice, travel date, motivation, travel mode, travel time, travel party, duration of stay, expenditure, satisfaction, and difficulties they confronted during traveling. If the answer is no, the respondents were asked to report the constraints to participate in tourism, including intrapersonal (e.g., lack of interest, health problems), interpersonal (e.g., constraint of partner's time), and structural constraints (e.g., lack of money, lack of time). Social-demographic data were also collected including gender, age, occupation, education level, annual income, marital status, household composition, residential area, car ownership. As a result, 1,253 questionnaires were obtained. This was the first time in Japan to conduct such relatively large-scale and balanced retrospective survey to investigate tourists' behavior in a year.

The individual characteristics are summarized in Table 3-1. It is observed that 64.0% of the respondents are married, 46.4% have a university degree, 51.8% are employed persons, and 77.2% have a private car.

Table 3-1 Summary of Individual Characteristics

Individual characteristic	Percentage
Gender	
Male	49.6
Female	50.4
Age	
< 30 years old	20.3
30 - 50 years old	34.0
> 50 years old	45.7
Occupation	
Employed	51.8
Student	3.50
Housewife	21.5
Others	23.2
Education level	
Having a university degree	46.4
Having no university degree	53.6
Marital status	
Single	36.0
Married	64.0
Household income	
<3 million yen/year	19.2
3-8 million yen/year	56.3
>8 million yen/year	24.5
Household size	
1 member	18.1
2 members	28.4
3 members	24.9
>3 member	28.6
Car ownership	
Have a private car	77.2
Have no car	22.8

Domestic tourism participation

As we only focus on domestic tourism in this study, the information of international trips is eliminated. Figure 3-1 shows the distribution of travel frequency of the sample in the year 2009. In total, 61.3% of the sample participated in domestic tourism. One quarter of respondents took only one domestic trip. Still, a remarkable proportion (10%) took more than three trips in one year period.
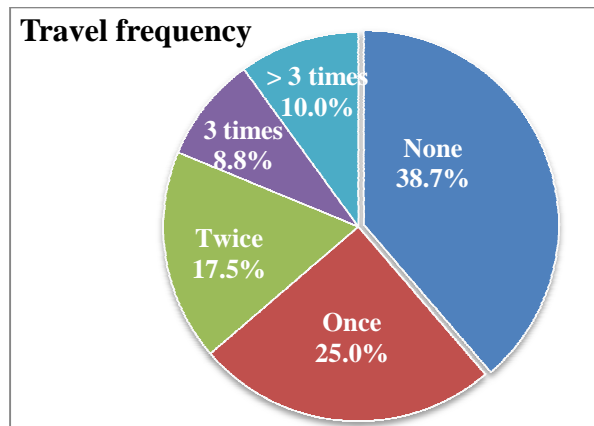
Figure 3-1 Travel Frequency for Domestic Tourism Trip in 2009

Figure 3-2 describes the tourism participation percentage in each month. One can see that the share is highest for August (17.8%), and lowest for February (6.4%). The shares in May, September and October are relatively high, while those in January and June are relatively low.
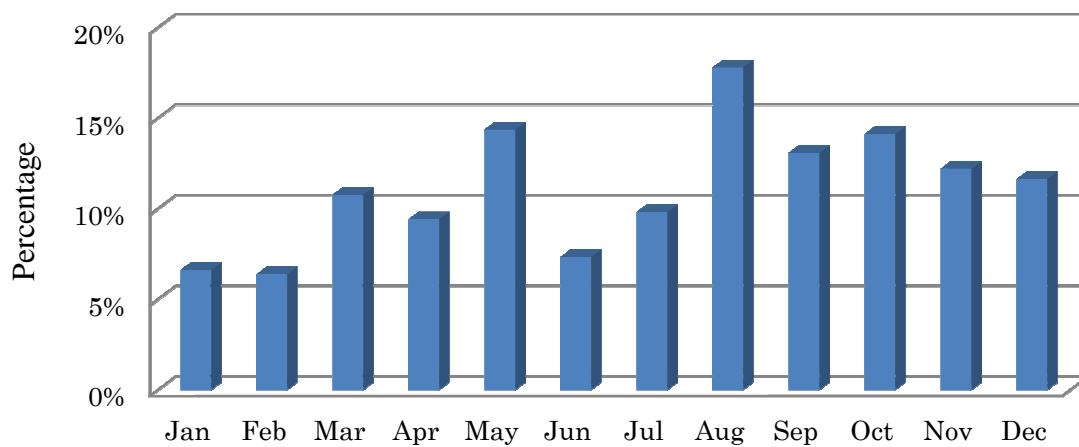
Figure 3-2 Tourism Participation Percentage in 12 Months

Information source

Figure 3-3 represents the information source when the respondents took their trips. As revealed by this figure, two main information sources are family or friends and previous visit, which take up 42% and 40%, respectively. There are only a small portion of tourists, who got information from Internet (8%) and TV (3%). As some tourists have more than one

information source, the percentages do not sum to 100%.

Information Source
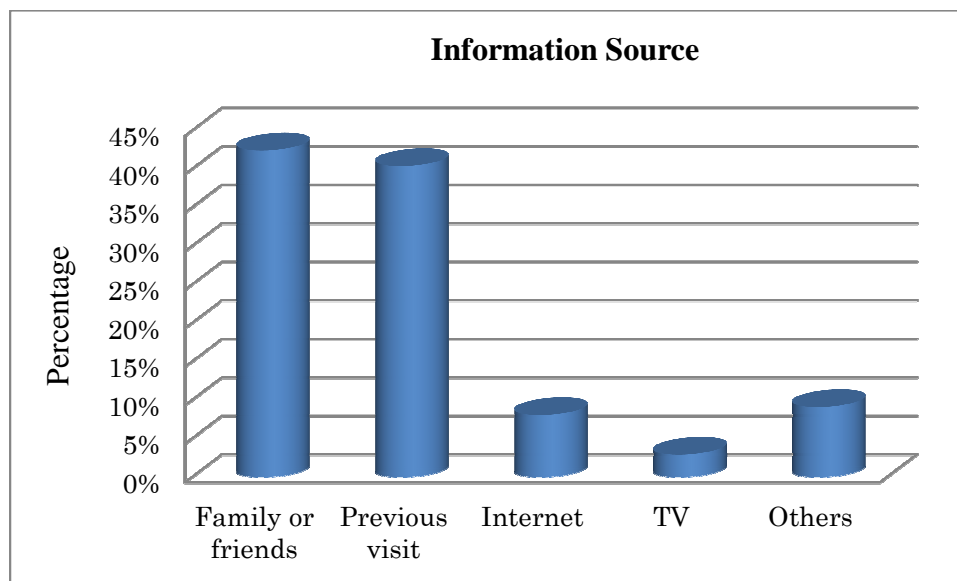
Figure 3-3 Information Source for the Tourism Trip
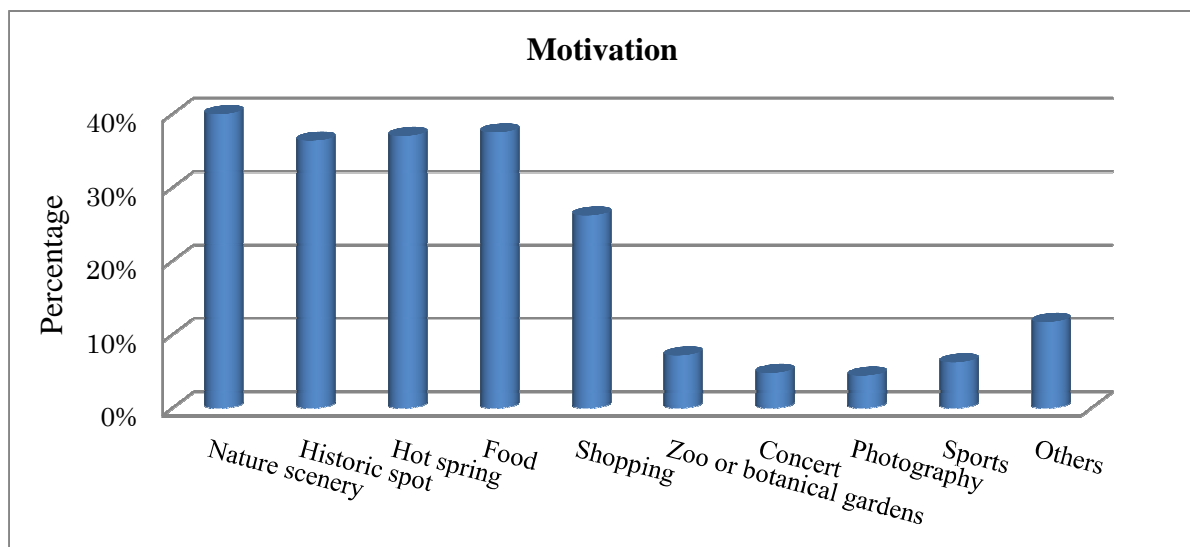
Motivation

Figure 3-4 Tourism Motivation for Domestic Trips

Tourism motivation

Figure 3-4 shows the tourism motivation of respondents who took domestic trips. There are

four major motivations for the tourists: nature scenery (40%), historic spot (36%), hot spring

(37%), and food (37%). And about a quarter of tourists are motivated by shopping activities.

A small part of tourists (around 5%) have motivation to visit zoo or botanical gardens, concert, take photos, or participate in sport activities.

Plan period

As for the plan period, more than one third of tourists (42%) made their plan half to one month before the trips (Figure 3-5). Around a quarter of tourists took less than two weeks to plan their trips. On the other hand, some tourists spend relatively longer time to plan. More than 20% of tourists plan their trips one to two months beforehand, and another 10% spend more than two months to plan.
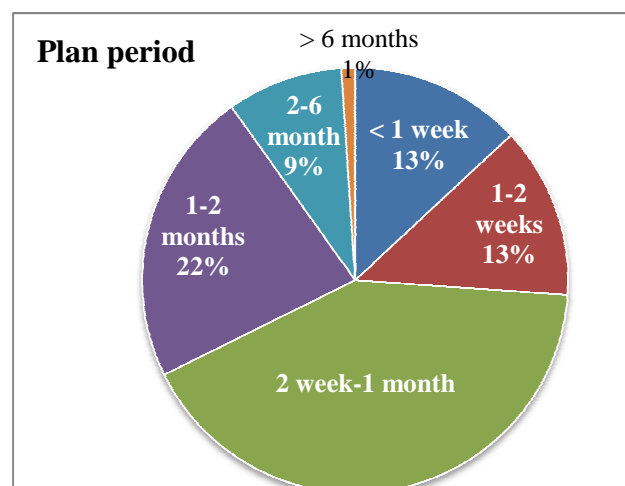
Figure 3-5 Plan Period Before Tourism Trips

Destination choice

In the survey, respondents were asked which prefecture they visited for their trips. Figure 3-6 shows the percentage of destination choice. It is observed that Hokkaido prefecture is ranked at the first place with 7%, followed by Shizuoka prefecture with 6.8%, and Tokyo is ranked at the third place with 6.5%. Nagano and Kanagawa prefecture are also popular destinations with visit percentage of 6.3% and 5.7%, respectively.
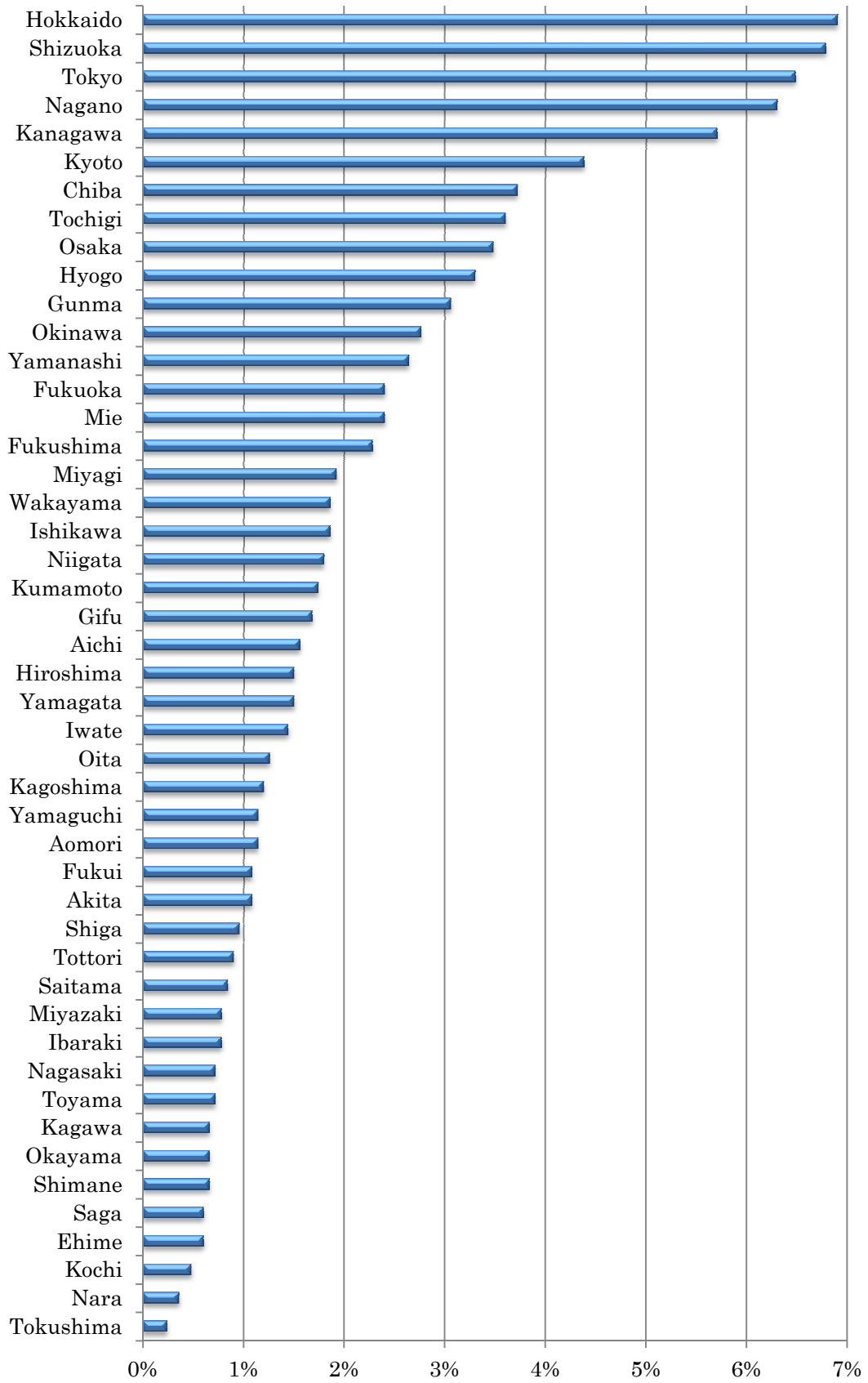
Figure 3-6 Distribution of Destination Choice

Travel party

Concerning travel party choice, traveling with family is the dominant travel pattern, which takes up 59% shares. Nearly a quarter of tourists choose to travel with friends. Tourists who travel alone take up a relatively small portion (14%). Only 1% of tourists choose package tour (Figure 3-7).

Travel mode

Distribution of travel mode choice is described in Figure 3-8. Nearly half of tourists choose to travel by private car. Among the public transportation mode, shikansen is the most used travel mode with 22%, followed by airplane and railway with 16% and 10%, respectively.

Figure 3-7 Distribution of Travel Party Choice
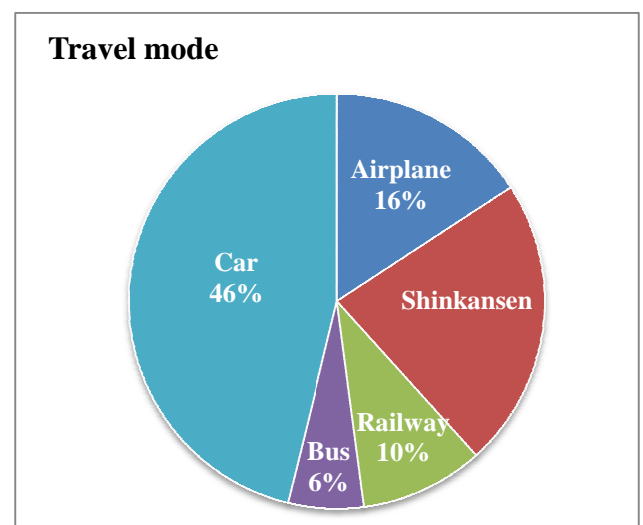
Figure 3-8 Distribution of Travel Mode Choice

Stay length

Figure 3-9 represents the distribution of stay length for one trip. As one can see from the figure, the length of stay is short in general cases. More than half of tourists stay only one night and nearly a quarter of tourists stay two nights. There are only 10% of tourists who stay more than three nights.

Monetary expenditure

Distribution of expenditure for one trip is showed in Figure 3-10. More than two thirds of trip expenditure range from 20 to 80 thousand yen. Tourists who spend relatively less (< 20 thousand yen) take up nearly 20%, and those who have relatively higher expenditure take up 14%.
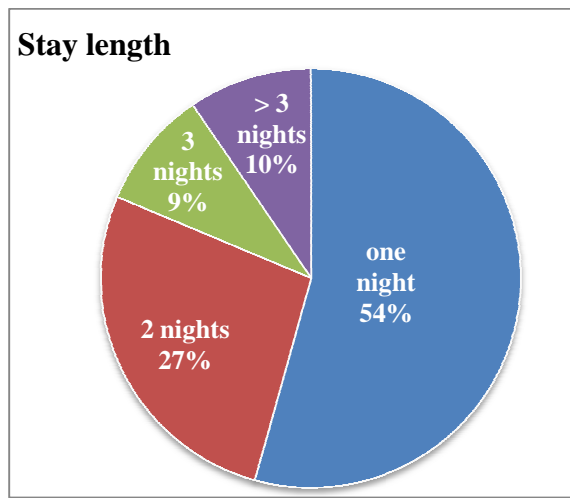
Figure 3-9 Distribution of Stay Length for One Trip
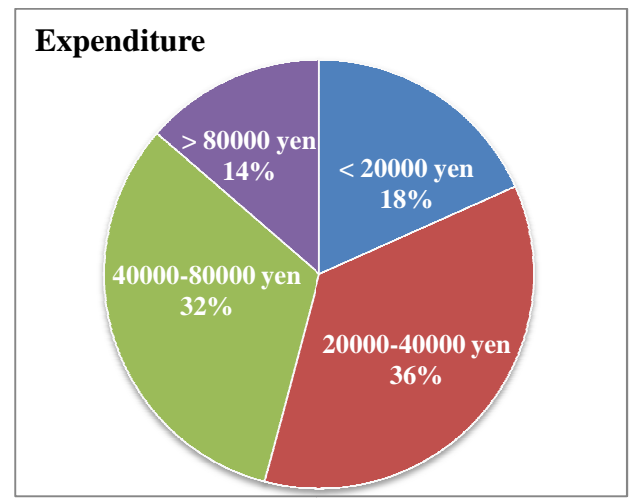
Figure 3-10 Distribution of Expenditure for One Trip

3.2 Survey in Kyusyu, Chugoku and Shikoku regions

The survey was conducted by the Kyusyu Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism, Japan. The data was collected at 29 major tourism destinations in Kyusyu, Chugoku and Shikoku regions in the summer of 2002 based on a face-to-face interview. Since each respondent had to answer the detailed travel activity information (e.g., travel mode, accommodation, time use and expenditure, etc.), subjective evaluations of several destinations, as well as personal travel preference and experience and the other individual attributes, questionnaire sheet became lengthy. To encourage the participation, 1,000 Japanese Yen was provided to each respondent as incentive. As a result,

about 2,500 questionnaires were obtained, including the data of individual characteristics and travel-related attributes. Individual characteristics include gender, age, occupation, annual income, and marital status, etc. while travel-related attributes include destination, travel party, travel mode, and duration of stay, etc. The individual characteristics are summarized in Table 3-2.

Table 3-2 Summary of Individual Characteristics

Individual characteristic	Percentage
Gender	
Male	51.4
Female	48.6
Age	
Young (< 30)	33.7
Middle (30 - 50)	46.1
Old (> 50)	20.2
Occupation	
Employee	62.9
Student	12.5
Housewife	18.2
Other	6.4
Marital status	
Single	35.7
Married	64.3
Annual income	
<4 million yen	58.6
4-10 million yen	25.1
>10 million yen	16.3

Figure 11-14 shows travel-related characteristics. It is observed that more than half of the sample travelled with family and two thirds of the sample travelled by private car. Concerning stay length, about one third of the tourists travelled for one day and another one third travelled for two days. Distribution of expenditure is showed in Figure 3-14. One can see that nearly half of the tourists spent less than 10,000 yen.

Travel party

**Alone
15%**

**With
friends
32%**

**With
family
53%**
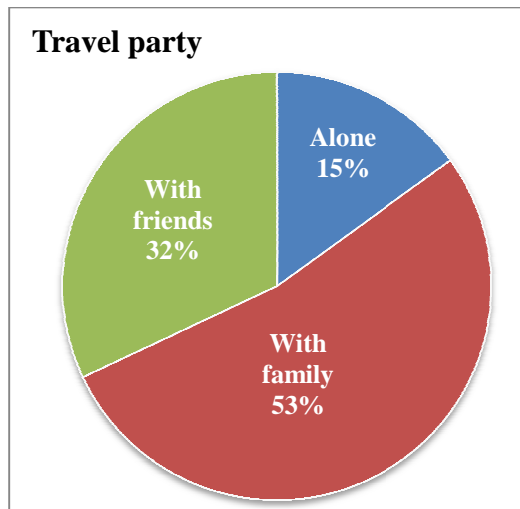
Figure 3-11 Distribution of Travel Party Choice

Travel mode

**Air
13%**

**Shinkansen
15%**

**Car
58%**

**Railway
8%**

**Bus
6%**
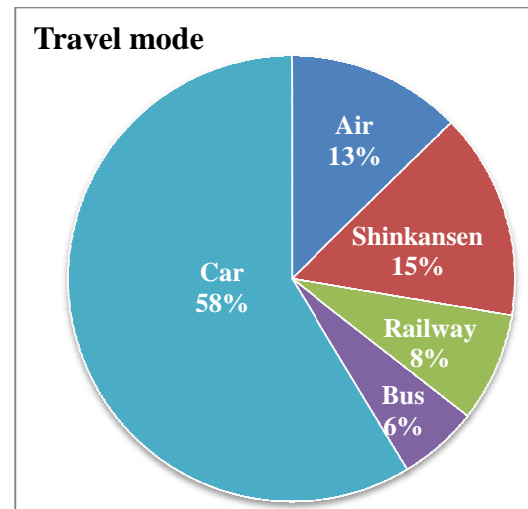
Figure 3-12 Distribution of Travel Mode Choice

Stay length

**> 3 days
17%**

**3 days
18%**

**One day
36%**

**2 days
29%**
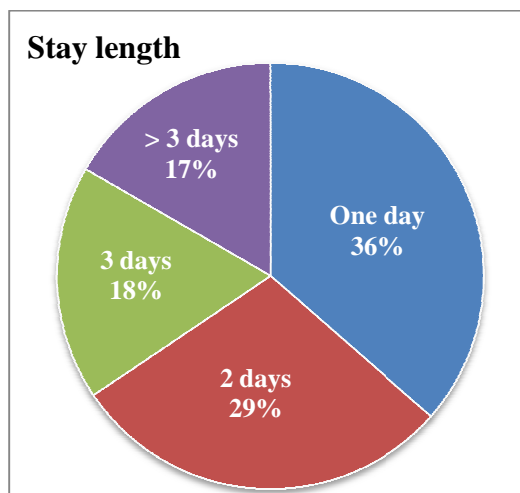
Figure 3-13 Distribution of Stay Length

Expenditure

**> 40000 yen
20%**

**< 10000 yen
48%**

**10000-40000 yen
32%**
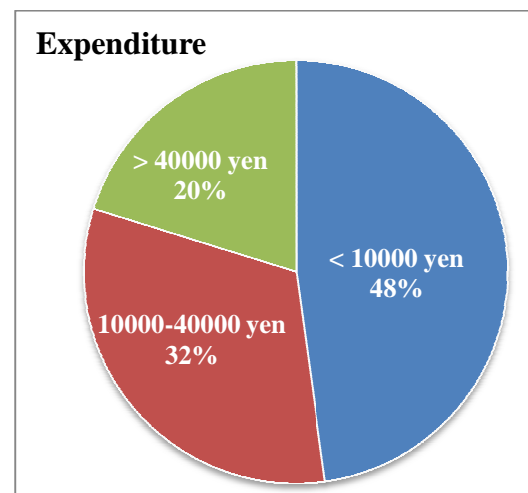
Figure 3-14 Distribution of Expenditure

3.3 On-site survey in the prefecture of Tottori

The survey was conducted by the Chugoku Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism, Japan. The data was conducted in the prefecture of Tottori in 2007 based on a face-to-face interview. Tottori is best known for its sand dunes which are a popular tourist attraction, drawing visitors from outside of the prefecture. The interview survey was conducted in four seasons across a year at 16 major tourism

destinations in Tottori. As a result, 761 valid samples were obtained, including the data of individual characteristics and travel-related attributes. Individual characteristics include gender, age, occupation, residential location, etc. while travel-related attributes include travel party, travel mode, duration of stay and expenditure, etc. Especially, tourists were asked to provide very detailed information of each tourism spot they visited, the arrival and departure time, and monetary expenditure on each spot. The individual characteristics are summarized in Table 3-3. Nearly 60% of the tourists are residents from other prefectures. And more than half of the tourists are first time visitors to Tottori prefecture.

Table 3-3 Summary of Individual Characteristics

Individual attributes	Percentage
Gender	
Male	55.4
Female	44.6
Age	
Young (<30)	8.3
Middle (30-50)	40.7
Old (>50)	51.0
Occupation	
Employee	37.6
Student	1.2
Housewife	14.7
Other	46.5
Residential location	
Inside the prefecture	41.3
Outside the prefecture	58.7
Travel experience	
Visited Tottori before	44.5
Otherwise	55.5

Figure 11-14 shows travel-related characteristics. It is observed that nearly 80% of the sample travelled with family and more than 90% of the sample travelled by private car. Concerning stay length, more than half of the tourists travelled for one day. Distribution of expenditure is showed in Figure 3-18. One can see that about one third of the tourists spent less than 10,000 yen and another one third of them spent more than 40,000 yen.
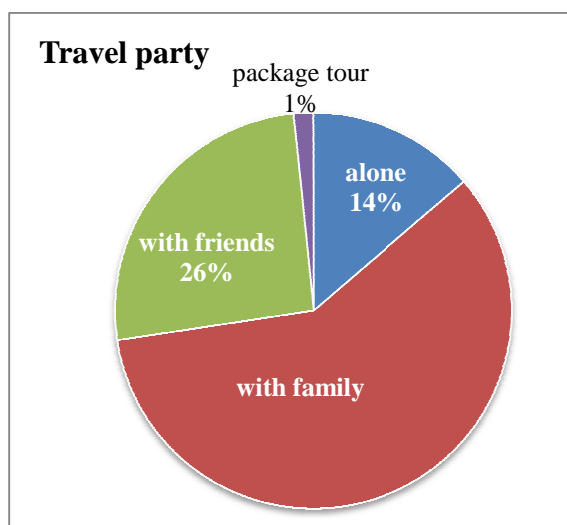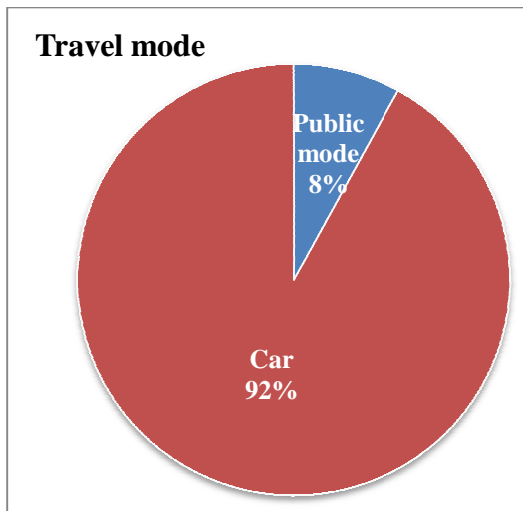
Figure 3-15 Distribution of Travel Party Choice
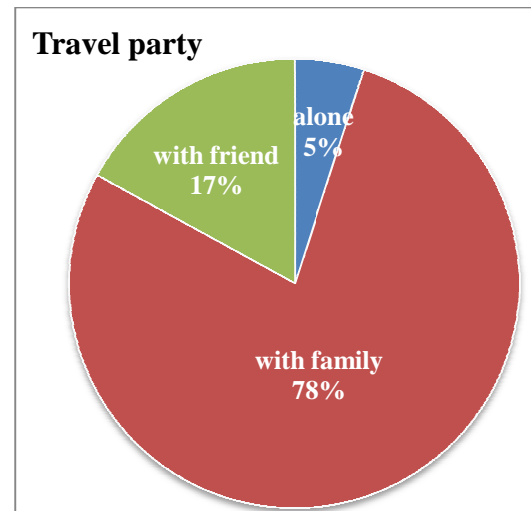
Figure 3-16 Distribution of Travel Mode Choice
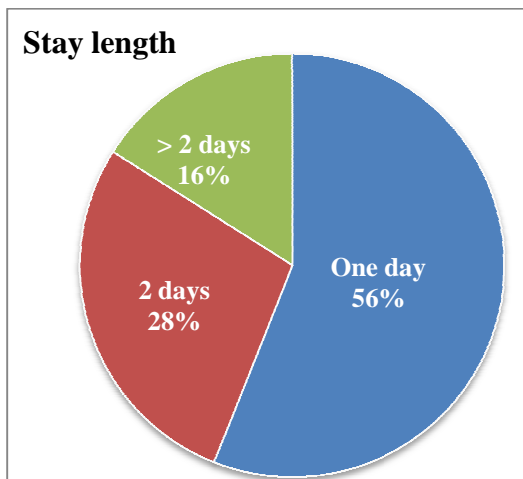
Figure 3-17 Distribution of Stay Length
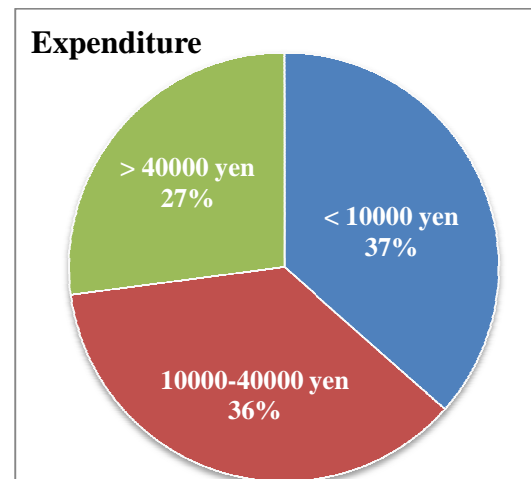
Figure 3-18 Distribution of Expenditure

Chapter 4 Analysis of Tourism Generation Incorporating the Influence of Social Interactions and Constraints

4.1 Introduction

One of the biggest difficulties in tourism behavior analysis would be in how to deal with the substantially flexible decision making of tourism activities. This is also true to the study about whether to participate in tourism or not. Such tourism participation is usually influenced by various factors. To explore the influential factors in tourism participation behavior, the utility-maximizing choice models have been widely applied in the existing studies. In these studies, factors such as income (Fleischer & Seiler, 2002; Mergoupis & Steuer, 2003), age (Nicolau & Mas, 2005), education level (Melenberg & Soest, 1996), health condition (Alegre, Mateo, & Pou, 2010), number of children (Hellstrom, 2006), household size (Hellstrom, 2006; Nicolau & Mas, 2005), residential area (Nicolau & Mas, 2005), traffic condition (Stemerding, Oppewal, & Timmermans, 1999) are found to be influential to tourism participation. However, these studies do not take account of psychological factors, which are also found to be influential to tourism participation. For example, the "push and pull" motivation theory (Dann, 1977) stated that people travel because they are pushed by their internal motives and pulled by external forces of a destination. The Theory of Planned Behavior (TPB) (Ajzen, 1991) proposed that intentions to perform tourism behavior can be predicted by attitudes, subjective norms, and perceived behavior control. Some studies recognized that tourism participation is prohibited by a number of constraints including intrapersonal, interpersonal, and structural constraints (Crawford, Jackson, and Godbey, 1991; Jackson, 1991). Therefore, this study attempts to include two kinds of psychological factors, namely, social interactions and constraint effects into the utility-maximizing choice models to investigate tourism participation behavior.

Over the past few decades, a number of studies in both economics and social science have examined the influence of social interaction in decision-making behavior (Case & Katz,

1991; Gaviria & Raphael, 2001; Marmaros & Sacerdote, 2002; Moretti, 2011; Powell, Tauras, & Ross, 2005). Social interaction refers to the idea that individual's behavior is influenced by their reference groups. It has been applied to diverse behaviors, such as youth smoking (Powell *et al.*, 2005), criminal activity (Case & Katz, 1991), school dropout (Gaviria & Raphael, 2001), job search (Marmaros & Sacerdote, 2002), welfare participation (Duflo & Saez, 2003), consumption behavior (Moretti, 2011). In context of tourist behavior, social interaction is also confirmed to have important influence. The fact that tourist tend to obtain information from their peer groups and conform to the group norm is well documented in the literature (Fodness & Murray, 1999; Moutinho, 1987). A theoretical approach that demonstrated the influence of social interaction in tourist behavior is the Theory of Planned Behavior (TPB) (Ajzen, 1991). The TPB proposed that tourist behavior is influenced by three factors: attitude, subjective norms and perceived control, in which the subjective norms can reflect the influence of others on individual's behavior. Jackson (1991) argued that interpersonal influence plays a significant role in individual's travel intentions. Specifically speaking, what others think or do (social norms) have the potential to influence travel intentions. Similarly, Lam and Hsu (2006) found social norms to be an important factor in influencing tourists' intentions to visit a certain destination. In addition, other tourism research (e.g. Beerli & Martin, 2004) has provided evidence that word-of-mouth (WOM) information derived from sources such as friends or family can affect image perceptions of a destination. These results confirmed that tourist behavior cannot be fully understood unless social interaction is taken into consideration.

Concerning the modeling of social interaction, the pioneering work was conducted by Manski (1993), who identified three aspects of social interactions. First is endogenous effect, which means that behaviors of the members in a social group have a causal effect on the behavior of each individual in that group. Second, individual behavior might be influenced by

the characteristics of their social group, which is identified as exogenous social effects. Third, individuals in a social group behave similarly because they have similar unobserved characteristics or they share a common environment, which is identified as correlated effects. The identification of these three aspects has great policy significance because they have different implications. The endogenous effect implies that the behavior of an individual is directly influenced by his/her social group, which will generate social multiplier effect. Social multiplier effect means that the aggregate effect of a policy will be larger at the social level than the individual-level, and can be measured by the ratio of aggregate effect to individual-level effect (Glaeser, Sacerdote, & Scheinkman, 2003). For example, if an economic incentive is given to some individuals to participate in tourism, it will increase the tourism participation percentage of both target population and their social group. However, exogenous effects and correlated effects do not generate social multiplier effect. Exogenous effects indicate that individuals' behaviors are influenced by the characteristics of their social group but not the behavior of them. Correlated effects represent the unobserved factors shared by people in the same social group, which do not imply that individual behavior is influenced by the behavior of their social groups either. Even though the importance of distinguishing the exogenous effects and correlated effects from endogenous effects has been recognized, most of the existing studies built up the decision-making models under the assumption that these two types of social interactions are not present. Thus, no methodology has been developed to distinguish the endogenous effects from the exogenous effects and the correlated effects. In addition, the difficulty to represent social interaction also lies in the fact that individuals are usually influenced by two or more social groups, for example, their friends, the community that they reside in, and/or people with similar characteristics. However, the existing research usually examined the influence of one reference group. This study aims to fill in this gap by representing the influence of multiple social interactions on

tourism participation behavior and incorporating the three aspects of social interactions at the same time.

The second psychological factor that the study attempts to take into account is constraint effects. Constraint effects are factors assumed to prohibit participation in tourism (Jackson, 1991), which can be classified into three categories: intrapersonal ones, reflecting an individual's psychological state (e.g. stress, anxiety or depression), physical state (physical limitations or illnesses) or cognitive skills; interpersonal ones, which are associated with interaction and interpersonal relations (e.g. being unable to find a travel partner); and, finally, structural ones, which stand between a person's leisure preferences and real participation (tied in with the stage in the family lifecycle, the economic cost of the activity, time etc.). These constraints are ordered sequentially so that each level of a constraint must either not exist or be overcome before going on to the next level (Crawford *et al.*, 1991). In explaining this hierarchy, Crawford *et al*. (1991) contended that there are psychological orientations that may prevent individuals from experiencing higher level constraints. Therefore, individuals who are most affected by intrapersonal difficulties would be less likely to participate in a given leisure activity and thus would not reach higher order constraints (interpersonal and structural). However, there are some studies arguing that these constraints were interactive rather than hierarchical (Daniels, Rodgers, & Wiggins, 2005; Gilbert & Hudson, 2000). Many of these models have been applied to specific tourism activities like skiing, camping, golf, or adventure or risk activities (Gilbert & Hudson, 2000), or to specific segments of the population with characteristics that are potentially restrictive, such as an advanced age, gender-related constraints or illnesses (Daniels *et al.*, 2005). However, most of constraint models only provide theoretical or descriptive perspectives, rather than the methods of behavior modeling and demand forecasting.

In the perspective of model attempt, since participation in tourism activities can be

treated as a binary choice, most existing studies adopted a binary logit model to deal with participation choice. The application of the logit model implicitly assumes that the sensitivity of individuals to changes in explanatory variables is highest for those who have indifferent preferences over participation and non-participation (i.e., choice probability is 50%). However, in reality the probability level at which explanatory variables have their maximum impact on a change in choice probability is not necessarily 50%. Such potentially unrealistic assumption is caused by the fact that the choice probability derived from the logit model is symmetric about zero utility. In this case, there is a possibility that the marginal effects of explanatory variables, which depend on not only the estimated parameters but also the form of choice probability, are misspecified.

With the above considerations, the purposes of this study are: (1) representing the influence of social interactions and constraint effects on tourism participation behavior; (2) attempting to adopt an alternative model, which includes a skewness parameter to relax the assumption made in binary logit model that the sensitivity of individuals to changes in explanatory variables is highest for those who have indifferent preferences over participation and non-participation.

4.2 Methodology

4.2.1 Utility function incorporating social interactions

In order to incorporate three aspects of social interactions, the utility U_n that individual n decides to participate in tourism can be described as:

$$U_n = V_n + \varepsilon_n = \sum_s \rho E(\tilde{d}_{ns}) + \sum_s \gamma E(\tilde{x}_{ns}) + \sum_s v_s + \eta z_n + \varepsilon_n \qquad (4\text{-}1)$$

Here, $E(\tilde{d}_{ns})$ indicates the average choice results of social group s for individual n, which is used to capture the influence of endogenous effect. In the context of tourism participation decision, the endogenous effect means that individuals' tourism participation decision is directly influenced by the tourism participation decisions of their social group. For example, if everyone around them goes to travel, they may want to travel as well. $E(\tilde{x}_{ns})$ is a vector of individual characteristics of social group s, which represent the influence of exogenous effect. Exogenous social effects imply that individuals are influenced by the characteristics of their social group, but not directly by their behavior. Furthermore, the correlated effect is reflected by ν_s. Correlated effect means individuals in a social group behave similarly because they have similar unobserved characteristics or they share a common environment. For example, if a city has convenient accessibility to tourism facilities, people in that city are more likely to participate in tourism. In this study, this kind of unobserved effect is represented by the random component ν_s, which is shared by each member in the same social group. And v_s is assumed to follow a normal distribution with mean 0 and standard deviation σ_s ($v_s \sim \mathrm{N}(0, \sigma_s^2)$).

Besides social interactions, individual's tourism participation decision is also expected to be influenced by other factors. Here, z_n represents a vector of explanatory variables that directly influence tourism participation behavior, including individual and household attributes, and constraint effects. ε_n is an error term.

4.2.2 A scobit-based multi-level model

Tourism participation decisions can be treated as a binary choice, i.e., whether to participate in tourism or not. If we use Y_n to represent the choice result of individual n, then tourism

participation decisions can be given as:

$$Y_n = \begin{cases} 1 & U_n > 0 \\ 0 & otherwise \end{cases} \qquad (4\text{-}2)$$

Then, the probability that individual chooses to participate in tourism is:

$$P_n(Y_n = 1) = P(\varepsilon_n > -V_n) = 1 - F(-V_n) \qquad (4\text{-}3)$$

Here, F indicates the distribution function of error term ε_n. Let f be probability density function of ε_n. Then, marginal effect of z_n on the participation probability P_n is:

$$\partial P_n(Y_n = 1) / \partial z_n = \eta f(-V_n) \qquad (4\text{-}4)$$

In existing research, ε_n is assumed to follow either a normal distribution or a Gumbel distribution. In both cases, marginal effect will reach a maximum when V_n is equal to zero. This implies that the change of variable of z_n will have its greatest effect on individuals with the value of V_n equal to zero, or the probability P_n equal to 50%.

However, in reality, there might be heterogeneous initial probability among individuals. This means that the Logit or Probit model would result in a misspecification. In this sense, this study adopts an alternative distribution function to address this problem:

$$F(\varepsilon_n; \alpha) = \frac{1}{(1 + \exp(-\varepsilon_n))^{\alpha}} \qquad (4\text{-}5)$$

The probability that individual chooses to participate in tourism can be derived based on the above distribution function:

$$P_n(Y_n = 1) = 1 - F(-V_n) = 1 - \frac{1}{(1 + \exp(V_n))^{\alpha}} \qquad (4\text{-}6)$$

This model is called as Scobit model, named by Nagler (1994). Here α is skewness parameter. When α is equal to 1, the model will become Logit model. In the Scobit model, marginal effect of z_n on the participation probability P_n is:

$$\partial P_n(Y_n = 1)/\partial z_n = \alpha \exp(V_n)(1 + \exp(V_n))^{-\alpha-1} \eta \qquad (4\text{-}7)$$

It can be noticed that the marginal effect of z_n is also influenced by α, which will relax the assumption that the sensitivity of individuals to changes in explanatory variables is highest for those who has an initial probability of 50%.

Then probabilities that individual n chooses to participate in tourism and not to participate can be derived as:

$$P_n(Y_n = 1) = 1 - \frac{1}{(1 + \exp(\sum_s \rho E(\tilde{d}_{ns}) + \sum_s \gamma E(\tilde{x}_{ns}) + \sum_s \nu_s + \eta z_n))^{\alpha}} \qquad (4\text{-}8)$$

$$P_n(Y_n = 0) = \frac{1}{(1 + \exp(\sum_s \rho E(\tilde{d}_{ns}) + \sum_s \gamma E(\tilde{x}_{ns}) + \sum_s \nu_s + \eta z_n))^{\alpha}} \qquad (4\text{-}9)$$

The likelihood function is given as follows:

$$L = \int_{v_1}...\int_{v_s} \prod_{n=1}^{N} P_n(Y=1)^{\delta_n} \times P_n(Y=0)^{1-\delta_n} f(v_1|\sigma_1)...f(v_s|\sigma_s) dv_1...dv_s \qquad (4\text{-}10)$$

Here, N indicates the total number of samples, and δ_n is dummy variable that is equal to 1 when individual n participate in tourism, otherwise 0.

Such kind of model is called as multi-level model, which includes random parameters that vary at multiple levels. In the case of this study, the multi-level variations are random components that vary across different social groups.

To estimate such model, some simulation methods are usually adopted, such as a series of Monte Carlo methods and numerical quadrature methods. In this study, a hierarchical Bayesian procedure based on Markov Chain Monte Carlo (MCMC) method (e.g., Train, 2003) is adopted. The method incorporates prior distribution assumptions and, based upon successive sampling from posterior distribution of the model parameters, yields a chain which is then used for making point and interval estimations. Draws from the posterior are obtained using the software WinBUGS (Bayesian inference Using Gibbs Sampling) (Lunn, Thomas, Best, & Spiegelhalter, 2000). In the Gibbs sampling, draws of each parameter are obtained from its posterior conditional on the other parameters (Train, 2003). The convergence of the estimation results can be checked using the Geweke diagnostic (Geweke, 1992).

4.3 Model estimation

4.3.1 Data description

The data used in this study comes from a web-based questionnaire survey conducted in Japan in April 2010, as introduced in Chapter 3. The survey included detailed information of individual's tourism behavior in the year 2009 (e.g., how many times they participated in tourism during the whole year, destination choice, timing, travel mode, travel party, duration of stay, expenditure for each trip) and individual characteristics (e.g., gender, age, occupation, education level, annual income, marital status, household composition, residential area, car ownership, etc.). Especially, the individuals who did not participate in tourism reported the constraints to participate in tourism, including intrapersonal (e.g., lack of interest, health problems), interpersonal (e.g., constraint of partner's time), and structural constraints (e.g., lack of money, lack of time). As a result, 1253 questionnaires were obtained. The samples were collected according to gender, age and residential area distribution in the whole nation. In total, 61.3% of the sample participated in domestic tourism during the year 2009.

For those who did not participate in tourism, we asked about constraints that prohibit them from participating in tourism. Each constraint is on a scale from 1 to 4 (1 is least agree, 4 is most agree). From Figure 4-1, we can see that money constraint is the main constraint for tourism participation. About 40% of the non-participants think money constraint is the most important constraint (level 4) and another 30% regard it as important constraint (level 3). Time constraint is another significant constraint, about 30% think time constraint is the most important constraint (level 4) and about 20% think their partner's time constraint is the most important constraint (level 4). In addition, about 8% of the individuals think available information, health problem and lack of interest are the most important constraints.
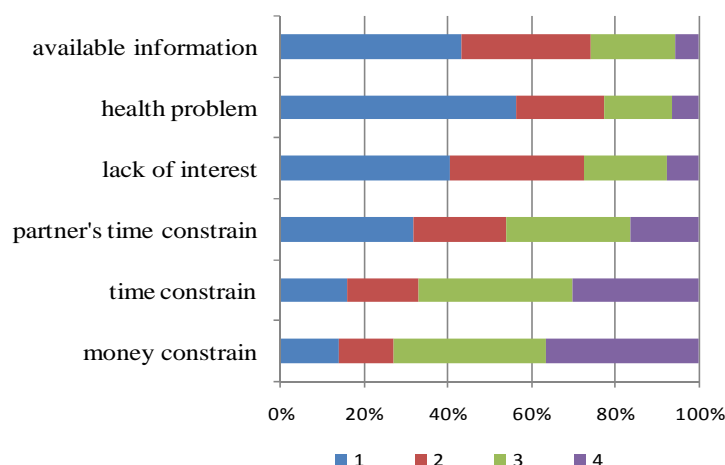
Figure 4-1 The Constraints to Participate in Tourism

4.3.2 Explanatory variables

In this study, individual characteristics including gender, marital status, education level; household attributes including household size, existence of children in household, car ownership are used as explanatory variables. Because we attempt to investigate how constraints will affect individual's choice of tourism participation, the constraints in Figure 4-1 are also included as explanatory variables. Since we do not have the data about constraints level for people who participate in tourism, it is assumed that the level of all constraints for them are 1. Although it would be quite a strong assumption, this could be explained by the theoretical model proposed by Crawford *et al*. (1991): in their theoretical model, it is assumed that if an individual encounters a constraint, the outcome will be non-participation. If this assumption is true, the level of all constraints for people who participate tourism should be 1, implying there are no constraints at all. The advantage of employing this assumption is that we can easily introduce constraint components into the existing econometric models and empirically examine the model with the typical data set. Of course, there are different theoretical models, for example, "negotiation" of leisure constraints (Jackson, Crawford, & Godbey, 1993) that does not accept the assumption that the

outcome will be non-participation if an individual encounters a constraint. But if we are to employ such a complicated theoretical framework, we will also need the data of constraints for tourism participants, i.e., how they overcome constraints. How to collect such data would be a very challenging issue, and it would also be worth examining tourism constraint effects with different theoretical assumptions in future.

Table 4-1 Explanatory Variables

Explanatory variables for participation	
Gender(dummy variable)	1: Male; 0: Female
Marital status(dummy variable)	1: Married; 0: otherwise
Education level (dummy variable)	1: having a university degree; 0: otherwise
Household size	Number of household members
Existence of children (dummy variable)	1: having a child of school age in household 0: otherwise
Car ownership (dummy variable)	1: Owning a private car; 0: otherwise
Money constraint	scale from 1 to 4
Time constraint	scale from 1 to 4
Partner's time constraint	scale from 1 to 4
Lack of interest	scale from 1 to 4
Health problem	scale from 1 to 4
Available information	scale from 1 to 4

4.3.3 Social interactions

The existing research suggests that the mechanisms of social interactions are imitative behavior of other people, which relies mainly on external information sources (e.g., mass media) and behavior of other individuals. Social interactions might arise through direct communication (e.g., WOM information from friends) or indirectly effect such as social norm formation in the social space of the individual. In this study, we define this social space as the

prefecture that individual resides in. It might be argued that individual's behavior is more likely to be influenced by the immediate spatial locality (e.g., a neighborhood). However, it is difficult to get the information of tourism participation percentage at the neighborhood level. In addition, most of policies are implemented in the prefecture level. This study, therefore, defines prefecture as the social space. On the other hand, it is expected that individual behavior is influenced by not only the general trend, but also behavior of homogenous group, for example, people with similar characteristics. In the case of tourism participation, it is expected that individual's behavior will be influenced by the people with same income level or same occupation. Therefore, in this study, the average tourism participation percentages of prefectures, homogenous income groups and homogenous occupation groups are included in the model to represent the endogenous social effect.

Exogenous social effects imply that individuals are influenced by the characteristics of their reference groups. In order to decide which characteristics should be included in this study, the correlation analysis is conducted. The result shows that average value of education level, household size and household income at the prefecture level have significant correlation with individual's tourism participation decision. Therefore, these three factors are used to explain exogenous social effect.

Finally, the random components that vary across reference groups are included into the model to represent the correlated social effect.

4.4 Estimation results

For the model estimation, MCMC method is employed in this study. The non-informative prior distributions are given for all parameters, and a total of 220,000 iterations are carried out in order to obtain 10,000 draws: the first 20,000 iterations are used for burn-in mitigate

start-up effects and the remaining 200,000 iterations are used to generate the 10,000 draws, i.e., every 20 iterations are retained. The results of Geweke diagnostic indicate all parameters are well converged.

To compare the differences of Logit model and Scobit model, we estimated the models with the Logit structure and Scobit structure, respectively. Estimation results of the two models are presented in Table 4-2. One can see that parameters of most of the explanatory variables are statistically significant at 90% or 95% level. To judge whether the proposed scobit-based model is superior to the logit-based model, Chi-square test is conducted. The Chi-square value is 94.6, which is much larger than the critical value 6.64 (degree of freedom: 1) at the 99% confidence level, suggesting that the scobit-based model is better than the logit-based model.

Skewness parameter

The estimated value of skewness parameter is 0.42. When skewness parameter is equal to one, the Scobit model becomes the Logit model. Here two types of t-test are conducted: one corresponds to the null hypothesis $\alpha=0$ and the other to $\alpha=1$. As a result, it is confirmed that skewness parameter is statistically different from both 0 and 1. Figure 4-2 shows the probability of participation under two values of α ($\alpha=1$ and $\alpha=0.42$). It can be noticed that when the value of α is 0.42, the participation probabilities have a very different curve from the Logit curve. When skewness parameter α is equal to 0.42, individuals with participation probability of 40% are most sensitive to the change in utility.

Table 4-2 Model Estimation Results

Explanatory variable	Logit-based model			Scobit-based model		
	Parameter	t-statistic		Parameter	t-statistic	
Constant term	3.89	1.10		5.12	1.25	
Individual and household attributes						
Gender	-0.36	-1.51		-0.42	-1.60	
Marital status	0.41	1.84	*	0.43	1.91	*
Educational level	0.18	1.99	**	0.19	2.14	**
Household size	-0.13	-2.81	**	-0.14	-2.93	**
Existence of children	-0.37	-2.46	**	-0.37	-2.68	**
Car ownership	0.28	1.67	*	0.29	1.84	*
Constraint effects						
Money constraint	-3.51	-2.15	**	-3.63	-2.23	**
Time constraint	-2.84	-2.64	**	-2.87	-2.71	**
Partner's time constraint	-1.84	-1.91	*	-1.85	-2.01	**
Lack of interest	-1.15	-1.94	*	-1.17	-1.95	*
Health problem	-0.12	-1.41		-0.15	-1.53	
Available information	-0.63	-3.15	**	-0.68	-3.27	**
Endogenous social effect						
Prefecture	1.84	1.90	*	1.91	2.54	*
Homogenous income group	1.31	2.74	**	1.45	2.81	**
Homogenous occupation group	2.37	1.01		2.43	1.28	
Exogenous social effect						
Education level	0.67	1.68	*	0.69	1.73	*
Household size	-0.04	-0.25		-0.05	-0.13	
Household income	-0.08	-0.48		-0.07	-0.64	
Random effects						
Prefecture variation	0.16	1.84	*	0.18	1.90	*
Income group variation	0.07	2.10	**	0.07	2.08	**
Occupation group variation	0.13	1.08		0.15	1.15	
Skewness Parameter				0.42	6.13	**
Initial log-likelihood	-868.51			-868.51		
Converged log-likelihood	-462.57			-415.25		
McFadden's Rho-squared	0.47			0.52		
Sample size	1253			1253		

* significant at the 90% level, ** significant at the 95% level
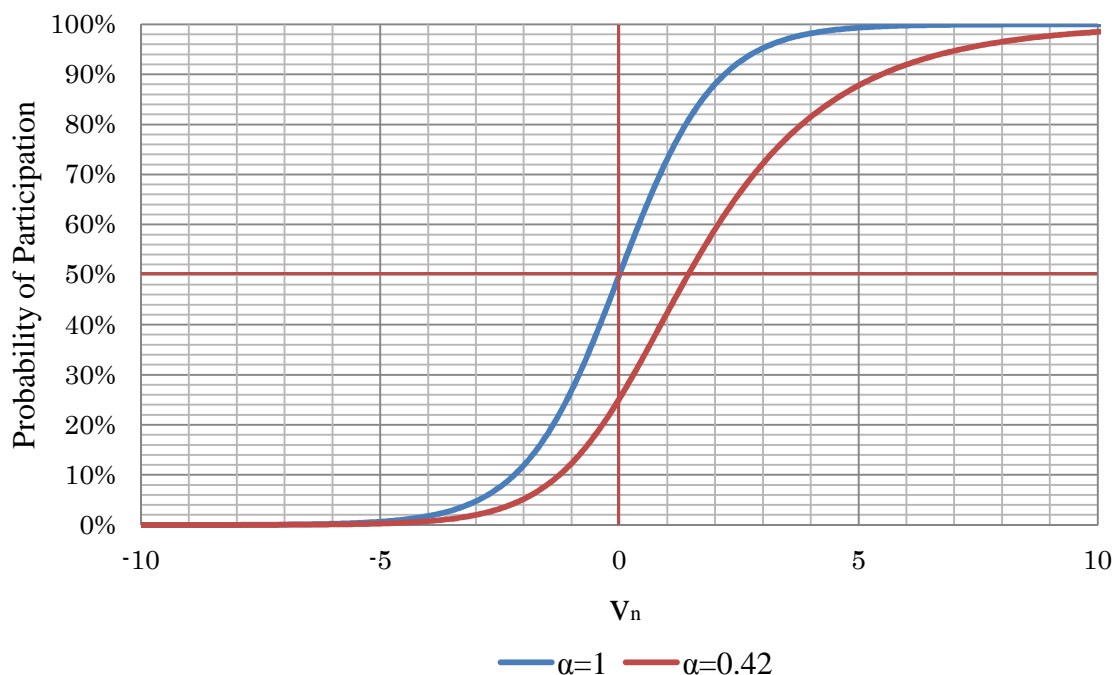
Figure 4-2 Probability of Participation under Different Values of α

Explanatory variables

Focusing on the estimation results of introduced explanatory variables, it can be seen that parameters of marital status, education level, car ownership are positive and statistically significant at 95% level, while parameters of household size and existence of children are negative. This may be because that married people have a partner to travel with; higher education level can arouse more interest in tourism and allows better access to information and knowledge of tourism; car ownership provide more convenience to travel. The negative parameters of household size and existence of children mean that individuals from a larger household or household with children might confront financial constraints and family commitments, therefore, would have lower probability to participate in tourism. In terms of constraint effects, constraints of money, time, partner's time, lack of interest and available information are significant at level of 90% or 95%. This confirms the important influence of these constraints in individual's tourism participation. It is necessary to eliminate these constraints to encourage more tourism activities.

Social interaction effects

From the result, one can see that endogenous social effects of prefecture and homogenous income group have positive and significant influences, which implies that behavior of the people from the same prefecture and people with same income level have causal effects on the individual's tourism participation decision. In terms of exogenous social effect, education level show significant positive influence, which means that individuals are more likely to travel when they live in a prefecture whose residents have higher education level. This might be because that higher education level can create cultural environment and stimulate cultural need that can be satisfied by tourism activities. The correlated social effects are represented by random components that vary across reference groups. The standard deviations of random components that vary across different prefectures and different income groups are 0.18 and 0.07, respectively, with statistical significance, supporting the argument that correlated social effect should be taken into account. Such effect might be caused by some unobserved factors, such as availability of tourism information, travel liking and motivational factors.

4.5 Conclusion

This study analyzed people's decisions on tourism participation considering the influence of social interaction and constraints effects, by using a Scobit model that has a skewed structure, different from the traditional logit model. The results have both academic and practical importance.

From the academic perspective, as the existing research has confirmed that social interactions and constraint effects have important influence on various aspects of tourist behavior, we can get a better understanding of tourist behavior if these factors are taken into consideration. Concerning the model attempt, using the Scobit model can measure the

sensitivity of explanatory variables in a more proper way than the logit model.

The effectiveness of the established model is empirically confirmed. The impacts of social interaction, constraint effects, as well as several individual attributes on tourism participation are investigated. The model estimation results confirm the significant influence of social interaction on individual's tourism participation behavior. Specifically speaking, the endogenous social effects of prefecture and homogenous income group show significant influences to a certain extent. For the exogenous social effect, education level show significant positive influence. This result means that the tourism participation percentage in a prefecture will increase if the average education level in that prefecture increases. In addition, the correlated social effects within same prefecture and homogenous income group are confirmed to be significant, which states the importance of accounting for the correlated social effects. In term of the constraint effects, the empirical results indicate that five constraints including money, time, partner's time, lack of interest and available information have significant influences on tourism participation.

These results have important policy implications. Because the endogenous social effects of prefecture have positive and significant influences, the policies that aims to increase or decrease tourism demand would have "social multiplier" effect. In other words, the effect of a policy intervention will be larger than the individual-level direct effect. In addition, since constraint effects are confirmed to have significant influence on tourism participation behavior, policies that aims to eliminate these constraints should be implemented to promote tourism generation.

Although this study could somewhat include two kinds of psychological factors into the utility-maximizing choice models to investigate tourism participation behavior, there are still several important future issues. Firstly, as this study use average tourism participation percentage of social groups as a part of explanatory variables, it is difficult to directly apply

the model for future prediction. It remains as a future task to develop an appropriate methodology to explore the equilibrium process between microscopic individual behavior and macroscopic social behavior. Another challenging issues is how to observe the process of overcoming tourism constraints. This information could be used for examining the impacts of constraint effects on tourism participation with much complicated theoretical assumptions of people's decision making, such as "negotiation" assumption (Jackson *et al.*, 1993). In addition, the constraints that individuals confront might vary across destinations, the current study should be further improved by segmenting samples based on destinations (e.g., domestic and international destinations). Finally, more explanatory variables should be included to derive useful policies.

Chapter 5 Tourists' Multi-stage Choice Models

Tourists' travel decisions usually involve a number of choices that are made over time and across space (Dellaert, Ettema, & Lindh, 1998; Woodside & MacDonald, 1993), including whether to participate in tourism or not, where to go (destination choice), how to go (travel mode choices), with whom to go (travel party choice), and so on. Although the above choices can be made at different timings, they may interact with each other. Outcomes of choices that are made first might influence the choices made sequentially. For example, a tourist first chooses a destination and then makes a choice of accommodation considering prices and available rooms of hotels at the destination. Therefore, tourists' choice behavior should be regarded as a multi-stage choice process that consists of a number of separate but interrelated choices. This means tourism decisions can be highly complex due to the existence of many interrelated components being decided by decision makers, resulting in the increase in the difficulty of tourism behavior modeling tasks.

This chapter includes two parts. The first part concerns with two interrelated choice aspects, namely, destination and travel party choice. The second part deals with tourists' three-stage choice: tourism participation, destination and travel mode choice.

5.1 Representing tourists' heterogeneous choices of destination and travel party with an integrated latent class and nested logit model

5.1.1 Introduction

To represent tourists' multi-stage choice behavior, it is important to specify the sequence in which tourism decisions are made regarding different choice dimensions (e.g., destination, composition of the travel party) (Dellaert, Ettema, & Lindh, 1998). However, it is difficult to expect that there is a consistent sequence in which all tourists make such decisions. Existing

studies suggest that the sequence of decision making varies among tourists and contexts (Bansal & Eiselt, 2004; Dellaert, Ettema, & Lindh, 1998; Fesenmaier & Jeng, 2000; Hyde, 2004; Hyde & Lawson, 2003; Woodside & King, 2001). Furthermore, the above choices themselves might differ across tourists, i.e., heterogeneity might exist. For example, different tourists might show different responses to the same factor (e.g., the attractiveness of a destination), and this type of heterogeneity can be represented by segmenting the population based on some observed information (e.g., individual attributes like age and gender), or by assuming that parameter of the factor follows a certain probability distribution (e.g., the mixed logit model). In case of choosing two or more behavioral elements (e.g., destination, travel party, travel mode, and accommodation), the nested logit model is applicable; however, if different tourists show different nested choice structures, then it becomes problematic how to specify such nested model structure. Properly representing the behavioral interaction and heterogeneity is essential to a better understanding of tourists' behavior and can be consequently expected to provide more appropriate insights into tourism marketing and policy decisions. Careful review however suggests a lack of such studies in literature (Zhang, 2010).

With this background, this study attempts to develop a model that incorporates the interaction between choices of destination and travel party by reflecting heterogeneous choice model structures. Destination and travel party are two important elements of tourists' behavior (e.g., Dellaert, Ettema, & Lindh, 1998). A destination choice (or choice of travel party) can be conceptualized as a tourist's selection of a destination (or a type of travel party: e.g., travel alone or travel with other persons) from a set of alternatives. Even though the destination choice (the choice of travel party) could be influenced by various factors (e.g., tourists' individual attributes and attributes of destinations), to represent such choice behavior, the principle of random utility maximization is usually adopted. In other words, it is usually assumed that the tourist chooses the destination (the travel party) that generates the highest

level of utility. This study deals with the joint choice of destination and travel party. To represent such joint choice behavior, the nested logit (NL) model could be applied under the principle of random utility maximization, same as the above single-faceted choice behavior. The NL model first groups the choices of destination and travel party into two nests, e.g., the upper level describes the choice of destination and the lower level explains the choice of travel party. And then, the NL model incorporates the interaction between destination choice and choice of travel party with the help of an inclusive value, which is, in fact, the maximal utility of the alternatives in the choice set of the lower level nest. In reality, there may be existing different nested choice structures among different tourists. To represent such heterogeneous nested choice structures, one could first segment the population into several groups and then build the NL model separately. However, it is difficult to decide what kinds of variables could be used to best segment the population, and the segmentation becomes more difficult if the same tourist shows different nested choice structures depending on choice situations (e.g., the length of holidays, domestic or international travel). In this sense, it is necessary to represent such heterogeneous nested choice structures in a more flexible and convincible way. To this end, this study attempts to integrate the latent class (LC) modeling approach with the NL model in the context of domestic tourism of Japan.

5.1.2 Methodology

This study deals with two types of discrete choice behavior at a disaggregate level (i.e., each tourist is treated as the unit of analysis): destination and travel party. To represent such choice behavior, discrete choice models built under the principle of random utility maximization have been widely applied (e.g., Haider & Ewing, 1990; Crouch & Louviere, 2004; Huybers, 2003). To jointly describe the choices of two or more behavioral elements, the nested logit

(NL) model (Ben-Akiva & Lerman, 1985) has been often applied to logically incorporate the interaction among the behavioral elements with the help of expected maximal utility (also called logsum variable or inclusive value) (e.g., Eymann & Ronning, 1992; Seddighi & Theocharous, 2002; Hong, Kim, Jang, & Lee, 2006). The NL model can be used to represent the choices of destination and travel party in two ways, depending on how to allocate the choice of travel party (or destination) to either upper or lower level. Equation (5-1) shows one type of the NL model, where destination choice is allocated at the upper level influenced by the choice of travel party, and equation (5-2) shows the other NL model, which has an inverse model structure where travel party choice is assumed to be influenced by destination choice.

$$P_{njg} = P_n(j)P_n(g|j), \quad P_n(j) = \frac{\exp(V_{nj} + \theta_j \Gamma_{njg})}{\sum_{j'} \exp(V_{nj'} + \theta_{j'} \Gamma_{nj'g})} \tag{5-1}$$

$$P_{ngj} = P_n(g)P_n(j|g), \quad P_n(g) = \frac{\exp(V_{ng} + \theta_g \Gamma_{ngj})}{\sum_{g'} \exp(V_{ng'} + \theta_{g'} \Gamma_{ng'j})} \tag{5-2}$$

$$\Gamma_{njg} = log \sum_g exp(V_{ng}) \tag{5-3}$$

$$\Gamma_{ngj} = log \sum_j exp(V_{nj}) \tag{5-4}$$

where,

  n : a tourist

  $j\,(j')$: an alternative of destination choice

  $g\,(g')$: an alternative of travel party choice

  V_{nj} : the utility of destination j for tourist n

  V_{ng} : the utility of travel party g for tourist n

  Γ_{njg} : the expected maximal utility of travel party choice (i.e., logsum variable)

  Γ_{ngj} : the expected maximal utility of destination choice (i.e., logsum variable)

θ_j : a parameter to capture the expected influence of travel party choice on destination choice

θ_g : a parameter to capture the expected influence of destination choice on travel party choice

It is usually suggested to check whether the parameter θ_j or θ_g is located in the interval (0, 1) or not in order to meet the principle of random utility maximization. However, in reality, specifying the destination choice as upper level and the travel party choice as lower level might be suitable for some tourists while the opposite model structure might be more appropriate for the other tourists. To explicitly accommodate such heterogeneous interaction between travel party choice and destination choice, we propose to apply latent class modeling approach (e.g., Zenor & Srivastava, 1993; Swait & Sweeney, 2000) to simultaneously represent the above two types of nested logit structure within the same modeling framework.

For choices of destination and travel party, there are only two possible nested logit model structures, one in equation (5-1) and the other in equation (5-2). Assume the probability that each tourist n belongs to each type of nested logit structure is equal to H_{ns}. Here, each type of model structure corresponds to each latent class. Since the probability of a certain alternative (either destination or travel party) for each latent class can be defined as L_{n1} and L_{n2}, respectively, it is straightforward that the resulting log-likelihood function can be represented like the way in equation (5-5). Here, the probability of a certain alternative for each latent class is defined in the way of likelihood (see equation (5-6)) because it is unknown to analysts which alternative will be chosen or not in advance.

$$LnL = \sum_{n} \ln(H_{n1}L_{n1} + H_{n2}L_{n2}) \qquad (5\text{-}5)$$

$$L_{n1} = \prod_{j,g} (P_{njg})^{\delta_{njg}} , \quad L_{n2} = \prod_{g,j} (P_{ngj})^{\delta_{ngj}} \qquad (5\text{-}6)$$

$$H_{n1} = 1/(1 + \exp(\sum_k \gamma_k z_{nk})), \quad H_{n2} = 1 - H_{n1} \tag{5-7}$$

where, H_{ns} is the membership probability that individual n belongs to latent class s ($s=1, 2$), and each latent class corresponds to a specific nested choice structure; z_{nk} denotes the kth observed attribute to explain each class with parameter γ_{sk}; P_{nig} and P_{ngj} correspond to equation (5-1) and equation (5-2) respectively; δ_{njg} and δ_{ngj} are dummy variables being equal to 1 when the combination of alternative g or j is chosen, and 0 otherwise.

The above latent class model with destination choice and travel party choice can be estimated using the Expectation-Maximum (EM) algorithm and the Bayes' Theorem. The Expectation-Maximization (EM) algorithm is a method for getting maximum likelihood estimates of parameters in models which include unobserved latent variables. EM algorithm comprises two steps: the expectation (E) step computes the expectation of the log-likelihood evaluated using the current estimate for the latent variables; and the maximization (M) step computes parameters maximizing the expected log-likelihood found on the (E) step. Both the (E) step and (M) step are repeated until convergence. Let $R_{ns}=1$ if tourist n belongs to latent class s, and $R_{ns}=0$ otherwise. The following log-likelihood function is used to estimate the model.

$$\ln L(t) = \sum_n \sum_s R_{ns}(t) \ln H_{ns}(t) + \sum_n \sum_s R_{ns}(t) \ln(L_{ns}(t)) \tag{5-8}$$

Using Bayes' Theorem, the $R_{ns}(t)$ at the tth iteration is calculated using the postetior probability $r_{ns}(t-1)$:

$$R_{ns}(t) = \begin{cases} 1 & r_{ns}(t-1) \geq \max(r_{ns}(t-1) \mid s' \neq s) \\ 0 & otherwise \end{cases} \tag{5-9}$$

$$r_{nq}(t-1) = \frac{\hat{H}_{ns}(t-1)\hat{L}_{ns}(t-1)}{\sum_{s'} \hat{H}_{ns'}(t-1)\hat{L}_{ns'}(t-1)} \tag{5-10}$$

where $H_{ns}(t-1)$, $L_{ns}(t-1)$ are the latent class membership probability and the likelihood under class s, estimated using the parameters at the $t-1$th iteration.

5.1.3 Model estimation and results

Data

The data used in this study was collected at 29 major tourism destinations in Kyusyu, Chugoku and Shikoku regions of Japan in the summer of 2002 based on a face-to-face interview. To guarantee the population representative of the collected samples, respondents were randomly selected at each destination in proportion to the number of visitors during the survey season at each destination zone, reported by official governmental information sources. Since each respondent had to answer the detailed travel activity information (e.g., travel mode, accommodation, time use and expenditure, etc.), subjective evaluations of several destinations, as well as personal travel preference and experience and the other individual attributes, questionnaire sheet became lengthy. To encourage the participation, 1 000 Japanese Yen was provided to each respondent as incentive. As a result, about 2 500 questionnaires were obtained, including the data of individual characteristics and travel-related attributes. Individual characteristics include gender, age, occupation, annual income, and marital status, etc. while travel-related attributes include destination, travel party, travel mode, and duration of stay, etc. Eliminating missing data, 2 050 questionnaires were used in this study. In this

study a destination refers to the main destination that a tourist chooses to visit during a single travel. In total, the choice set of destinations consists of 14 zones, where each zone includes one or two prefectures. Travel party is divided into three categories: travel alone, travel with family members, and travel with friends and others. The data characteristics are summarized in Table 5-1. It is observed that "travel alone" accounted for 15.1%, "travel with family members" 53.0%, and "travel with friends and others" 31.9%. The top three of the most visited destinations were zone 8 (Fukuoka: 15.4%), zone1 0 (Nagasaki: 12.4%), and zone 11 (Kumamoto: 10.7%), which are all located in Kyusyu region. And, 66.9% of tourists traveled by car.

Table 5-1 Summary of Data Characteristics

Individual characteristic	Percentage	Trip characteristic	Percentage
Gender		Travel mode	
Male	51.4	Public transportation	33.1
Female	48.6	Private car	66.9
Age		Travel party	
Young (< 30)	33.7	Alone	15.1
Middle (30 - 50)	46.1	With family members	53.0
Old (> 50)	20.2	With friends and others	31.9
Occupation		Destination	
Employee	62.9	Zone 1 (Okayama Prefecture)	3.6
Student	12.5	Zone 2 (Hiroshima Prefecture)	7.2
Housewife	18.2	Zone 3 (Tottori and Shimane Prefectures)	5.1
Other	6.4	Zone 4 (Yamaguchi Prefecture)	5.8
Household composition		Zone 5 (Kagawa & Tokushima Prefectures)	5.5
Single	35.7	Zone 6 (Ehime Prefecture)	5.7
Married and without child	16.9	Zone 7 (Kochi Prefecture)	5.1
Married and with child	47.4	Zone 8 (Fukuoka Prefecture)	15.4
Annual income		Zone 9 (Saga Prefecture)	4.7
<4 million yen	58.6	Zone 10 (Nagasaki Prefecture)	12.4
4-10 million yen	25.1	Zone 11 (Kumamoto Prefecture)	10.7
>10 million yen	16.3	Zone 12 (Kagoshima Prefecture)	4.6
		Zone 13 (Miyazaki Prefecture)	5.5
		Zone 14 (Oita Prefecture)	8.7

Selection of explanatory variables and model performance

Based on a preliminary correlation analysis, travel time from home to destination, attractiveness of destination (number of visitors per year), and number of tourist spots were selected as the explanatory variables to describe the choices of the 14 zones. Gender, age, and marital status were selected to explain the choice of travel party. Since existing studies show that individuals' socio-demographic attributes are influential to latent class membership probability (Bucklin & Gupta, 1992; Gupta & Chintagunta, 1994), this study adopts gender, age, income and marital status to define the latent class membership probability using the above-mentioned correlation analysis (see Table 5-2).

Table 5-2 Explanatory Variables

Explanatory variables	Description
Individual and Household Socio-demographics	
Gender (dummy variable)	1 if individual is female, 0 otherwise
Age (dummy variable)	1 if individual is younger than 30, 0 otherwise
Income (million yen)	annual income (not categorized)
Marital status (dummy variable)	1 if married, 0 otherwise
Travel Related Attributes (all the continuous variable)	
Travel time (minutes)	travel time from home to destination
Attractiveness of destination	number of tourists to destination per year
Number of tourist spots	number of tourism spots in destination

Estimation results of the developed model are presented in Table 5-3. One can see that parameters of most of the explanatory variables are statistically significant at 90% or 95% level (practically, 95% level is often adopted; however, since this is a case study and we want to find more potentially significant factors, 90% level is also used in this study). Model accuracy (i.e., McFadden's Rho-squared is 0.102) is not so high but good enough to show the effectiveness of the proposed model.

Membership probabilities

Income and gender have a significant effect on the membership probability at 90% and 95%

level, respectively. The negative sign of parameter for income level indicates that tourists with higher income level tend to decide their destination by considering the existence of travel party (latent class 1) while the low-income tourists tend to decide their travel parties conditional on the destination choice (latent class 2). The positive sign of parameter for gender indicates that female tourists are more likely to belong to class 2. Thus, the statistical significances of these parameters suggest that there are surely two types of the nested choice structures between the choices of destination and travel party.

In order to estimate the membership probabilities, it is necessary to fix all the parameters (γ_{sk}) to zero for a pre-specified latent class (class 1 in this case: see equation (5-7)). It is shown that on average 49% of the samples have higher membership probabilities belonging to latent class 1 (upper level: destination; lower level: travel party) and 51% have higher membership probabilities belonging to latent class 2 (upper level: travel party, lower level: destination). This confirms heterogeneous nested choice structures among different tourists. In other words, it is inappropriate to apply one structure to the whole population. Figure 5-1 gives the distribution of membership probabilities belonging to latent class 1, where two types of distributions are shown together for ease of understanding: original membership probabilities and sample shares. For membership probabilities belonging to latent class 1, 10% of samples have the values of 30%~40%, 40% of samples have the values of 40%~50%, 31% of samples have the values of 50%~60%, and 19% of samples have the values of 60%~70%. Note that membership probabilities less than 30% or larger than 70% are not observed in samples. This may be because they do not have extreme tendency towards each latent class (i.e. they do not belong to each latent class at very high probability), which can further confirm the necessity to adopt the proposed model in this case.
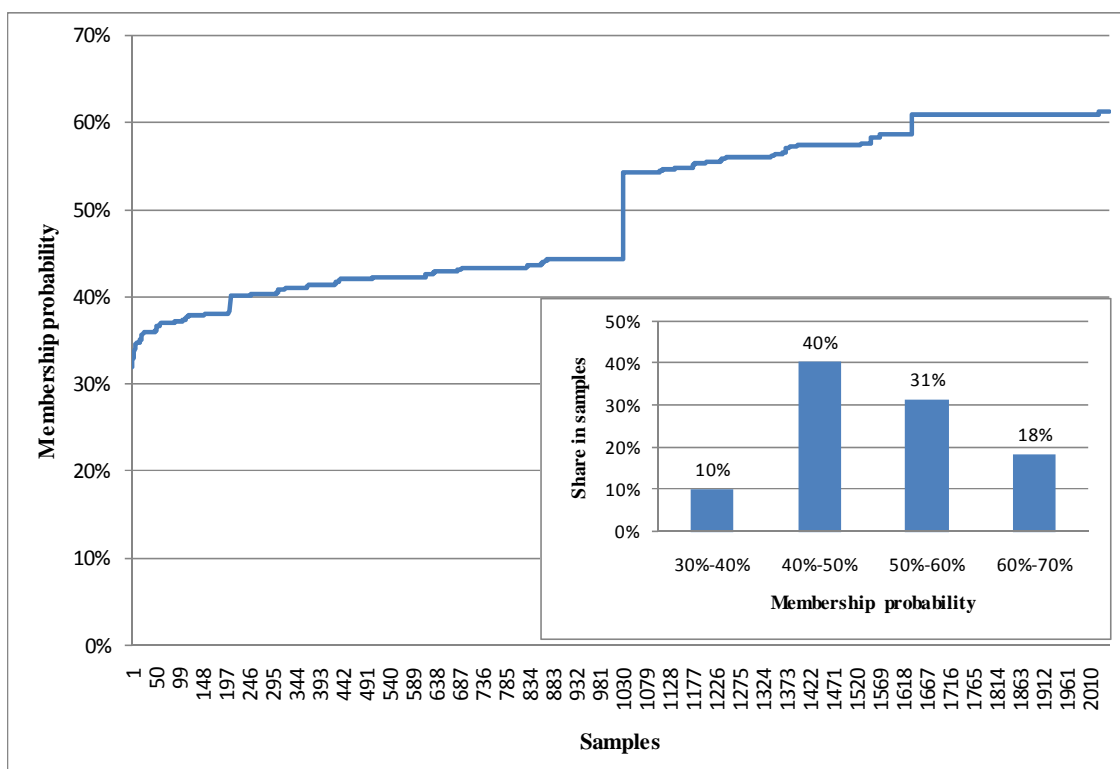
Note: Membership probabilities less than 30% or larger than 70% are not observed in samples.

Figure 5-1 Distribution of membership probabilities belonging to latent class 1

Heterogeneous influences between choice behaviors

The parameter θ in equation (5-1) or equation (5-2) is used to capture the interaction between destination choice and travel party choice. The estimated parameters θ are all located between 0 and 1, and especially most of the parameters are statistically different from both 0 and 1 at the 90% or 95% level. When $\theta = 0$, it is suggested that choice of destination and choice of travel party are independent; in contrast, when $\theta = 1$, it is suggested that using the multinomial logit model is enough to represent the joint choice of destination and travel party. These statistical test results suggest that the NL model is applicable to both latent classes. Larger values of these parameters suggest the larger influence of the choice behavior at lower level on that at upper level and decreasing substitution among alternatives in the nest. The estimated parameters for destination choice suggest that tourists' choices of some destinations

are influenced more strongly by the travel party choice. Taking the Nagasaki prefecture (Zone 10) as an example, the parameter is 0.426, which is the highest, indicating that the choice of this destination is most influenced by travel party choice and travel party choice conditioned on this destination shows weaker substitution. In other words, the change in the utility of an alternative in travel party choice under this nest could change the probability of the nest being chosen more dramatically. In contrast, choices of some other destinations such as Saga Prefectures of (Zone 9) and Kagoshima Prefecture (Zone 12) are less influenced by travel party choice. In terms of travel party choice, these estimated parameters shows that "travel with family members" and "travel with friends and others" is more influenced by the destination choice than "travel alone" and destination choice conditioned on choice of "travel with family" and "travel with friends" show weaker substitution, suggesting that tourists tend to travel to certain kind of destination when they choose to travel with family or with friends and others. The part of reason might be that tourists would like to visit destination which is suitable for group traveling (e.g. destinations where they can enjoy group activities such as camping) when they travel with family or with friends and others.

Table 5-3 Model Estimation Results

Explanatory variable	Latent Class 1		Latent Class 2	
	Parameter		Parameter	
Variable for membership probability: equation (5-5)				
Income (million yen)			-0.041	*
Age (1, < 30; 0, otherwise)			-0.051	
Gender (male=0,female=1)			0.215	**
Marital status (single=0, married=1)			0.013	
Destination Choice				
Travel time (minute)	-0.005	**	-0.005	**
Attractiveness of destination (tourists/year)	0.122	**	0.136	**
Number of tourism spots	0.164	**	0.109	**
Inclusive value for destination choice (Zone 1 "Okayama" serves as a reference)				
Zone 2 (Hiroshima Prefecture)	0.168	* (**)		
Zone 3 (Tottori and Shimane Prefectures)	0.037	(**)		
Zone 4 (Yamaguchi Prefecture)	0.209	**(**)		
Zone 5 (Kagawa & Tokushima Prefectures)	0.159	* (**)		
Zone 6 (Ehime Prefecture)	0.147	(**)		
Zone 7 (Kochi Prefecture)	0.171	*(**)		
Zone 8 (Fukuoka Prefecture)	0.174	(**)		
Zone 9 (Saga Prefecture)	0.072	(**)		
Zone 10 (Nagasaki Prefecture)	0.426	**(**)		
Zone 11 (Kumamoto Prefecture)	0.298	**(**)		
Zone 12 (Kagoshima Prefecture)	0.008	(**)		
Zone 13 (Miyazaki Prefecture)	0.236	**(**)		
Zone 14 (Oita Prefecture)	0.226	**(**)		
Travel Party Choice				
Travel with family				
Constant	-0.619	*	-2.211	**
Gender (male=0,female=1)	0.675	**	0.831	**
Age (1, < 30; 0, otherwise)	-0.282	**	-0.294	**
Marital status (single=0, married=1)	3.757	**	3.884	**
Travel with friends				
Constant	0.976	**	-0.298	
Gender (male=0,female=1)	0.790	**	0.841	**
Age (1, < 30; 0, otherwise)	-0.238	**	-0.241	**
Marital status (single=0, married=1)	0.165		0.269	
Inclusive value for travel party choice ("travel alone" serves as a reference)				
travel with family members			0.521	
travel with friends and others			0.424	(*)
Latent class membership probability	49.3%		50.7%	
Sample size	2.050			
Initial log-likelihood	-9083.17			
Converged log-likelihood	-8157.91			
McFadden's Rho-squared	0.102			

* significant at the 90% level, ** significant at the 95% level;   Inside the parenthesis: null hypothesis "parameter=1";   Outside the parenthesis: null hypothesis "parameter=0"

Influential factors to choices of destination and travel party

The results also confirm the impacts of tourists' individual characteristics and trip characteristics on destination choice and travel party choice. All of the explanatory variables included in the destination choice model have statistically significant parameters at 95% level. The negative sign of parameter for travel time indicates that the increase of travel time to a destination will reduce the probability of choosing the destination. The positive signs of attractiveness of destination and number of tourist spots mean that tourists tend to visit destinations which are popular (more visitors) and have more tourist spots. In term of travel party choice, the positive signs of gender and marital status indicate that female and married people are more likely to travel with family members and with friends and others. The negative sign of age indicates that young people are more likely to travel alone.

To further understand the influence of each variable, the proportion of variance for each explanatory variable in the total variance of the utility (excluding the influence of unobserved factors, i.e., the error term) is calculated as follows.

$$\text{Proportion of variance (\%)} = \frac{\text{var}(\beta_k x_{ijk})}{\text{var}(\sum_k \beta_k x_{ijk})} = \frac{\beta_k^2 \, \text{var}(x_{ijk})}{\sum_k \beta_k^2 \, \text{var}(x_{ijk})} \quad (5\text{-}11)$$

The variance proportions for the two classes are shown in Table 5-4. It is revealed that the most influential factor in destination choice is travel time, which accounts for almost 50% of the total variance. This indicates that the change of travel time will have important impact on destination choice. The second and third influential factors are attraction and number of spots, respectively. In terms of travel party choice, the most influential factor is marriage status for the choice of traveling with family, which accounts for more than 90% of the total variance. It

is straightforward that the choice of traveling with family is influenced by tourist's marriage

status to a great extent. For the choice of traveling with friends, the most influential factor is

gender.

Table 5-4 Proportions of Variances Explained by Explanatory Variables

Explanatory variable	Variables proportion	
	Class 1	Class 2
Destination Choice		
Travel time (min)	48.2%	49.9%
Attraction (number of tourist per year)	31.6%	40.0%
Number of spots	20.2%	10.1%
Travel Party Choice		
Travel with family		
Gender(male=0,female=1)	3.2%	4.4%
Age	4.4%	4.4%
Marriage status(single=0, married=1)	92.4%	91.2%
Travel with friends		
Gender(male=0,female=1)	56.5%	58.5%
Age	41.2%	36.1%
Marriage status(single=0, married=1)	2.3%	5.4%

5.1.4 Conclusions

There are various interactions existing in tourist behavior due to the influences of various

constraints and tourists' preferences. Such interactions might be different across tourists.

Focusing on the choice interaction between travel party and destination, this study has

attempted to represent the heterogeneous nested choice structure involved in the choices of

these two decision aspects by combining the latent class and the nested logit modeling

approaches. Using a data collected from 2 050 tourists in Japan, the effectiveness of the

developed model was first confirmed. Statistical significances of the parameters used to

explain the latent classes and the nested model structure suggest that there are surely

heterogeneous interactions between choices of destination and travel party, which are represented by two types of the nested choice structures. It is observed that the nested choice structure could significantly differ across income level and gender. In this case study, it was confirmed that on average the two types of the nested choice structures are almost shared equally by the samples. These results support our developed model. The theoretical contribution of this study is to develop an additional modeling approach that can represent tourists' heterogeneous choice behavior. Even though we applied the approach to deal with choices of destination and travel party, it could be also applicable to other choice contexts. The observed findings about heterogeneous interactions between choices of destination and travel party have important practical implications. For example, the proposed modeling approach could helpful to policy makers to quantitatively evaluate the effects of tourism policies or marketing activities on tourist choice behavior in advance in a more convincible way, and it is also suggested that segmentation in tourism marketing should be done by focusing on not only tourists' individual attributes, but also their interrelated choice behaviors.

5.2 Dynamic analysis of tourists' three-stage choices: Tourism participation, destination choice and travel mode choice

5.2.1 Introduction

In addition to the interrelation between different choice aspects, tourist behavior might be also interrelated over time and show state dependence. In other words, tourist's previous behavior may influence current behavior. In the context of tourism participation behavior, for example, individuals who take tourism trips in the previous month might feel tired of travel, worry about overuse of disposal income or the conflicts with working schedule, and as a result, they might be less likely to take the trip in the next month. In terms of destination choice, tourists might visit different destination from the one visited previously, because of the variety seeking nature in tourist behavior. In addition, state dependence is also expected to exist in tourist travel mode choice. Although state dependence has been well studied in the transportation research, relevant research about tourist behavior linked with transportation aspects is limited.

Under such circumstances, the purpose of this study is to jointly analyze tourist's three interrelated choice (whether to travel, destination choice, travel mode choice) and examine the influences of state dependence as well as other factors on these three choices. To model state dependence, we need repeated choices of the same agents. For this purpose, this study conducted a web-based questionnaire survey in the year 2010 to collect the information about the monthly tourism behavior from the whole country in Japan with the help of a major Internet survey company, which had more than 1.4 million registered panels. As a result, 1,253 valid samples were obtained with a representative age, gender and residential distribution of the whole population in Japan. This is a panel data with 12 waves (i.e.,

months). In this study, the joint choice of three components is analyzed using a nested logit (NL) model, which includes three levels: the first level is tourism participation choice, the second one is destination choice and the third one is travel mode choice. The NL model incorporates the interaction between different choice dimensions with the help of an inclusive value (Eymann & Ronning, 1997; Hong, Kim, Jang, & Lee, 2006; Wu, Zhang, & Fujiwara, 2011), which is, in fact, the maximal utility of the alternatives in the choice set of the lower level nest. To examine the influence of state dependence, lagged endogenous variables are included into the model.

5.2.2 Methodology

In this study, tourist behavior is analyzed during one year period, where one year is divided into twelve waves (each month is a wave). In each wave, tourism participation, destination choice and travel mode choice are jointly analyzed using the nested logit (NL) model. The nested logit model has been often applied to logically incorporate the interaction among the behavioral elements with the help of expected maximal utility (i.e., logsum variable or inclusive value). Here, the nesting structure is assumed to include tourism participation choice at the first level, destination choice at the second level and travel mode choice at third level. The joint probability of an individual's choice at wave t can be described as:

$$P_{nt} = P_{nt}(y)P_{nt}(d|y)P_{nt}(j|d) \tag{5-12}$$

where $P_{nt}(y)$ is the marginal tourism participation probability, $P_{nt}(d/y)$ is the conditional probability of destination d being chosen given participation, $P_{nt}(j/d)$ is the conditional probability of travel mode j being chosen given destination d being chosen.

The third level travel mode choice probability follows the standard multinomial logit

equation and can be represented as:

$$P_{nt}(j|d) = \frac{\exp(V_{jt}/\theta_d)}{\sum_{j'}\exp(V_{j't}/\theta_{d'})} \tag{5-13}$$

where V_{jt} represents the observable components of the utility function of travel mode j in the

wave t, and θ_d is the scale parameter associated with the nest of destination d. θ_d should be

located in the interval (0, 1). The larger value of θ_d suggests larger influence of travel mode

choice on the choice of destination d and weaker substitution of travel mode choice

conditioned on destination d.

The observable components of the utility for travel mode choice V_{jt} is specified as:

$$V_{jt} = \alpha_{jt} + \lambda_j y_{jt'} + \sum_h \beta_h v_h \tag{5-14}$$

where, α_{jt} is constant term for travel mode j in the tth wave; $y_{jt'}$ represents whether travel

mode j was used in the previous trip; v_h is the hth attribute describing travel mode choice.

The second level destination choice probability can be derived as:

$$P_{nt}(d|y) = \frac{\exp((V_{dt} + \theta_d \Gamma_{dt})/\theta_p)}{\sum_{d'}\exp((V_{d't} + \theta_d \Gamma_{dt'})/\theta_p)} \tag{5-15}$$

$$\Gamma_{dt} = \log(\sum_{j'}\exp(V_{j't}/\theta_{d'})) \tag{5-16}$$

where V_{dt} represents the observable components of the utility function of destination d in the wave t, Γ_{dt} is the logsum variable (or inclusive value) associated with nest of destination d and θ_p is the scale parameter associated with nest of tourism participation.

The observable components of the utility for destination choice V_{dt} is specified as:

$$V_{dt} = \lambda_d \, y_{dt'} + \Sigma_g \, \beta_g X_g \qquad (5\text{-}17)$$

where, $y_{dt'}$ represents whether destination d was visited in the previous trip; X_g is the gth attribute describing destination d.

Then tourism participation and non-participation probability in wave t can be derived as:

$$P_{nt}(y=1) = \frac{\exp(V_{pt} + \theta_p \Gamma_{pt})}{1 + \exp(V_{pt} + \theta_p \Gamma_{pt})} \qquad (5\text{-}18)$$

$$P_{nt}(y=0) = 1 - P_{nt}(y_{nt} = 1) \qquad (5\text{-}19)$$

$$\Gamma_{pt} = \log(\Sigma_{d'} \exp((V_{d't} + \theta_d \Gamma_{dt'})/\theta_p)) \qquad (5\text{-}20)$$

where V_{pt} is the observable components of the utility function of tourism participation in the wave t, Γ_{pt} is the inclusive value associated with nest of tourism participation.

The observable components of the utility for tourism participation V_{pt} is specified as:

$$V_{pt} = \alpha_t + \lambda_p \, y_{p(t-1)} + \Sigma_s \beta_s z_s \qquad (5\text{-}21)$$

where, α_t is constant term for the *t*th month; $y_{p(t-1)}$ is tourism participation decision in the

*(t-1)*th month; z_s is the *s*th explanatory variables.

The log-likelihood function is given as follows:

$$LogL = \sum_{n=1}^{N}\sum_{t=1}^{T}\ln((P_{nt}(y=1)\times(P_{nt}(d|y)\times P_{nt}(j|d)^{\delta_{jt}})^{\delta_{dt}})^{\delta_{nt}}\times P_{nt}(y=0)^{1-\delta_{nt}}) \qquad (5\text{-}22)$$

where, *N* indicates the total number of samples, *T* is number of waves (equal to 12 in this case)

and δ_{nt} are dummy variables that are equal to 1 when individual *n* participate in tourism at *t*th

wave, otherwise 0; δ_{dt} are dummy variables that are equal to 1 when individual *n* choose

destination *d* in the *t*th wave, otherwise 0; δ_{jt} are dummy variables that are equal to 1 when

individual *n* choose travel mode *j* in the *t*th wave, otherwise 0. The resulting model can be

estimated using standard maximum likelihood estimation method.

5.2.3 Model estimation and results

Data

In the survey, the destination alternatives are 47 prefectures in Japan. In this study, 47

prefectures are further categorized into 18 zones based on geography vicinity for the sake of

model estimation (extremely lower shares of some prefectures are avoided). Figure 5-2 gives

a map of 18 zones.

Travel mode choice includes five alternatives: air, Shinkansen (bullet train), railway,

bus and car. Figure 5-3 shows the travel mode choice percentages to 18 destinations. We can

see that air mode is the dominant mode (97.7%) to destination 18. As Okinawa prefecture is an

island located separately from other part of Japan, the surface travel modes are not available to get there. Likewise, destination 1 (Hokkaido prefecture) is an island located at the north end of Japan, it is difficult for tourists from other places to get there by surface modes. In case of the main land of Japan (Destinations 2 to 17), car is the main travel mode for most of the destinations except destinations 6, 7, 13 and 14. Because these destinations cover three important cities, namely Tokyo, Kyoto and Osaka, the public transport systems have been well developed in these regions. Focusing on travel mode choice percentages over 12 months (Figure 5-4), private car is the most popular travel mode for holiday trips, which takes 30-50% across 12 months. Especially in May, August and October, almost half of the tourists choose to travel by car. The second popular mode is airplane, whose share is 20-36% across 12 months. In contrast to car, the share of airplane is lower in May, August and October than other months. There are also a considerable number of tourists choose to travel by Shinkansen, and its share is stable across 12 month (around 20%). The least common travel mode is railway and bus. The shares for these two modes are around 8% and 5%, respectively.

Zone 1   Hokkaido Prefecture
Zone 2   Aomori, Iwate, Akita Prefecture
Zone 3   Miyagi, Yamagata, Fukushima, Niigata Prefecture
Zone 4   Ibaraki, Tochigi, Gunma, Saitama Prefecture
Zone 5   Chiba Prefecture
Zone 6   Tokyo
Zone 7   Kanagawa Prefecture
Zone 8   Toyama, Ishikawa, Fukui Prefecture
Zone 9   Yamanashi, Shizuoka Prefecture
Zone 10   Nagano Prefecture
Zone 11   Gifu, Aichi Prefecture
Zone 12   Mie, Shiga, Nara, Wakayama Prefecture
Zone 13   Kyoto
Zone 14   Osaka, Hyogo Prefecture
Zone 15   Tottori, Shimane, Okayama, Hiroshima, Yamaguchi Prefecture
Zone 16   Tokushima, Kagawa, Ehime, Kochi Prefecture
Zone 17   Fukuoka, Saga, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima Prefecture
Zone 18   Okinawa Prefecture

Figure 5-2 Map of Destination Alternatives
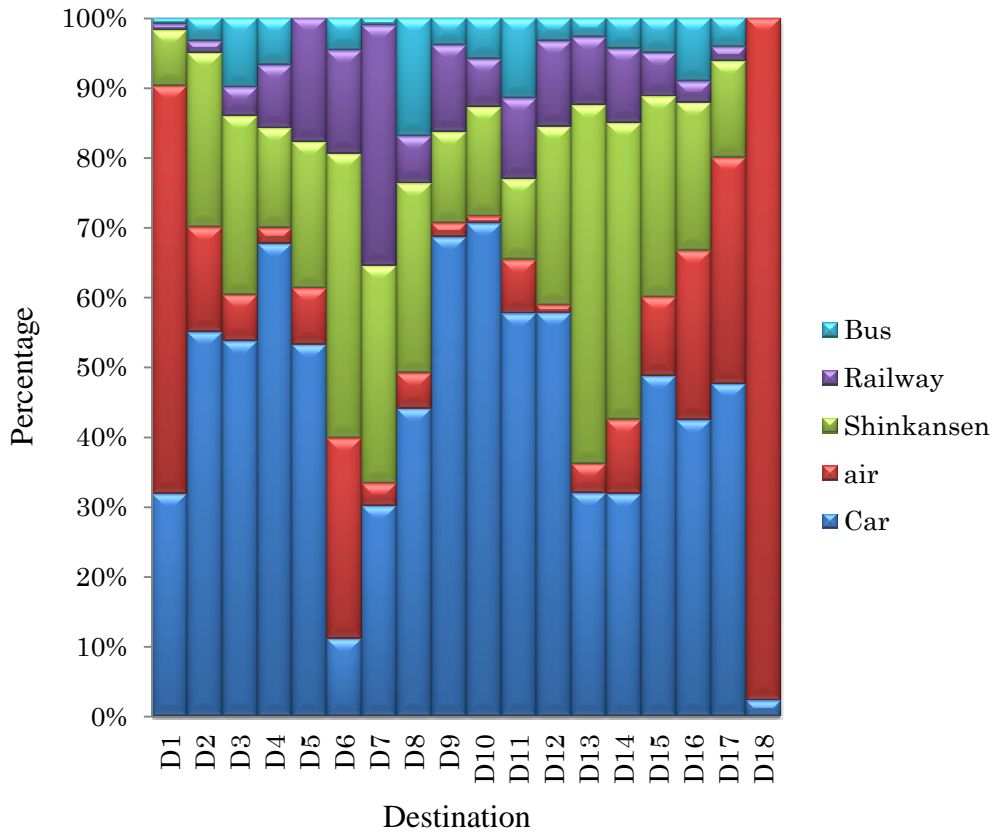
Figure 5-3 Travel Mode Choice Percentages to 18 Destinations
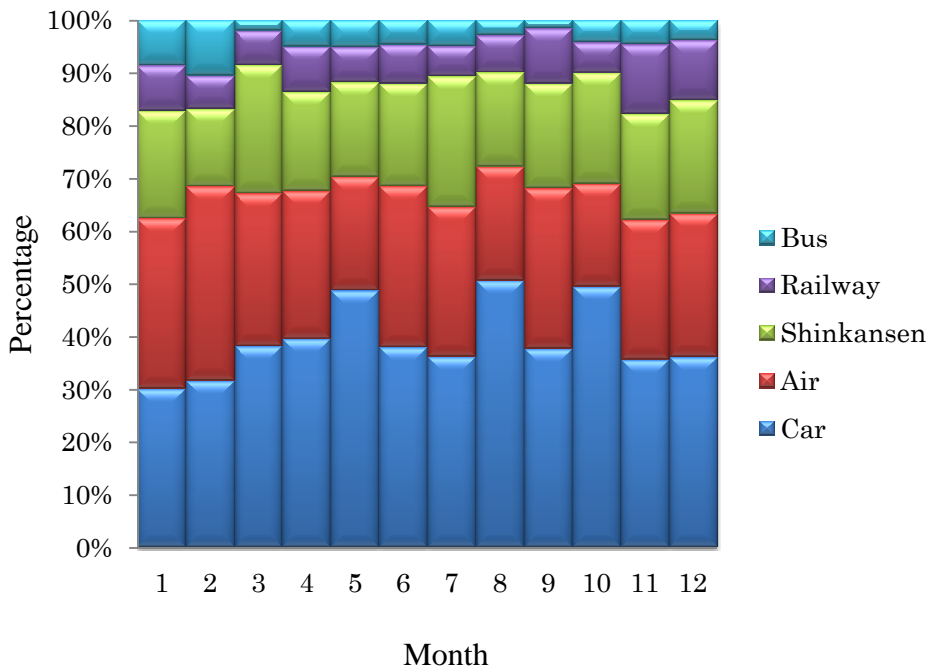
Figure 5-4 Travel Mode Choice Percentage in 12 Months

Explanatory variables

Based on the literature and previous work, variables including age, marital status, education level, annual income, household size, existence of children in the household, car ownership, length of holiday are used as variables to explain utility of tourism participation in this study. It is expected that being married, high education level, high income, having a car and longer holiday will have positive effects on tourism participation, while larger household size and existence of children in the household may have negative effects.

Table 5-5 Explanatory Variables

Tourism participation	
Age	Actual age
Marital status (dummy variable)	1: Married; 0: otherwise
Education level (dummy variable)	1: having a university degree; 0: otherwise
Income	Annual household income (Million yen/year)
Household size	Number of household members
Children	Existence of children in the household
Car ownership (dummy variable)	1: Owning a private car; 0: otherwise
Holiday	Length of statutory holiday in wave t
Destination choice	
Tourist arrivals	Tourist arrivals to destination d in wave t
Festival	Number of festivals hold in the destination d in wave t
Household size ×distance	Number of household members × distance from residential area to destination d
Nature Motivation ×density of nature park	Dummy variable for whether or not have nature tourism motivation × area of natural park per km^2 in destination d
Culture Motivation ×density of culture facilities	Dummy variable for whether or not have culture tourism motivation × number of culture facilities per km^2 in destination d
Shopping Motivation ×density of department stores	Dummy variable for whether or not have shopping motivation × number of department stores per km^2 in destination d
Sport Motivation ×density of sport facilities	Dummy variable for whether or not have sport motivation × number of sport facilities per km^2 in destination d
Travel mode choice	
Age	Actual age
Travel with others	1: Travel with others; 0: travel alone
Travel time (Hours)	Travel time from residential area to destination by mode j
Travel fee (Thousand yen)	Travel fee from residential area to destination by mode j

As in this study, the destination choices are the combinations of prefectures, the attributes which are appropriate for large-scale tourism analysis are used as explanatory variables to describe destination choice, such as density of natural parks, density of culture facilities, density of department store, density of sports facilities, tourist arrivals, number of festivals hold in the destination. In the existing research, tourism motivation is confirmed to have significant influence on destination choice. This study includes motivation factors into the model as interaction terms with destination specific attributes by assuming that tourist with a certain motivation will pay attention to a certain characteristic when they choose the holiday destination.

For the travel mode choice, age, travel companions, travel time and cost are used as explanatory variables. It is assumed that older people and tourists who travel with others are more likely to choose private car.

Estimation results

Estimation results are presented in Table 5-6. One can see that parameters of most of the explanatory variables are statistically significant at 90% or 95% level. Model accuracy (i.e., McFadden's Rho-squared is 0.64) is good enough to show the effectiveness of the model.

State Dependence:

The parameter of state dependence in tourism participation choice is negative. This result indicates that participation in tourism during month *t-1* has negative influence on the participation during month *t*. This first confirms that tourism participation behavior surely depends on the past behavior and then suggests that the monthly participation in the past reduces the probability of the participation in the next month.

Table 5-6 Model Estimation Results

	Tourism participation		Destination choice		Travel mode choice							
					Air		Shinkansen		Railway		Bus	
	Parameter		Parameter		Parameter		Parameter		Parameter		Parameter	
Constant term												
January	-6.28	**			-1.18	**	-0.95	**	-1.39	**	-1.77	**
February	-6.30				-1.39	**	-1.36	**	-1.66	**	-1.81	**
March	-4.97	**			-1.49	**	-0.83	**	-1.72	**	-3.36	**
April	-5.07				-1.73	**	-1.01	**	-1.42	**	-2.48	**
May	-4.78	**			-1.85	**	-1.22	**	-1.83	**	-2.61	**
June	-6.58	**			-1.23	**	-0.88	**	-0.97	**	-1.89	**
July	-6.04	**			-1.48	**	-0.87	**	-1.41	**	-2.33	**
August	-5.17	**			-1.49	**	-1.14	**	-1.33	**	-2.59	**
September	-5.93	**			-1.26	**	-0.80	**	-0.93	**	-3.38	**
October	-4.90	**			-2.04	**	-1.06	**	-2.24	**	-2.75	**
November	-6.61				-1.43	**	-0.87	**	-0.55		-2.19	**
December	-6.42	**			-1.31	**	-0.74	**	-0.83	**	-2.61	**
Explanatory variable for tourism participation												
Age (Aug.)	-0.01	**										
Age (Apr., Jun., Nov)	0.02	**										
Age (other months)	0.01											
Married	0.29	**										
Education level	0.09	*										
Income	0.01	*										
Household size	-0.08	*										
Children	-0.20	*										
Car ownership	0.18	*										
Holiday	0.19	**										
Explanatory variable for destination choice												
Tourist arrival			0.02	**								
Festival			0.07	*								
Household size ×Distance			-0.01	*								
Nature Motivation ×density of natural park			3.86	**								
Culture Motivation ×density of culture facilities			0.28	**								
Shopping Motivation ×density of stores			1.38	**								
Sport Motivation ×density of sport facilities			12.3	**								
Explanatory variable for travel mode choice												
Age					0.89	**	0.29		-0.48		3.51	**
Travel with others					-0.75	**	-1.02	**	-0.12		-0.55	*
Travel time							-1.63	**				
Travel fee							-0.54	*				

Table 5-6 Model Estimation Results (continued)

	Tourism participation	Destination choice	Travel mode choice			
			Air	Shinkansen	Railway	Bus
	Parameter	Parameter	Parameter	Parameter	Parameter	Parameter
Inclusive value parameters						
Participation	0.71 **(**)					
Destination1		0.64 **( )				
Destination2		0.31 (**)				
Destination3		0.25 **(**)				
Destination4		0.33 **(**)				
Destination5		0.01 * (**)				
Destination6		0.01 * (**)				
Destination7		0.04 * (**)				
Destination8		0.01 * (**)				
Destination9		0.43 **(**)				
Destination10		0.30 **(**)				
Destination11		0.09 **(**)				
Destination12		0.11 **(**)				
Destination13		0.12 **(**)				
Destination14		0.13 **(**)				
Destination15		0.16 **(**)				
Destination16		0.37 **(**)				
Destination17		0.30 **(**)				
Destination18		0.62 **(*)				
State dependence						
Participation	-0.39 **					
Destination		0.24 **				
Travel mode		3.56(car)**	1.47 **	3.83 **	3.70 *	9.62 *
Initial log-likelihood		-22926.3				
Converged log-likelihood		-8136.19				
McFadden's Rho-squared		0.64				
Sample size		1253				

* significant at the 90% level, ** significant at the 95% level;
Inside the parenthesis: null hypothesis "parameter=1"; Outside the parenthesis: null hypothesis "parameter=0"

For the destination choice, state dependence shows positive influence. Because the destination alternatives are prefectures in this study, the positive parameter for state dependence does not necessarily mean tourists tend to repeated exactly same tourism attractions. They might have acquired information about the area on an initial visit and choose this area again in subsequent trip to visit other places that has been planned but not finished in the previous tour.

In terms of travel mode choice, the parameters of state dependence for all five alternatives are positive, which suggest the persistence in tourists' travel mode choice. This kind of persistence is especially notable in choice of bus, while it is not so much in choice of air

mode.

Inclusive Value Parameters:

The estimated inclusive value parameters are all located between 0 and 1, and especially most of the parameters are statistically different from both 0 and 1 at the 90% or 95% level. These statistical test results suggest that the NL model is applicable for this study. Larger values of these parameters suggest the larger influence of the choice behavior at lower level on that at upper level and decreasing substitution among alternatives in the nest. The estimated inclusive value parameters for destination choice suggest that tourists' choices of some destinations are influenced more strongly by the travel mode choice. Taking the Hokkaido prefecture (Destination 1) as an example, the parameter is 0.64, which is the highest, indicating that the choice of this destination is most influenced by travel mode choice and travel mode choice conditioned on this destination shows weaker substitution. In other words, the change in the utility of an alternative travel mode under this destination nest could change the probability of the destination being chosen more dramatically. The weaker substitution suggests that tourists tend to use certain mode when they travel to this destination. As explained previously, Hokkaido prefecture is located separately from other part of Japan, so it is difficult for tourists from other places to get there by surface modes. While for some destinations such as destination 5, destination 6, destination 7, destination 8, the inclusive value parameters are quite small, suggesting that the choices of these destinations are less influenced by travel mode choice and travel mode choice conditioned on these destinations shows higher substitution. This may be because the transport systems have been well developed in these regions, it is convenient for tourists to use all the five travel modes to reach these destinations.

The result that tourist destination choice be influenced by travel mode choice is consistent with the result from previous research. Fukuda and Morichi's (2002) study also

confirmed the interrelations between these two choice aspects. They developed a modeling framework of recreational travel behavior that incorporated the interrelations between destination and travel mode choices using a bivariate dichotomous probit model. However, their model can only be used to analyze binary choice behavior, while the nested logit model can incorporate multiple choice alternatives, and at the same time represent the relation between different choice aspects.

Influential Factors:

Here, the influences of explanatory variables are discussed below.

1) **Tourism participation**: In equation (5-21), β_s is expected to be temporally-changing for some variables and temporally-invariant for others, which mean that some variables may have different influence on tourism participation behavior in different waves, while some variables might have temporally-invariant influence. Therefore, t-test was conducted to compare tourists' individual and household characteristics in different months. The results show that tourist who travel in August are significantly younger than other months and those who travel during April, June, November are older than other months. So the parameters for age are set to be different in those four months. As other characteristics do not show significant differences over months, the relevant parameters are set to be same for every month.

From the estimation results, one can see that the parameter of age for August is negative while those for April, June, November are positive. This means that older people are more likely to travel during April, June, and November and less likely to travel during August. In terms of other individual and household attributes, they are set to be same for the 12 months. It can be seen that parameters of marital status, education level, income, car ownership, and length of holiday are positive and statistically significant at 95% level, while parameters of household size and existence of children are negative. This may be because that married people

have a partner to travel with; higher education level can arouse more interest in tourism and allows better access to information and knowledge of tourism; car ownership provide more convenience to travel; longer holiday can eliminate time constraint to participate in tourism.. The negative parameters of household size and existence of children mean that individuals from a larger household and those who have children in the household might confront financial constraints and family commitments, therefore, would have lower probability to participate in tourism.

From the value of constant term, we can see if other variables are same, individual are more likely to travel in March, April, May, August, September, October and less likely to travel in January, February, June, July, November, December.

2) **Destination choice**: It is found that tourists are more likely to visit destinations with more tourist arrivals, which can be explained by the effects of social interaction. In other words, tourists might think destinations visited by more people are more attractive. In addition, number of festivals is proved to have significant influence on destination choice. The parameter for interaction term of household size and distance is negative, which implies that tourists with larger household size are more likely to choose destination that is close to their residential area. This may be because they want to reduce the overall travel cost and it might be easier to make group decision if they choose closer destination.

In the existing research, it has been argued that tourism motivation has important impact on destination choice. In this survey, respondents were asked about their motivation to travel, including motivation of natural activities, motivation of cultural activities, motivation for shopping and motivation of sport activities. This study examines the influence of motivation by incorporating them as interaction term with certain destination characteristics. The results show that tourists with motivation of natural activities are more likely to choose

destinations with larger area of natural parks; tourists with motivation of cultural activities are more likely to choose destinations with more cultural facilities; tourists with motivation of shopping are more likely to choose destinations with more department stores; tourists with motivation of sport activities are more likely to choose destinations with more sports facilities. Especially, density of sport facilities shows remarkable influence, which indicates that increase of sport facilities will lead to the significant increase of tourists with motivation of sport activities.

3) **Travel mode choice**: The results show that travel time and travel fee have negative influence on travel mode choice. The value of time implied by this model is -1.64/-0.53=3,020 Yen per hour (For comparison, the average salary of national public servants is about 2,000 Yen per hour). In order to estimate the influences of age and travel with others, it is necessary to fix the parameters of these two variables to zero for one alternative. In this study, private car is chosen as the base alternative. One can see that tourists are more likely to choose airplane and bus with age increase. This result is intuitive, since older people might feel exhausted to drive a long way to travel. In terms of the influence of travel companions, it is confirmed that those who travel with others are more likely to use private car, potentially to reduce the overall travel fee or because car can provide private space for them to communicate with each other.

The constant terms reflect the inherent preference of travel mode choice (car is chosen as base mode). The negative parameters for all the public transportation modes indicate that tourists have preference to travel by car if other variables are same. Such preference is especially strong in some months, such as May and October. This might be caused by some unobserved factors. In order to promote the use of public transportation modes, it is essential to get a better understanding of these unobserved factors.

5.2.4 Conclusion

This study jointly analyzed tourists' three interrelated choice aspects over a course of year: tourism participation, destination choice and travel mode choice, while takes the influence of state dependence into account. The data used in this study is derived from a web-based retrospective panel survey conducted in Japan in the year 2010. This was the first panel data in Japan to look at various tourist behaviors at the monthly level of a year in a single survey, including the above three choice aspects. In the analysis, the joint choice of three components is analyzed using the nested logit (NL) model, and lagged endogenous variables are included into the model to examine the influence of state dependence. The effectiveness of the model is first empirically confirmed. Model estimation results showed the significant influence of state dependence on the three choice aspects and revealed the regionally heterogeneous influence of travel mode choice on destination choice. The results also clarified the influence of tourism motivation, individual characteristic, destination specific attributes and travel specific attributes on the three choice aspects.

These results have important policy implications. For example, it indicated that length of national holiday has a significant influence on tourism participation decision. Based on this result, region-specific Golden week (different region has the Golden week holiday during different time period) will have certain effect to eliminate the concentration of tourism demand. Focusing on destination marketing and management, a prefecture can market its tourism destination by targeting larger families in the close regions; more information about the local attractions could be provided to tourists so that it can increase their repeated visit to the same region; some prefectures (e.g., Hokkaido Prefecture, Yamanashi Prefecture, Shizuoka Prefecture, Okinawa Prefecture) can increase their tourist arrivals dramatically by improving their transportation service level. Since travel mode choices conditioned on some destinations

(e.g., Chiba Prefecture, Tokyo, Kanagawa Prefecture, Toyama Prefecture, Ishikawa Prefecture, Fukui Prefecture) show higher substitution, the use of public transport modes to these destinations will increase significantly if the service level of public mode increase.

The analysis also offers a tool to forecast tourist behavior in future. Because of an aging population in Japanese society, individual's tourism pattern is expected to change accordingly. In addition, the change in demographics might also result in a change of tourism motivation, which will further influence tourist behavior. A better understanding about such kind of change will provide more appropriate insights into tourism marketing and policy decisions.

There are some unsolved research issues. First, tourist's choice behavior might be influenced by some unobserved heterogeneity, which will result in the correlation between past behavior and current behavior. It is necessary to adopt some different models (e.g., random effect model) to look at this issue. Second, the nested logit model in this study included destination choice at the second level and travel mode choice at the third level. However, the structure might be reversed as suggested in section 5.1. It is necessary to incorporate these two different model structure to reflect heterogeneous choice mechanism.

Chapter 6 A Tourist's Multi-destination Choice Model

with Future Dependence

6.1 Introduction

Various studies have been done to represent tourists' destination choice behaviors (e.g., Huybers, 2003; Nicolau & Mas, 2006; Nicolau & Mas, 2008; Seddighi & Theocharous, 2002; Um & Crompton, 1990). However, interactions among destination choices when two or more destinations are included in a single trip have not been satisfactorily represented. Such interactions could be spatial and temporal. Spatial interactions refer to that observed with respect to tourism sites at different locations (Fujiwara & Zhang, 2005). This is relevant not only to the choice of multiple destinations, but also to the choice of a single destination. Spatial closeness and similarities of attributes and so on might directly affect the interaction while tourists' personal travel tastes to destinations might be some indirect causes. On the other hand, temporal interactions might occur due to past visits and/or future visits. For example, within a trip involving two or more destinations, it is natural to expect that tourists may not like to re-visit a destination visited several hours/days ago, and when they visit a destination, they have to decide when to leave for next destination, meaning that future behavior may affect their current behavior.

Figure 6-1 illustrates the future dependence in destination choices behavior. Suppose destination A and B are identical in every aspect and located exactly the same distance away from the tourist's current location O. These two destinations have therefore identical attractiveness to the tourist at O. But this statement holds true only if the tourist makes only one visit to either A or B. If the tourist has intended future choice to other destinations, A and B are no longer equally attractive; obviously, destination B which is near to other opportunities is more attractive than A. In other words, the choice between A and B is affected by future choice. Therefore, if destination choices are treated as independent behavior, the number of choices to destination A will be overestimated. In such cases, future dependence

should be properly incorporated. To represent future dependence, the popular nested logit model becomes relevant in the sense that it includes an inclusive value (or logsum variable). This inclusive value or logsum variable describes the expected influence of the choice behavior at lower level on that at upper level. In case of multi-destination choice behavior, for example, we may deal with visits of subsequent destinations at the lower level and that of visiting current destination at the upper level. When the number of destinations is three or more, even though theoretically there is not any serious problem of using the nested logit model, it becomes problematic in practice how to determine the nests for the multiple destinations. This is especially true when such nesting structure is heterogeneous across tourists, i.e., different tourists show different sequencing behaviors.

With this background, this study attempts to investigate interrelated choices underlying multi-destination tour behavior by proposing a model of destination choice accounting for future dependence. Different from the widely adopted nested logit model, this study suggests using the mother logit model, proposed by McFadden, Train, and Tye (1977). The mother logit model was originally proposed to test the assumption of the independence from irrelevant alternatives (IIA), but it also has the potential to represent the future dependence. To the authors' best knowledge, this study is the first attempt in the field of tourism to investigate/represent the influence of future dependence on tourists' choice behavior by applying the mother logit model.
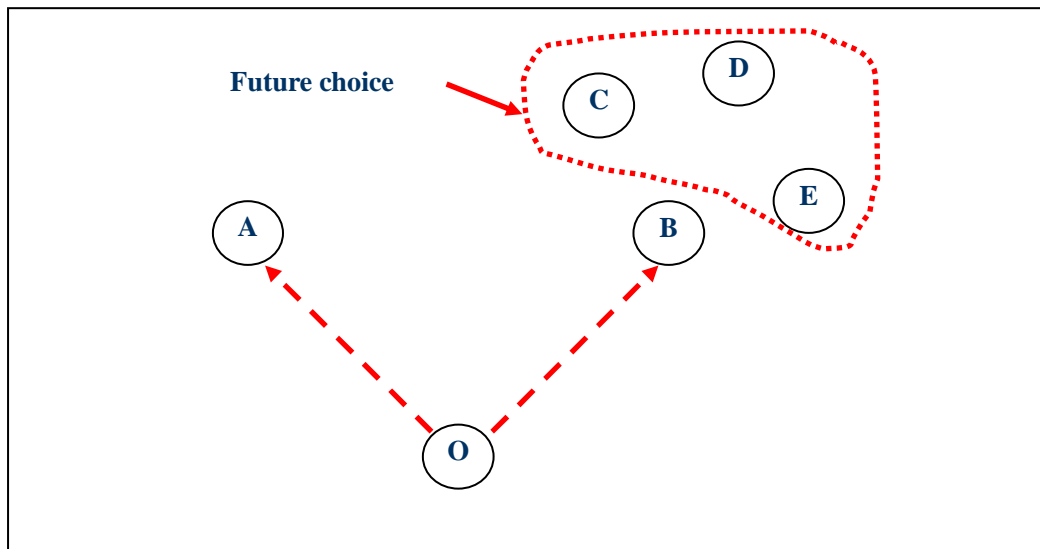
Figure 6-1 An Example Showing Future Dependence of Destination Choices in a Tour Trip

6.2 Methodology

Empirical studies about multi-destination choice behavior have mainly treated destination choice as a set, assuming that a tourist allocates his/her travel budget to make visits to a set of destinations such that the total utility obtained from these visits will be maximized. This approach has some advantages in representing multi-destination travel choice behavior in the sense that traditional choice models (e.g., nested logit model) can be applied directly. However, a problem with this approach is that it leads to an explosion of the size of choice set. For instance, if there are 10 possible destinations, then the number of possible choice sets will be 2^{10}. Its application to tourists' multi-destination choice analysis, in which the number of alternatives is usually large, thus becomes difficult.

As opposed to these approaches are sequential modeling approaches, which first decompose travel decisions into a sequence of interrelated choices and analyze them one by one (e.g., Kitamura & Kermanshah, 1983). There are several advantages of the sequential approach. It can avoid the problems in the nested logit model (i.e., the difficulty to determine the nests for the multiple destinations), as discussed above, and explosion of choice set.

Furthermore, when the interactions across choices are appropriately accounted for, the sequential approach is equivalent to the simultaneous approach (Ben-Akiva, 1974).

Let D_j be the jth destination in a tour trip, the probability that a set of destinations is chosen by individual n can be represented in the sequential approach by a set of conditional probabilities, as shown below, where $P_n (D_1, D_2, …, D_j)$ is the joint probability that individual n choose all the J destinations, $P_n (\cdot \mid \cdot)$ is the conditional probability, and $P_n (D_1)$ is the probability that the first destination is chosen.

$$P_n(D_1, D_2, \cdots D_J) = P_n(D_J \mid D_1, D_2, ..., D_{J-1}) \times ... \times P_n(D_j \mid D_1, D_2, ..., D_{j-1}) ... \times P_n(D_1) \qquad (6\text{-}1)$$

The conditional destination choice probabilities can be expressed as follows:

$$P_n(D_j \mid D_1, D_2, \cdots D_{j\text{-}1}) = \frac{\exp(U_{nj})}{\sum_{k=j}^{J} \exp(U_{nk})} \qquad (6\text{-}2)$$

Although sequential analysis of travel decision has an advantage over simultaneous one in reducing the size of choice set, the difficulty of this approach is how to appropriately represent the interrelationship across choices. Based on the above discussions, the concept of "prospective utility", which was proposed by Kitamura (1984), is introduced to represent the expected utility of a visit to a target destination. In fact, the adopted model structure by Kitamura is the universal logit model (see equation (6-3)), which was proposed by McFadden *et al*. (1977). The original purpose of developing the universal logit model was to test the independence of irrelevant alternatives (IIA) property in the multinomial logit model. Here, v_{nj} is used to reflect the influence of factors specific to alternative j, and $v_{njj'}$ (or $v_{nkk'}$) describes the influence of alternative j' (or k') on the choice of alternative j (or k).

$$P_{nj} = \frac{\exp(v_{nj} + \sum_{j' \neq j} v_{njj'})}{\sum_k \exp(v_{nk} + \sum_{k' \neq k} v_{nkk'})} \tag{6-3}$$

Looking at the above model structure, it is obvious that the utility of alternative *j* is defined as a function of the factors (i.e., v_{nj}) related to alternative *j* as well as the information about other alternatives in a choice set (i.e., $v_{njj'}$ or $v_{nkk'}$). This model structure seems suitable to deal with the future dependence in the multi-destination choice behavior by properly making use of the term $v_{njj'}$, where *j'* could be used to indicate the destination that will be visited later than destination *j*.

Here, to logically incorporate the influence of future dependence into the multi-destination choice behavior, the utility of a destination is defined below, imitating the idea of the universal logit model. In universal logit model, the utility of alternative is defined to include the influence of other alternatives in the choice set. In this study, destination choice is assumed to be future-dependent. Therefore, the utility of destination *j* is defined as equation (6-4) to incorporate the influence of future choices. Note that different from Kitamura's (1984) study, some new elements are introduced, as explained later.

$$U_{nj} = V_{nj} + \lambda (p_{n,j+1} \sum_{j'} \Psi_{n,jj'} + p_{nh} \Psi_{njh}) + \varepsilon_{nj} \tag{6-4}$$

where,

U_{nj} : utility of destination *j* for individual *n*

V_{nj} : observed utility determined solely by the factors affecting the choice of

destination *j*

$p_{n,j+1}$: probability that individual *n* will continue travelling after visiting destination *j*

p_{nh} : probability that individual n will go home after visiting destination j

$\Psi_{n,jj'}$: the influence of visiting the subsequent destination j' on the choice of

       destination j

Ψ_{njh} : the influence of going home on the choice of destination j

λ : parameter capturing future dependence

ε_{ij} : error term, assumed to follow a Gumbel distribution

The above utility function includes three parts: a utility determined solely by the factors related to the target destination V_{nj}, the influence of the destinations that may be visited subsequently and going-home behavior (i.e., $\lambda(p_{n,j+1}\sum_{j'}\Psi_{n,jj'} + p_{nh}\Psi_{njh})$), and the error term ε_{nj}.

Concerning the first part, V_{nj} is defined as a linear function of alternative-specific attributes x_{njk}, which are further classified into three groups: travel accessibility to destination j ($TA_{njk(1)}$), attributes of the destination itself ($DA_{njk(2)}$), and other factors ($z_{njk(3)}$). This is shown below, where $\beta_{k(1)}, \beta_{k(2)}, \beta_{k(3)}$ are the parameters included in the above three parts and $k(1)$, $k(2)$, $k(3)$ correspond to a number identifying each variable, respectively.

$$V_{nj} = \sum_k \beta_k x_{njk} = \sum_{k(1)}\beta_{k(1)}TA_{njk(1)} + \sum_{k(2)}\beta_{k(2)}DA_{njk(2)} + \sum_{k(3)}\beta_{k(3)}z_{njk(3)} \qquad (6\text{-}5)$$

Based on a preliminary analysis, travel time is used to describe the *TA*, *DA* includes number of tourism spots (*NS*) in and the diversity index (*DV*) of the destination of interest, and the other factors include dummy variable *y* (an indicator identifying whether a destination was already visited in that tour trip or not). Here, *DV* is specified based on the concept of biodiversity, which means the variation of species within a given ecosystem and is defined as

the probability that two organisms randomly selected from an ecosystem will belong to a different species. In this study, tourism spots are categorized into three types: natural resource, cultural resource, and sport resource. *DV* means the diversity of tourism resource and is defined as the probability that two tourism spots randomly selected from a destination will belong to a different type. The higher index means the more diverse of tourism resource.

For the second part in the utility function, it consists of two parts: $p_{n,j+1}\sum_{j'}\Psi_{n,jj'}$ and $p_{nh}\Psi_{njh}$. This specification is based on the expectation that after individual *n* visits destination *j*, there will be two options for him/her: to continue traveling or to go home. $p_{n,j+1}$ and p_{nh} thus represent the probabilities of these choices, respectively. In this study, $p_{n,j+1}$ and p_{nh} are explained only by the remaining time RT_{nj} after visiting the destination *j* in the form of a logit function (is the parameter of RT_{nj}), under the hypothesis that more time the tourist has, more likely he/she will continue travelling, where other factors are ignored due to the data limitation. Note that $p_{n,j+1}$ + p_{nh} =1.

$$p_{n,j+1} = \exp(\gamma RT_{nj})/(1 + \exp(\gamma RT_{nj})) \qquad (6\text{-}6)$$

$$p_{nh} = 1 - p_{n,j+1} \qquad (6\text{-}7)$$

In the case of continuing the tour trip, $\Psi_{n,jj'}$ is determined by the accessibility from *j* to *j`*; dissimilarity between *j* and *j`* ($DIS_{jj'} = \frac{1}{(N-1)}\sum_{k}^{N}\left|X_{jk} - X_{j'k}\right|$, where, X_{jk} is the percentage of tourism spots belonging to type *k* in destination *j*); and the attributes (*NS* and *DV*) of destination *j`*. Ψ_{njh} is determined by accessibility from *j* to home.

The parameter λ, therefore, can be interpreted as a weight assigned to future choice by

the tourist in assessing the utilities of destination zones which can measure the interactions across destination choices. If the estimated value of λ is significantly different from 0, it will indicate that tourists' destination choices are future dependent to some extent. In terms of parameter estimation, since $\Psi_{n,jj'}$ and Ψ_{njh} are linear utility function, it will cause identification problem of parameter λ. Because $\Psi_{n,jj'}$ and V_{nj} include some common attributes (*TA, NS* and *DV*), the parameters of these attributes are set to be same in $\Psi_{n,jj'}$ and V_{nj} to solve the identification problem.

6.3 Model estimation and results

6.3.1 Data description

Table 6-1 Summary of Data Characteristics

Individual attributes	Percentage	Trip attributes	Percentage
Gender		Transportation mode	
Male	55.4	Public transportation	7.9
Female	44.6	Private car	92.1
Age		Travel party	
Young (<30)	8.3	Alone	5.2
Middle (30-50)	40.7	With family	78.3
Old (>50)	51.0	With friends	16.5
Occupation		Duration	
Employee	37.6	1 day	56.0
Student	1.2	2 days	28.0
Housewife	14.7	>2 days	16.0
Other	46.5	Number of destination	
Residential location		1	31.5
Inside the prefecture	41.3	2	26.0
Outside the prefecture	58.7	3	24.2
		4	9.9
		5	8.4

The data used in this study was collected in the prefecture of Tottori in 2007 based on a face-to-face interview. The interview survey was conducted in four seasons across a year at 16 major tourism destinations in Tottori. As a result, 761 valid samples were obtained, including the data of individual characteristics and travel-related attributes. Individual characteristics include gender, age, occupation, residential location, etc. while travel-related attributes include destination, travel party, travel mode, departure time, duration of stay and expenditure, etc. The data characteristics are summarized in Table 6-1. Nearly 80% of the sample travelled with family and more than 90% of the sample travelled by private car. It is worth noticing that almost 70% of the tourists visited more than one destination in their tour trip.

In this study the prefecture is divided into 16 zones and tourism spots are categorized into three types: natural resource, cultural resource, and sport resource. Table 6-2 gives the number of each type of tourism spots in each zone. The cultural resource takes highest share.

Table 6-2 Number of Tourism Spots in Each Zone

Zone ID	Destination	Spots of natural resource	Spots of cultural resource	Spots of sport resource
1	Tottori city	29	57	12
2	Ketaka town	19	43	2
3	Motigase town	24	22	2
4	Tottori sand dunes	5	4	2
5	Yonago city	12	26	6
6	Kurayoshi city	13	23	3
7	Sakaiminato city	5	3	1
8	Iwami town	4	2	6
9	Wakasa town	7	7	2
10	Chizu town	10	9	0
11	Yazu town	6	11	2
12	Misasa town	10	2	1
13	Yurihama town	16	8	4
14	Kotoura town	19	11	3
15	Hokuei town	2	12	1
16	Daisen town	16	10	8

6.3.2 Estimation results

Based on a preliminary study, we first selected the samples for this study. By excluding missing values of explanatory variables, 327 samples were finally used in this study. Estimation results of the developed model are presented in Table 6-3. The McFadden's Rho-squared is 0.21, suggesting the model accuracy is acceptable. Prediction accuracy of the model is given in Table 6-4. One can see that the prediction accuracy of the model with future dependence is 4.40% ~ 15.41% higher than that its counterpart.

Table 6-3 Model Estimation Results

Explanatory variable	Destination 1		Destination 2		Destination 3		Destination 4		Destination 5	
	Parameter		Parameter		Parameter		Parameter		Parameter	
Travel time (TA)	-0.03	**	-0.02	**	-0.04	**	-0.02	**	-0.02	
Number of spots (NS)	0.01	**	0.01	**	0.01	**	0.01	*	0.01	**
Diversity index (DV)	2.89	**	2.89	**	2.89	**	2.89	**	2.89	**
Visit experience (y: visited or not)			-4.44	**	-2.53	**	-0.71	**	0.72	
Dissimilarity (DIS)	-1.98	**	-1.98	**	-1.98	**	-1.98	**	-1.98	**
Remaining time (RT)	0.02		0.02		0.02		0.02		0.02	
λ	2.80	**	1.24	**	0.76	*	1.79	**	2.52	*
Sample size	327									
Initial log-likelihood	-2173.08									
Converged log-likelihood	-1722.94									
McFadden's Rho-squared	0.21									

* significant at the 90% level, ** significant at the 95% level

Table 6-4 Accuracy of Prediction: A Comparison with/without Future Dependence

	Without future dependence (A)	With future dependence (B)	Relative improvement of model accuracy (B-A)/A
Destination 1	31.8%	36.7%	15.41%
Destination 2	47.1%	51.1%	8.49%
Destination 3	50.0%	52.2%	4.40%
Destination 4	66.4%	71.5%	7.68%
Destination 5	61.3%	65.0%	6.04%

In this study, we did not conduct comparison with the NL model because it is difficult to determine the nests for the multiple destinations as explained in the first section.

The results show that parameters of most of the explanatory variables are statistically significant at 90% or 95% level. We can see that all the parameters of λ are significantly different from 0, indicating that tourists' destination choices are surely influenced by future choice. Therefore, it is inadequate to analyze destination choice separately and independently without considering the interrelationships that may exist among choices and future dependence should be incorporated into choice analysis.

The results also confirm the impacts of several factors on destination choice. All of the explanatory variables included in destination choice have significant effects at 90% or 95% level. The negative sign of parameter for travel time indicates that the increase of travel time will reduce the probability of choosing that destination. The positive signs of number of tourism spots and diversity index mean that tourists tend to visit destinations with more tourism spots and diverse tourism resources. In terms of *y* (an indicator identifying whether a destination was already visited in that tour trip or not), the negative signs of parameters for the second destination to the fourth destination indicate that tourists tend to choose different destinations during their tour trips. The parameter for the last destination, however, is positive. This can be partly explained by the "gateway" function of some destinations. Some tourists from other prefectures are likely to enter and depart the prefecture from the same destination.

These destinations thus play a role of "gateway".

To further understand the influence of each variable, the proportion of variance for each explanatory variable in the total variance of the utility (excluding the influence of unobserved factors, i.e., the error term) is calculated as follows.

$$\text{Proportion of variance (\%)} = \frac{\text{var}(\beta_k x_{ijk})}{\text{var}(\sum_k \beta_k x_{ijk})} = \frac{\beta_k^2 \, \text{var}(x_{ijk})}{\sum_k \beta_k^2 \, \text{var}(x_{ijk})} \qquad (6\text{-}8)$$

The variance proportions are shown in Table 6-5. It is revealed that the most influential factor in choice of the first destination is travel time, which accounts for 97.4% of the total variance. This indicates that the change of travel time will have important impact on the first destination choice. Since the parameter of travel time is negative, making efforts to reduce travel time from home to the first destination could remarkably increase the number of visitors. In terms of the following destination choices, travel time and diversity index of tourism resource account for 30%~60% of the total variance, respectively. This further confirms the important role of travel time in explaining destination choice behavior. At the same time, it is revealed that tourists prefer to visit different types of destinations when making a tour with two or more destinations, indicating that variety-seeking significantly affects tourists' destination choices. From the marketing perspective, variety-seeking suggests the importance of branding a destination with multiple features. From the perspective of destination development, this implies that constructing some attractive spots and/or preparing

some attractive events could be useful to attract more visitors.

Table 6-5 Proportions of Variances Explained by Explanatory Variables

Explanatory variable	Proportions of Variances				
	Destination 1	Destination 2	Destination 3	Destination 4	Destination 5
Travel time (TA)	97.4%	30.2%	41.8%	55.3%	36.9%
Number of spots (NS)	1.5%	11.2%	4.4%	5.7%	3.7%
Diversity index (DV)	0.6%	50.8%	31.7%	35.1%	51.3%
Visit experience (y: visited or not)		5.4%	20.9%	2.5%	4.3%
Dissimilarity (DIS)	0.4%	2.3%	1.1%	1.3%	3.7%
Remaining time (RT)	0.1%	0.1%	0.1%	0.1%	0.1%

6.4 Conclusions

A better understanding of tourists' destination choices is essential to successful tourism marketing and management. Various studies have been done in literature to model the destination choices; however, the multi-destination choice behavior has not well been represented. This study has analyzed interrelated choices underlying the multi-destination behavior, motivated by the argument that choice of a destination in a tour with two or more destinations might be influenced by the choice behavior of subsequent destinations visited. In other words, future dependence might be relevant to the destination choice behavior. To reflect such decision-making mechanism, this study adopts the universal logit modeling framework to explicitly and flexibly accounting for the future dependence in the multi-destination choice behavior. Concretely speaking, the future dependence for a destination is represented by introducing the probabilities of visiting subsequent destinations as well as the probability of going home. Dissimilarities among destinations are also introduced into the model. Using a questionnaire survey data collected in tourist destinations of Tottori Prefecture, Japan in 2007, the effectiveness of the established model was first

empirically confirmed, and then the existence of future dependence in tourists' multi-destination choice behaviors was also statistically clarified. Influential factors affecting tourists' multi-destination choice behaviors were finally examined.

Having summarized the findings in this study, some limitations of this study should be made clear. First, the adopted sample size in this study is limited and it is therefore necessary in future to collect more samples in order to derive more general conclusions. Next, since tourists' choice behaviors are multi-dimensional in the sense that tourists make decisions on various aspects, such as travel timing, travel party, duration, travel budget, and transportation modes, in addition to destination choice. It is therefore worth exploring how to integrate these decision aspects by reflecting the future dependence under study. Needless to say, more explanatory variables should be further explored to contribute to a better understanding of the multi-destination choice behavior. With the integrated modeling framework, it is also important to explore its applicability to various tourism policies.

Chapter 7 Resource Allocation Models

Time and money are main resources to perform travel activities. Because of the availability and scarcity values of these two resources, participations in various activities are constrained. Resource allocation decisions include both long-term and short-term aspects. The long-term decision concerns when to go for a travel, how long and how much to spend on a trip. The short-term decision mainly refers to the decisions during the travel (time and money allocation during travel). This chapter includes two parts. The first part investigates monthly tourism expenditure behavior (long-term aspect). The second part analyzes tourist time allocation on on-site activities (short-term aspect)

7.1 Tourism participation and expenditure behavior: Analysis using a Scobit-Based discrete-continuous choice model

7.1.1 Introduction

Estimating tourism expenditure can provide detailed information for assessing the economic benefits of tourism. However, the existing research has a lot of problems in representing tourism expenditure as a decision which is independent from the decision of participation in tourism. In fact, these two decisions might be interrelated with each other. The interrelationship between the decision of participation and expenditure can be explained by observed factors and unobserved factors. As the observed factors, for example, available monetary and time budgets could commonly influence decisions on the participation and expenditure (those who have more money might travel more and spend more on travel than others). The participation and expenditure could be jointly affected by psychological factors (e.g., travel liking: those who like traveling might travel more and spend more on travel than others). The neglect of such interrelationship might bring in some serious problems. Most of

the studies adopted the OLS regression analysis to investigate tourism expenditure (Dardis, Derrick, & Wolfe, 1981; Jang, Bai, Hong, & O'Leary, 2004). A primary drawback with OLS regression is that it could not provide consistent, unbiased estimates of parameters if non-participation population is included in the samples (i.e. travel expenditure is zero) (Kennedy, 1998). To solve this issue, some other studies have used the Tobit analysis (Cai, 1999; Dardis, Soberon-Ferrer, & Patro, 1994). However, the Tobit analysis still has problems in representing the two-step decisions, because these two decisions may be influenced by different factors or may be influenced by same factors to different degrees.

Another problem of the existing studies about tourism expenditure is that most of them are static analysis. However, it is expected that tourism expenditure behavior has dynamic properties, such as state dependence. In order to understand tourism expenditure behavior in a more appropriate way, it is thus necessary to take dynamic aspects into account. With the above considerations, this study attempts to represent tourism participation and expenditure simultaneously and take the state dependence into account.

7.1.2 Methodology

This study attempts to model individual's two choices simultaneously: the choice of whether or not to participate in tourism; if the individual choose to participate in tourism, how much he/she spend on tourism activities. These two choice aspects are analyzed during one year period, where one year is divided into twelve waves (each month is a wave).

Tourism expenditure in wave *t* can be represented as:

$$y_{nt} = \lambda y_{n(t-1)} + \sum_q \beta_q x_{nq} + \eta_{nt} \tag{7-1}$$

where,

y_{nt} : tourism expenditure of individual n in wave t,

$y_{n(t-1)}$: tourism expenditure of individual n in wave t-1,

λ : capture the influence of state dependence on tourism expenditure decision,

x_{nq} : the qth explanatory variable,

β_q : the parameter of the qth explanatory variable,

η_{nt} : an error term, which is assumed to follow a normal distribution $\eta_{nt} \sim N(0, \sigma_n^2)$

When individual n choose to participate in tourism during wave t, tourism expenditure y_{nt} would be positive, otherwise y_{nt} would be zero.

Choice of tourism participation can be treated as a binary choice, the utility U_{nt} that individual n choose to participate in tourism during wave t can be described as:

$$U_{nt} = V_{nt} - \varepsilon_{nt} = \rho Y_{n(t-1)} + \sum_s \gamma_s z_{ns} - \varepsilon_{nt}$$

$$Y_{nt} = \begin{cases} 1 & U_{nt} > 0 \\ 0 & otherwise \end{cases} \tag{7-2}$$

where,

Y_{nt} : choice of tourism participation for individual n in wave t (1: participate; 0: otherwise),

V_{nt} : the deterministic term,

$Y_{n(t-1)}$: choice of tourism participation for individual n in wave t-1,

ρ : capture the influence of state dependence on tourism participation decision,

z_{ns} : the sth explanatory variable,

γ_{s} : the parameter of the *s*th explanatory variable,

$\varepsilon_{\mathrm{nt}}$: an error term.

Then, the probability that individual *n* chooses to participate in tourism is:

$$P_{nt}(Y_{nt}=1) = P(\varepsilon_{nt} < V_{nt}) = F(V_{nt}) \tag{7-3}$$

Here, *F* indicates the distribution function of error term ε_{nt}. This study also use scobit model to represent tourism participation choices. The error term is assumed to have distribution function:

$$F(\varepsilon_{nt}) = \frac{1}{(1 + \exp(-\varepsilon_{nt}))^{\alpha}} \tag{7-4}$$

The probability that individual chooses to participate in tourism can be derived based on the above distribution function:

$$P_{nt}(Y_{nt} = 1) = F(V_{nt}) = \frac{1}{(1 + \exp(-V_{nt}))^{\alpha}} \tag{7-5}$$

Since the error terms η_{nt} and ε_{nt} in equations (7-1) and (7-2) might be interrelated with each other, the choice of tourism participation and tourism expenditure should be estimated simultaneously. Lee's (1983) transformation is adopted to transform the equations (7-1) and (7-2) into a standard normal distribution, respectively.

$$\varepsilon_{nt} = J_1(\varepsilon_{nt}) = \varphi^{-1}(F(\varepsilon_{nt}))$$ (7-6)

$$\eta_{nt} = J_2(\eta_{nt}) = \varphi^{-1}(G(\eta_{nt}))$$ (7-7)

Where, φ^{-1} represents the inverse of the standard normal cumulative distribution function. Then, η_{nt} and ε_{nt} can be assumed to follow a bivariate standard normal distribution with the marginal distribution $G(\eta_{nt})$ and $F(\varepsilon_{nt})$:

$$C(\varepsilon_{nt}, \eta_{nt}; \mu_n) = N(0, 0, 1, 1; \mu_n)$$ (7-8)

Then, the joint probability of tourism participation and tourism expenditure can be represented as:

$$\Pr(y_{nt} \cap (Y_{nt} = 1)) = \frac{1}{\sigma_n} \phi(\frac{y_{nt} - \sum_s \beta_s x_{ns}}{\sigma_n}) \varphi(\frac{\varphi^{-1}(F(V_{nt})) - \mu_n \frac{y_{nt} - \sum_s \beta_s x_{ns}}{\sigma_n}}{\sqrt{1 - \mu_n^2}})$$ (7-9)

where, ϕ represents the standard normal probability density distribution function.

And, the probability of non-participation can be represented as:

$$\Pr((y_{nt} = 0) \cap (Y_{nt} = 0)) = 1 - P_{nt}(Y_{nt} = 1)$$ (7-10)

Therefore, the log likelihood function of the joint model is:

$$LogL = \sum_{n=1}^{N} \sum_{t=1}^{T} \left\{ D_{nt} \left[\ln(\varphi(\frac{\varphi^{-1}(F(V_{nt})) - \mu_n \frac{y_{nt} - \sum_s \beta_s x_{ns}}{\sigma_n}}{\sqrt{1-\mu_n^2}})) + \ln(\phi(\frac{y_{nt} - \sum_s \beta_s x_{ns}}{\sigma_n})) - \ln(\sigma_n) \right] + (1 - D_{nt})\ln(1 - F(V_{nt})) \right\}$$

(7-11)

where, N indicates the total number of samples, T is number of waves (equal to 12 in this case) and D_{nt} is a dummy variable that indicates the choice of tourism participation (1: participate, 0: otherwise).

7.1.3 Model estimation and results

Explanatory variables

Based on the literature and previous work, variables including age, marital status, education level, annual income, household size, existence of children in the household, car ownership, length of holiday are used as variables to explain utility of tourism participation in this study. In terms of tourism expenditure, variables including age, marital status, annual income, household size, existence of children in the household, and travel distance are used as explanatory variables.

Table 7-1 Explanatory Variables

Explanatory variables for decision of tourism participation

Age	Age of individual
Marital status(dummy variable)	1 if Married; 0 otherwise
Education level (dummy variable)	1 if went to university; 0 otherwise
Income	Annual household income (Million yen/year)
Household size	Number of household members
Children	Existence of children in the household
Car ownership (dummy variable)	1 if own a private car; 0 otherwise
Holiday	Days of holiday in wave t

Explanatory variables for decision of tourism expenditure

Age	Age of individual
Marital status(dummy variable)	1 if Married; 0 otherwise
Income	Annual income
Household size	Number of household members
Children	Existence of children in the household
Distance	Average travel distance per trip

Model performance

The integrated model is estimated based on maximum likelihood estimation method using R statistical software. To compare the differences of Logit model and Scobit model, we estimated the integrated models with the Logit structure and Scobit structure, respectively. Estimation results of the two integrated models are presented in Table 7-2. One can see that parameters of most of the explanatory variables are statistically significant at 95% or 90% level. The correlation between tourism participation and tourism expenditure is positive and statistically significant at 95% level. This confirms the interaction between these two decisions. McFadden's Rho-squared are 0.59 for Logit-based model and 0.62 for Scobit-based model, which are good enough to show the effectiveness of the proposed model.

Table 7-2 Model Estimation Results

Explanatory variable	Logit-based model		Scobit-based model	
	Parameter	t-statistic	Parameter	t-statistic
Tourism participation				
Constant term				
January	-6.12	-2.10 **	-5.07	-2.32 **
February	-6.08	-2.10 **	-4.93	-2.64 **
March	-4.87	-3.51 **	-3.74	-3.80 **
April	-5.11	-1.61	-4.15	-1.68 *
May	-4.89	-2.39 **	-3.71	-2.45 **
June	-6.41	-1.75 *	-5.15	-1.87 *
July	-5.98	-2.94 **	-4.61	-3.21 **
August	-4.64	-3.45 **	-3.57	-3.51 **
September	-5.21	-1.70 *	-4.01	-2.10 **
October	-5.87	-3.10 **	-4.61	-3.15 **
November	-6.20	-1.61	-5.18	-1.78 *
December	-6.31	-1.54	-5.29	-1.58
State dependence	-0.54	-2.15 **	-0.57	-2.29 **
Individual and household attributes				
Age (August)	-0.01	-2.12 **	-0.01	-2.30 **
Age (April, June, November)	0.02	5.14 **	0.02	4.98 **
Age (other months)	0.01	0.58	0.01	0.81
Marital status	0.26	1.67 *	0.27	2.10 **
Educational level	0.08	2.12 **	0.09	2.34 **
Income	0.01	3.89 **	0.01	3.91 **
Household size	-0.12	-1.69 *	-0.14	-1.83 *
Children	-0.20	-1.90 *	-0.21	-1.94 *
Car ownership	0.23	3.28 **	0.25	3.54 **
Holiday	0.16	1.91 *	0.18	2.13 **
Skewness Parameter			0.36	6.10 (0) **
				10.8 (1) **
Tourism expenditure				
Constant term	0.36	5.66 **	0.40	5.71 **
State dependence	-0.10	-2.26 **	-0.10	-2.30 **
Individual and household attributes				
Age	-0.01	-0.11	-0.01	-0.36
Marital status	0.06	2.49 **	0.06	2.61 **
Income	0.05	2.61 **	0.05	2.84 **
Household size	0.01	1.85 *	0.01	1.96 *
Children	-0.12	-0.10	-0.12	-0.52
Distance	0.02	6.90 **	0.02	6.95 **
Correlation of the two error terms	0.23	2.87 **	0.26	3.01 **
Initial log-likelihood	-15824.8		-15824.8	
Converged log-likelihood	-6335.5		-5985.1	
McFadden's Rho-squared	0.59		0.62	
Sample size	1253		1253	

* significant at the 90% level, ** significant at the 95% level

Skewness parameter

The estimated value of skewness parameter is 0.36. When skewness parameter is equal to one, the Scobit model becomes the Logit model. Here two types of t-test are conducted: one corresponds to the null hypothesis $\alpha=0$ and the other to $\alpha=1$. As a result, it is confirmed that skewness parameter is statistically different from both 0 and 1. Figure 7-1 shows the probability of participation under two values of α ($\alpha=1$ and $\alpha=0.36$). It can be noticed that when the value of α is 0.36, the participation probabilities have a very different curve from the Logit curve. When skewness parameter α is equal to 0.36, individuals with participation probability of 38% are most sensitive to the change in utility.
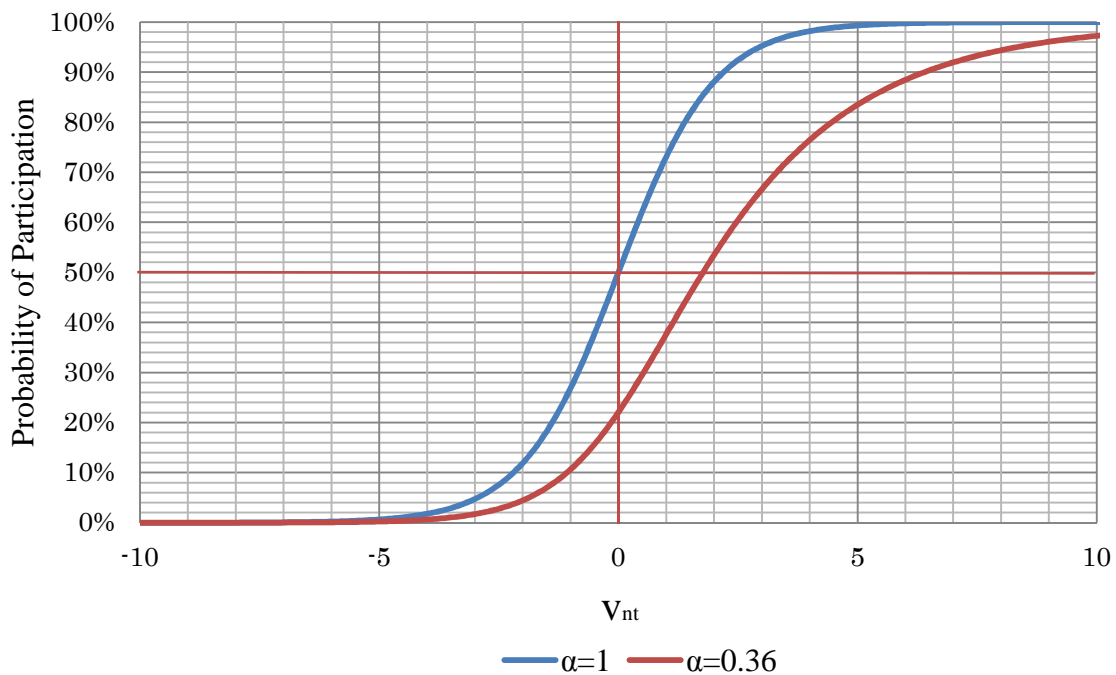
Figure 7-1 Probability of Participation under Different Values of α

Influential factors

1) Tourism participation: In equation (6-2), γ is expected to be temporally-changing for some variables and temporally-invariant for others, which mean that some variables may have different influence on tourism participation behavior in different waves, while some variables might have temporally-invariant influence. Therefore, t-test was conducted to

compare tourists' individual and household characteristics in different months. The results show that tourist who travel in August are significantly younger than other months and those who travel during April, June, November are older than other months. So the parameters for age are set to be different in those four months. As other characteristics do not show significant differences over months, the relevant parameters are set to be same for every month.

From the estimation results, one can see that the parameter of age for August is negative while those for April, June, November are positive. This means that older people are more likely to travel during April, June, and November and less likely to travel during August. In terms of other individual and household attributes, they are set to be same for the 12 months. It can be seen that parameters of marital status, education level, income, car ownership, and length of holiday are positive and statistically significant at 95% level, while parameters of household size and existence of children are negative. This may be because that married people have a partner to travel with; higher education level can arouse more interest in tourism and allows better access to information and knowledge of tourism; car ownership provide more convenience to travel; longer holiday can eliminate time constraint to participate in tourism.. The negative parameters of household size and existence of children mean that individuals from a larger household and those who have children in the household might confront financial constraints and family commitments, therefore, would have lower probability to participate in tourism. The parameter of state dependence is negative. This result indicates that participation in tourism during month *t-1* has negative influence on the participation during month *t*. This confirms that tourism participation behavior surely depends on the past behavior and suggests that the monthly participation in the past reduces the probability of the participation in the next month.

2) Tourism expenditure: For tourism expenditure, marital status, income, household size and travel distance have significant influence. It can be concluded that tourists who are married will spend more on tourism, and higher income also has positive effect on tourism expenditure, tourists who travel longer distance will spend more. What needs to be noticed is that tourists with larger household size will spend more on tourism. This result implies that although individuals from a larger household are less likely to participate in tourism, they will spend more once they participate in tourism. In addition, state dependence also shows negative influence on tourism expenditure decision.

Marginal effects

To further examine the difference of the two models, we calculated the marginal effects of holiday length on participation probability based on the Logit model and the Scobit model (Figure 7-2). We can see that the Logit-based model overestimates the marginal effects by almost 80%. It is expected that increasing the vacation length could remarkably increase the number of tourists; however, this study suggests that such expectation is not realistic, implying that policy makers need to figure out other factors that prohibit people's participation in tourism activities.
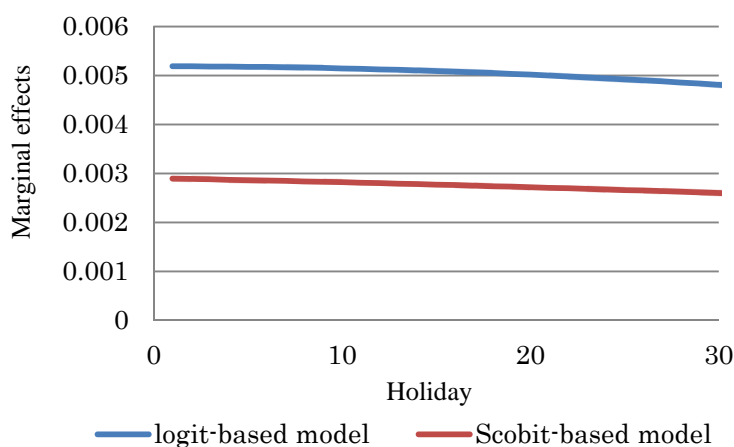

Figure 7-2 Marginal Effects of Holiday on Participation Probability

7.1.4 Conclusions

The study of tourism expenditure has attracted much attention in tourism analysis. However, the existing research has a lot of problems in representing tourism expenditure as a decision which is independent from the decision of participation in tourism. This study recognizes these two decisions might be interacted with each other. Therefore, a new discrete-continuous choice model is built to model the two decisions simultaneously. In particular, tourism participation is represented based on a Scobit model, which includes a skewness parameter to relax assumption that the sensitivity of individuals to changes in explanatory variables is highest for those who have indifferent preferences over participation and non-participation. The empirical application is carried out using the data derived from a survey conducted in Japan. The effectiveness of the established model is empirically confirmed. It is revealed that the correlation between tourism participation and tourism expenditure is positive and statistically significant at 95% level. The impacts of several attributes on tourism participation and tourism expenditure are investigated. It is revealed that individual's age, marital status, education level, income, household size, existence of children in the household, car ownership and length of holiday have significant influence on their choice of participation in tourism. For tourism expenditure, marital status, income, household size and travel distance have significant influence. Furthermore, the results derived from Scobit model and binary Logit model are compared. The Scobit-based model is proved to be superior to Logit-based model. In terms of marginal effects, the Logit-based model overestimates the marginal effects of holiday length on participation probability by almost 80%. The overestimate of marginal effects will result in the inaccurate estimation and expectation of tourism policy.

Some implications for both academic research and tourism organizations can be drawn from the study. The academic contribution of this study is to build a discrete–continuous

choice behavior model to represent tourist's two-dimensional choice: tourism participation and tourism expenditure. It could be also applied in other discrete–continuous choice, such as tourism participation and stay duration, tourism participation and frequency. In addition, the study also has important practical implications. On the one hand, the analysis of tourism participation behavior can help government/firms propose policies/measures to effectively eliminate tourism barriers and encourage tourism participation. Furthermore, representing tourism expenditure in a more appropriate way can provide more accurate assessment of revenue from tourism so that effective policies/measures to increase economic benefit of tourism can be implemented. On the other hand, it can offer important information about tourist's expenditure patterns, which are useful for a tourism destination to formulate better marketing strategies.

There are some research issues remaining as future tasks. First, there are a number of subjective constraints for individuals to participate in tourism, for example, lack of money, lack of partner, health constraint, etc. It is necessary to include this kind of constraints into analysis of tourism participation. Second, it is worth examining the influence of psychological factors (e.g., motivation, lack of interest) in a comprehensive way within the adopted modeling framework in this study. Finally, it is argued that not only tourism expenditure but also duration of stay could be interrelated with decision of tourism participation. Therefore, it is essential to develop a more general model to incorporate these three decision aspects.

7.2 Representing time use behavior based on a multiple discrete-continuous extreme value model

7.2.1 Introduction

It has been well recognized that temporal aspect is an important issue in tourism research (Pearce, 1988). However, careful reviews suggest that relevant studies are very limited. Most of the existing studies focused on the total time that tourist spend during a tour trip (Alegre & Pou, 2006; Garcia & Raya, 2008; Gokovali, Bahar, & Kozak, 2007). However, few studies investigated what kinds of activities tourists participate in and how they allocate their limited time to different activities. This chapter focuses on the ill-represented temporal aspects of tourism behavior, especially tourists' time allocation decisions on various activities during travel. Understanding tourists' time use decisions is useful for transport decision makers to make decisions on how to improve the levels of transport services for the convenience of activity participation and effective use of time allocated to activities. Since different tourism activities generate different impacts on environment, the investigation into tourist's time use during travel could provide a tool to estimate overall environmental impacts resulting from tourism activities.

It is expected that a tourist may decide to participate in multiple kinds of activities within a tour trip to satisfy various needs. Existence of temporal constraints forces tourists to decide how to make effective use of their available and limited time during travel. Therefore, tourists need to decide which activities to participate in and how long to perform each activity. Considering the existence of joint decision-making mechanism of tourist's activity participation and time allocation behavior, this study adopts Bhat's (2008) multiple discrete-continuous extreme value (MDCEV) model. The purposes of this chapter are, 1) to

examine the applicability of the MDCEV model to capture tourist's time use behavior involving multiple activities, 2) to explore factors affecting the tourist's time use behavior. This model can deal with individual's discrete-continuous choice and has the advantage to represent individual's choice of multiple alternatives simultaneously. In this chapter, we use a utility function structure with satiation effect (i.e., the marginal utility shows a diminishing property as the level of time allocation increases. For the above purposes, a questionnaire survey data collected from 761 tourists in Tottori Prefecture of Japan in 2007 is used in this study. This survey included detailed information about each tourism activity performed during travel as well as individual attributes.

7.2.2 Methodology

Within a tour trip, it is expected that a tourist may decide to participate in several activities under the time constraint. The tourist needs to decide which activities to participate in and how long to allocate the limited time to each activity. For such decision, it is expected that the tourist wants to allocate his/her time so that the total utility derived from all the activities is maximized. In this sense, the utility-maximizing principle can be applied. Let there be *K* different activities that a tourist can allocate time to. Let t_k be the time spent on activity *k* *(k=1,2,...,K)*. The utility is specified based on the utility structure proposed by Bhat (2008) and defined as the sum of the utilities obtained from allocating time to each activity:

$$U_n = \sum_{k=1}^{K} \gamma_k \psi_{nk} \ln(\frac{t_{nk}}{\gamma_k} + 1) \tag{7-12}$$

$$\psi_{nk} = \exp(\beta z_{nk} + \varepsilon_k) \tag{7-13}$$

where,

U_n : the total utility of tourist n to allocate time to all the K activities

ψ_{nk} : the marginal utility of tourism activity k when tourist n's allocated time is 0

t_{nk} : the time that tourist n allocates to activity k

γ_k : a satiation parameter (the larger the value of γ_k, the higher the accrue rate of utility derived from time allocation in activity k, i.e. the lower the satiation level)

z_{nk} : a set of attributes characterizing activity k performed by tourist n

ε_k : an error term, assumed to follow a standard extreme value distribution

Then, the marginal utility of time allocation in activity k can be computed as:

$$\frac{\partial U_{nk}}{\partial t_{nk}} = \psi_{nk} / (\frac{t_{nk}}{\gamma_k} + 1) \tag{7-14}$$

From equation (7-14), we can see that Ψ_{nk} is the marginal utility of activity k when time allocation is 0, which is explained by a set of attributes characterizing activities k and tourist n. As time allocation t_{nk} increases, the marginal utility will decrease. This diminishing marginal utility can reflect tourists' satiation when the duration of one activity increases. The parameter γ_k is introduced to influence this kind of satiation. The larger value of γ_k indicates the lower diminishing rate of marginal utility, which means that tourists are less likely to

satiate in activities k and willing to spend more time on activities k. Tourists may have different levels of satiation in different activities, which can be represented by the parameter γ_k.

The tourist n is assumed to maximize random utility U_n subject to the time constraint $\sum_{k=1}^{K} t_k = T$, where T is the total time. Then the Lagrangian function can be formed to solve the optimal time allocation:

$$L = \sum_k \gamma_k \exp(\beta z_{nk} + \varepsilon_k) \ln(\frac{t_{nk}}{\gamma_k} + 1) - \lambda(\sum_{k=1}^{K} t_k - T) \tag{7-15}$$

where λ is the Lagrangian multiplier associated with the time constraint. The Kuhn-Tucker first-order conditions for the optimal time allocations are given by:

$$\begin{aligned}
\exp(\beta z_{nk} + \varepsilon_k)/(\frac{t_{nk}}{\gamma_k} + 1) - \lambda = 0, \quad &\textit{if } t_{nk} > 0 \\
\exp(\beta z_{nk} + \varepsilon_k)/(\frac{t_{nk}}{\gamma_k} + 1) - \lambda < 0, \quad &\textit{if } t_{nk} = 0
\end{aligned} \tag{7-16}$$

When tourist n participates in activity k, $t_{nk}>0$; otherwise, $t_{nk}=0$. This can represent discrete choice (i.e., whether to participate in activity k or not). Since the tourist should at least participate in one of the K activities, let the activity 1 be the activity that tourist allocate some non-zero amount of time, the Kuhn-Tucker condition can be written as:

$$\lambda = \exp(\beta z_{n1} + \varepsilon_1)/(\frac{t_{nk}}{\gamma_k} + 1) \tag{7-17}$$

Substituting equation (7-17) into equation (7-16) and taking logarithms, the Kuhn-Tucker condition can be rewritten as:

$$
\begin{aligned}
& V_k + \varepsilon_k = V_1 + \varepsilon_1, \quad if \ t_{nk} > 0 \ (k = 2,3,...,K), \\
& V_k + \varepsilon_k < V_1 + \varepsilon_1, \quad if \ t_{nk} = 0 \ (k = 2,3,...,K), \\
& where \ V_k = \beta z_{nk} - \ln(\frac{t_{nk}}{\gamma_k} + 1) \ (k = 1,2,3,...,K)
\end{aligned}
\tag{7-18}
$$

We specify a standard extreme value distribution for ε_k and assume that ε_k is independent of t_k and independently distributed across alternatives. The probability that the tourist participates in *M* of the *K* activity given ε_1 can be calculated based on the study of Bhat (2008):

$$
P(t_2, t_3,...,t_M,0,0,...,0) = [\prod_{k=1}^{M}(\frac{1}{t_k + \gamma_k})][\sum_{k=1}^{M}(t_k + \gamma_k)][\frac{\prod_{k=1}^{M}e^{V_k}}{(\sum_{k=1}^{K}e^{V_k})^M}](M-1)!
\tag{7-19}
$$

Therefore, the log likelihood function of the model is:

$$
LogL_n = \sum_n \ln\{[\prod_{k=1}^{M}(\frac{1}{t_k + \gamma_k})][\sum_{k=1}^{M}(t_k + \gamma_k)][\frac{\prod_{k=1}^{M}e^{V_k}}{(\sum_{k=1}^{K}e^{V_k})^M}](M-1)!\}
\tag{7-20}
$$

To estimate equation (7-20), maximum likelihood estimation method is applied. The MDCEV model has a simple and elegant closed form which is easy to estimate.

7.2.3 Model estimation and results

Data description

The data used in this study was collected in the prefecture of Tottori in 2007 based on a face-to-face interview. Tottori is best known for its sand dunes which are a popular tourist attraction, drawing visitors from outside of the prefecture. The interview survey was conducted in four seasons across a year at 16 major tourism destinations in Tottori. As a result, 761 valid samples were obtained, including the data of individual characteristics and travel-related attributes. Individual characteristics include gender, age, occupation, residential location, etc. while travel-related attributes include destination, travel party, travel mode, departure time, duration of stay and expenditure, etc. The survey included very detailed information of each tourism spot that tourist visited, from which we can get information about activities that tourist has participated in. In this study the activities are divided into 7 categories: natural (e.g., sand dunes), hot spring, culture (e.g., museum), heritage, shopping, sport and amusement. It is found that 75% of the tourists participated in more than one activities in their tour trip.

As mentioned previously, the survey included detailed information of every tourism spots that tourists visited and time duration in each spot. In this study, these tourism spots are categorized into 7 kinds of activities: natural park, sand dunes, forest, lake, etc. are categorized into *nature activities*; hot spring is categorized into *hot spring*; museum, art gallery, library are categorized into *culture activities*; temple, castle are categorized into *heritage activities*; supermarket, department store are categorized into *shopping activities*; skiing site, gymnasium are categorized into *sport activities*; amusement park is categorized into *amusement activities*. Since duration in each spot was included in the survey, the time

allocation in each activity can also be calculated. Table 7-3 gives detailed information of participation percentage and average duration of each activity. From the table, one can see that tourists participate most in shopping activities but the duration of participation is shorter compared to other activities. This suggests a high baseline preference and also a high level of satiation. There is also a high percentage of participation in activities of nature, hot spring, culture, and amusement, and the durations of these activities are relatively long. This indicates high baseline preference and low level of satiation for these activities. In terms of the sport activities, the participation percentage is low but duration is long, which suggests a low baseline preference but a low level of satiation.

Table 7-3 Activities Participation Percentage and Duration

Activity	Participation Percentage (%)	Mean Duration of Participation (min)
Nature	44.4	184
Hot spring	36.3	227
Culture	39.4	102
Heritage	17.2	106
Shopping	63.7	86
Sport	5.6	347
Amuse	28.3	119

Figure 7-3 shows the cross aggregation analysis between age and durations of 7 categorized activities. One can see that with age increase, tourists are more likely to participate in activities of hot spring, culture, and heritage.
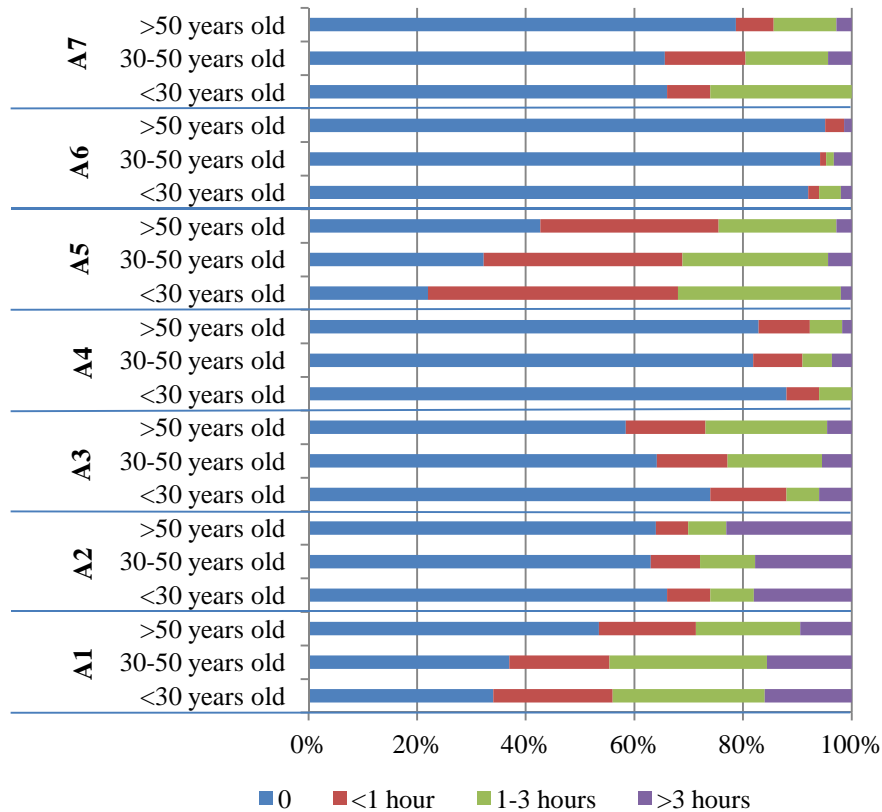
Figure 7-3 Cross Aggregation between Age and Duration of 7 Activities
*Note: A1—nature; A2—Hot spring; A3—culture;
A4—Heritage; A5—shopping; A6—sport; A7—Amusement

Figure 7-4 shows the cross aggregation analysis between several factors and durations of 7 categorized activities. (a) employment status: employees are shown to more willing to participate in heritage, sport activities but less willing for amusement activities; (b) residential area: it shows that tourists residing in Tottori prefecture would spend more time on all activities expect culture activities; (c) travel experience: it suggests that tourists who have visited Tottori before are more likely to spend time on shopping and sport activities, while less likely to participate in culture activities; (d) travel mode: tourists who travel by private car are more willing to be involved in sport and amusement activities but less willing to participate in nature, culture, and heritage activities.

(a) employment status

(b) residential area

(c) travel experience in Tottori

(d) travel mode

Figure 7-4 Cross Aggregation between Several Factors and Duration of 7 Activities
*Note: A1—nature; A2—Hot spring; A3—culture;
A4—Heritage; A5—shopping; A6—sport; A7—Amusement

Figure 7-5 shows the cross aggregation analysis between two factors and durations of 7 categorized activities. (a) travel party: tourists who travel alone are shown to be less likely to participate in hot spring, culture, heritage, sport activities but more likely to participate in other activities; (b) travel season: it shows that tourists more tend to participate in sport activities in winter.
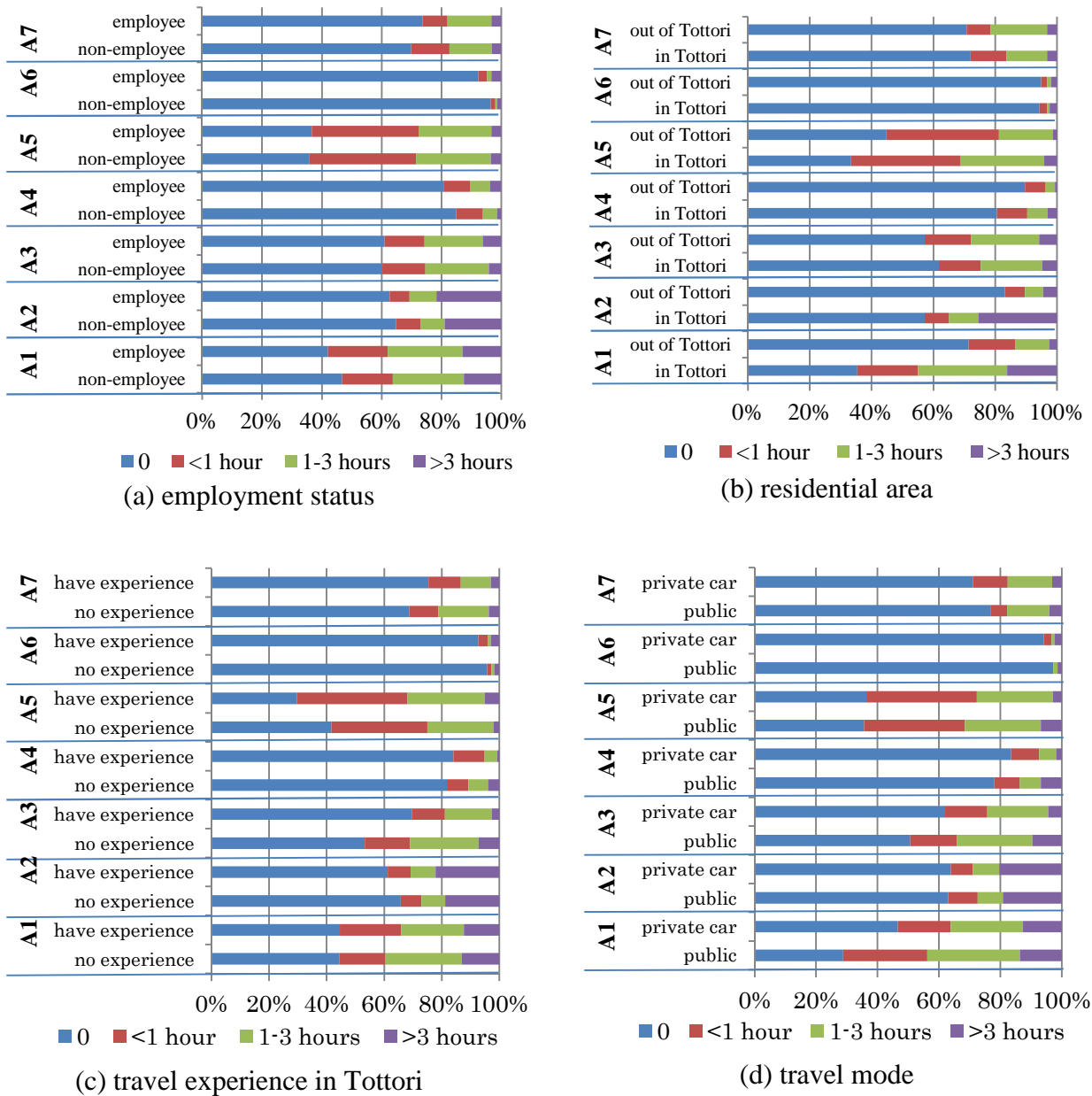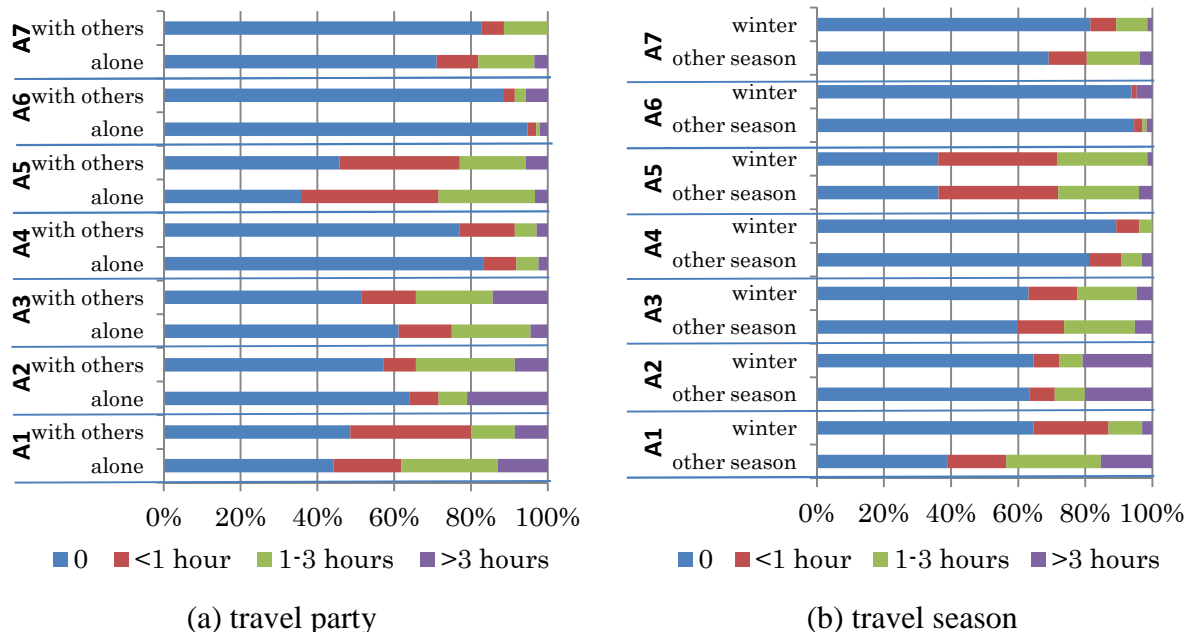
(a) travel party   (b) travel season

Figure 7-5 Cross Aggregation between Two Factors and Duration of 7 Activities (Continued)

*Note: A1—nature; A2—Hot spring; A3—culture;
A4—Heritage; A5—shopping; A6—sport; A7—Amusement

Explanatory variables

The results from cross aggregation show that individual attributes including age, occupation, residential area, travel experience and travel-related attributes including travel mode, travel party, travel season have important effects on tourist's time use behavior in different activities. Therefore, these variables are used as the explanatory variables in this study (Table 7-4).

Table 7-4 Explanatory Variables

Explanatory variables	Description
Individual Attributes	
Age	Age of the tourist
Employment status (dummy variable)	1 if employed, 0 otherwise
Residential area (dummy variable)	1 if in Tottori Prefecture, 0 otherwise
Travel experience (dummy variable)	1 if visited Tottori Prefecture before, 0 otherwise
Travel Related Attributes	
Travel mode (dummy variable)	1 if private car, 0 otherwise
Travel party (dummy variable)	1 if travel alone, 0 otherwise
Travel season (dummy variable)	1 if winter, 0 otherwise

Model performance

By excluding missing values of explanatory variables, 612 samples were finally used in this study. The model is estimated based on maximum likelihood estimation method using R statistical software. In order to estimate the model, it is necessary to fix all the parameters to zero for one of the alternatives. In this study, activity 1 (visit natural spots) is chosen as the base alternative, all the parameters for activity 1 are fixed to zero. Estimation results of the developed model are presented in Table 7-5. The log-likelihood value at convergence of the final multiple discrete–continuous extreme value (MDCEV) model is -7027. The corresponding value for the MDCEV model with only the constants in the baseline preference terms is -7125. The likelihood ratio test for testing the presence of exogenous variable effects is 196, which is substantially larger than the critical chi-square value ((63.69)) with 42 degrees of freedom at the 99% significance level.

<div align="center">Table 7-5 Model Estimation Results</div>

Explanatory Variables	Nature	Hot spring		Culture		Heritage		Shopping		Sport		Amuse	
Constant	--	-1.79	**	-1.18	**	-2.53	**	-0.34		-5.18	**	-2.12	**
Age	--	0.14	**	0.12	**	0.21	**	-0.01		0.04		-0.05	
Employment status	--	0.08		0.01		0.28		-0.04		0.86	**	-0.24	*
Residential area	--	0.12		1.16	**	0.51	**	1.24	**	1.83	**	1.38	**
Travel experience	--	0.22		-0.15		0.04		0.86	**	1.38	**	0.23	
Travel mode	--	0.19		-0.17	*	-0.18	**	-0.03		0.99	**	0.76	**
Travel party	--	-0.06	**	-0.05	**	0.01		-0.01		-0.24	**	-0.06	
Travel season	--	0.89	**	0.55	**	0.15		0.69	**	0.88	**	-0.08	
γ_k	65.0 **	141	**	85.4	**	66.3	**	30.4	**	204	**	83.5	**

<div align="right">* significant at the 90% level, ** significant at the 95% level</div>

Influential factors

The parameters of age are significant at the 95% level for activities of hot spring, culture and heritage. The positive parameters indicate that with the age increase, the baseline preference of these three activities will also increase. The effects of employment status indicate that employees have a higher baseline preference for sport activities, while have a lower baseline

preference for amusement activities. The parameters of residential area suggest that tourists residing outside Tottori Prefecture have lower baseline preference for all activities, especially for sport activities. The results for travel experience indicate that travel experience has a significant effect on activities of shopping and sport. Tourists who have visited Tottori Prefecture before have a higher baseline preference for these two activities. The effects of travel mode indicate that tourists who traveled by private car have a higher baseline preference for sport and amusement activities but have a lower baseline preference for culture and heritage. The effects of travel party indicate that tourists who traveled alone have a lower baseline preference for hot spring, culture and sport activities. It indicates that tourists are more likely to participate in these activities with others. The parameters of travel season show that the baseline preference for hot spring, culture, shopping and sport are higher in winter season. The main sport activity for tourists in Tottori is skiing, so it is reasonable that tourists are more willing to participate in sport in winter. The estimated results are a little different from cross aggregation results in the effects of residential area and travel season. In cross aggregation results, it is shown that tourists residing in Tottori prefecture would spend less time in culture, and tourists are less likely to participate in hot spring, culture and shopping in winter. Considering the cross aggregation just analyze the relationship between one factor and time allocation behavior, it cannot provide accurate effects of influential factors. Furthermore, the cross aggregation analysis cannot show which factors are the most significant influential factors in different activities.

In terms of satiation parameter γ_k, it is significant for all activities at the 95% level. The results indicate the high level of satiation for shopping and low level of satiation for sport and hot spring activities. This is consistent with observation that although the participation rate is high for shopping, the average duration is short; while for sport, the participation rate

is low, but as long as the tourist participates in sport, the duration is relative long. This kind

of different satiation level for different activities cannot be reflected without the parameter γ_k.

Some implications for tourism management can be drawn from the results. Tourists'

behavior pattern is one of the important issues for tourism destination management.

Concretely speaking, what kinds of tourism activities to participate, how long to perform

each activity, what are the influential factors to these behavior aspects can provide

information to management of tourism infrastructures (e.g., how many infrastructures need to

be constructed/improved, the business hours for different tourism spots) and offer a tool to

forecast the demand of different spots when the current situation change (e.g., the aging

society in Japan).

7.2.4 Conclusion

Enjoying tourism activities is one of important parts of quality of life for many people, and it

is therefore important for public policy makers, including transport policy makers, to support

such activity participation. On the other hand, improving the quality of time use during travel

could contribute to enhancing tourists' travel satisfaction and consequently the improvement

of life satisfaction. The importance of time use research in tourism has been recognized since

the late of 1980s, however the relevant study is still very limited.

In line with such consideration, this study has attempted to explore tourists' time use

behavior involving multiple activities by explicitly distinguishing between activity

participation and the time allocated to activities. For this purpose, this study has examined the

applicability of the multiple discrete-continuous extreme value (MDCEV) model, which has

several advantages over other existing time use models, including the joint representation of

multiple activities (corner solutions: zero consumption of each activity type) as well as the

allocated time, diminishing marginal utilities (satiation effects), and different baseline utilities. The established time use model for tourists were examined using a questionnaire survey data collected from 761 tourists who visited various tourism attractions located in a prefecture of Japan. Findings are summarized as follows:

(1) We confirmed the effectiveness of the multiple discrete-continuous extreme value (MDCEV) model in representing tourist's time use behavior with multiple activities. The good feature of the MDCEV model is that it can flexibly represent activity participation for any number of tourism activities. Since the model has a multinomial logit (MNL) form-equivalent structure, it is easier to apply the MDCEV model to the real world.

(2) Influential factors related to time allocation in different activities were explored. Concretely speaking, individual attributes including age, employment status, residential area, travel experience, and trip-related attributes including travel mode, travel party, travel season are found to be important influential factors. It is worth noting that tourists who resided outside Tottori Prefecture have lower baseline utilities for all activities. This may be because that they are less familiar with the tourism attractions in Tottori prefecture. Therefore, efforts should be made to introduce these local attractions to tourists from other place. In addition, the effects of travel mode indicate that tourists who traveled by private car have a higher baseline preference for sport and amusement activities but have a lower baseline preference for culture and heritage.

(3) It is observed that the level of satiation is high for shopping activities and low for sport and hot spring activities. In other words, tourists will be satisfied quickly by

participating in shopping activities. But when they participate in sport and hot spring activities, it will be less possible for them to be satiated.

The above findings provide some insights into understanding tourist's time use behavior. Furthermore, some policy implications can be drawn. For example, the low level of satiation for sport activities suggests that tourists who participate in sports usually have long duration. Therefore, some infrastructure should be constructed to satisfy tourists' needs in a long time period.

There are some research issues remaining as future tasks. In this study, the time allocation in different activities was assumed to be independent. However, in reality there might be interaction among these duration episodes, because the more time spent on one activity, the less time spent on other ones. In this sense, it is necessary to explicitly incorporate the interaction among time allocation in different activities into the model development process. It is also expected that discrete choice behavior and continuous choice behavior may be influenced by different sets of attributes because of their different characteristics; however, the adopted MDCEV model assumes that both discrete and continuous choices can be explained by the same set of attributes due to the econometric requirements during the modeling process. Such assumption should be relaxed while keeping the attractive features of the MDCEV model. Furthermore, the improved time use model should be integrated with other decision aspects, such as tourism generation, destination choice, travel model and route choices, and expenditure decision. Finally, tourism behavior models with the above mechanisms should be used to support tourism policies.

Chapter 8 Conclusions and Future Research

Tourists' travel decisions usually involve a number of separate but interrelated choices that are made over time and across space. Since tourists face many aspects of choices and have to deal with spatial and temporal constraints and some uncertainty, it is argued that tourist choice behavior is a multi-dimensional process and decisions about these dimensions of behavior are interrelated. Aiming to gain a thorough understanding of tourist behavior, this study attempts to build a model system, into which all the important choice aspects related to tourist behavior are incorporated and multi-faceted dependencies and interactions are taken into account. Concretely speaking, this study analyzed tourism participation behavior by considering the influence of various factors, including individual and household characteristics, social interactions and constraint effects; investigated tourist multi-stage choice process, including two interrelated choice aspects of destination and travel party, and three interrelated choice aspects of tourism participation, destination choice, and travel mode choice; analyzed tourist's multi-destination choice with future dependence; represented tourism participation and tourism expenditure simultaneously; examined tourists' time allocation decisions on various activities during travel.

The findings of this thesis are first summarized below. Then limitations and directions for future research are discussed.

8.1 Findings

8.1.1 Tourism participation behavior

This study analyzed individuals' tourism participation behavior by considering the influence of social interaction and constraints effects. The analysis was conducted based on a Scobit model, which includes a skewness parameter to relax the assumption made in binary logit model that

the sensitivity of individuals to changes in explanatory variables is highest for those who have indifferent preferences over participation and non-participation.

The effectiveness of the established model is empirically confirmed. The impacts of social interaction, constraint effects, as well as several individual attributes on tourism participation are investigated. The model estimation results confirm the significant influence of social interaction on individual's tourism participation behavior. Specifically speaking, the endogenous social effects of prefecture and homogenous income group show significant influences to a certain extent. For the exogenous social effect, education level show significant positive influence. This result means that the tourism participation percentage in a prefecture will increase if the average education level in that prefecture increases. In addition, the correlated social effects within same prefecture and homogenous income group are confirmed to be significant, which states the importance of accounting for the correlated social effects. In term of the constraint effects, the empirical results indicate that five constraints including money, time, partner's time, lack of interest and available information have significant influences on tourism participation.

These results have important policy implications. Because the endogenous social effects of prefecture have positive and significant influences, the policies that aims to increase or decrease tourism demand would have "social multiplier" effect. In other words, the effect of a policy intervention will be larger than the individual-level direct effect. In addition, since constraint effects are confirmed to have significant influence on tourism participation behavior, policies that aims to eliminate these constraints should be implemented to promote tourism generation.

8.1.2 Tourists' heterogeneous choices of destination and travel party

There are various interactions existing in tourist behavior due to the influences of various constraints and tourists' preferences. Such interactions might be different across tourists. Focusing on the choice interaction between travel party and destination, this study has attempted to represent the heterogeneous nested choice structure involved in the choices of these two decision aspects by combining the latent class and the nested logit modeling approaches. Using a data collected from 2 050 tourists in Japan, the effectiveness of the developed model was first confirmed. Statistical significances of the parameters used to explain the latent classes and the nested model structure suggest that there are surely heterogeneous interactions between choices of destination and travel party, which are represented by two types of the nested choice structures. It is observed that the nested choice structure could significantly differ across income level and gender. In this case study, it was confirmed that on average the two types of the nested choice structures are almost shared equally by the samples. These results support the developed model. The theoretical contribution of this study is to develop an additional modeling approach that can represent tourists' heterogeneous choice behavior. Even though we applied the approach to deal with choices of destination and travel party, it could be also applicable to other choice contexts. The observed findings about heterogeneous interactions between choices of destination and travel party have important practical implications. For example, the proposed modeling approach could helpful to policy makers to quantitatively evaluate the effects of tourism policies or marketing activities on tourist choice behavior in advance in a more convincible way, and it is also suggested that segmentation in tourism marketing should be done by focusing on not only tourists' individual attributes, but also their interrelated choice behaviors.

8.1.3 Joint analysis of tourism participation, destination choice and travel mode choice

This study jointly analyzed tourists' three interrelated choice aspects over a course of year: tourism participation, destination choice and travel mode choice, while takes the influence of state dependence into account. The data used in this study is derived from a web-based retrospective panel survey conducted in Japan in the year 2010. In the analysis, the joint choice of three components is analyzed using the nested logit (NL) model, and lagged endogenous variables are included into the model to examine the influence of state dependence. The effectiveness of the model is first empirically confirmed. Model estimation results showed the significant influence of state dependence on the three choice aspects and revealed the regionally heterogeneous influence of travel mode choice on destination choice. The results also clarified the influence of tourism motivation, individual characteristic, destination specific attributes and travel specific attributes on the three choice aspects.

These results have important policy implications. For example, it indicated that length of national holiday has a significant influence on tourism participation decision. Based on this result, region-specific Golden week (different region has the Golden week holiday during different time period) will have certain effect to eliminate the concentration of tourism demand. Focusing on destination marketing and management, a prefecture can market its tourism destination by targeting larger families in the close regions; more information about the local attractions could be provided to tourists so that it can increase their repeated visit to the same region; some prefectures (e.g., Hokkaido Prefecture, Yamanashi Prefecture, Shizuoka Prefecture, Okinawa Prefecture) can increase their tourist arrivals dramatically by improving their transportation service level. Since travel mode choices conditioned on some destinations (e.g., Chiba Prefecture, Tokyo, Kanagawa Prefecture, Toyama Prefecture, Ishikawa Prefecture, Fukui Prefecture) show higher substitution, the use of public transport modes to these

destinations will increase significantly if the service level of public mode increase.

The analysis also offers a tool to forecast tourist behavior in future. Because of an aging population in Japanese society, individual's tourism pattern is expected to change accordingly. In addition, the change in demographics might also result in a change of tourism motivation, which will further influence tourist behavior. A better understanding about such kind of change will provide more appropriate insights into tourism marketing and policy decisions.

8.1.4 Multi-destination choice behavior with future dependence

This study analyzed interrelated choices underlying the multi-destination behavior, motivated by the argument that choice of a destination in a tour with two or more destinations might be influenced by the choice behavior of subsequent destinations visited. In other words, future dependence might be relevant to the destination choice behavior. To reflect such decision-making mechanism, this study adopts the universal logit modeling framework to explicitly and flexibly accounting for the future dependence in the multi-destination choice behavior. Concretely speaking, the future dependence for a destination is represented by introducing the probabilities of visiting subsequent destinations as well as the probability of going home. Dissimilarities among destinations are also introduced into the model. Using a questionnaire survey data collected in tourist destinations of Tottori Prefecture, Japan in 2007, the effectiveness of the established model was first empirically confirmed, and then the existence of future dependence in tourists' multi-destination choice behaviors was also statistically clarified. Influential factors affecting tourists' multi-destination choice behaviors were finally examined.

8.1.5 Tourism participation and expenditure behavior

The study of tourism expenditure has attracted much attention in tourism analysis. However, the existing research has a lot of problems in representing tourism expenditure as a decision which is independent from the decision of participation in tourism. This study recognizes these two decisions might be interacted with each other. Therefore, a new discrete-continuous choice model is built to model the two decisions simultaneously. In particular, tourism participation is represented based on a Scobit model, which includes a skewness parameter to relax assumption that the sensitivity of individuals to changes in explanatory variables is highest for those who have indifferent preferences over participation and non-participation. The empirical application is carried out using the data derived from a survey conducted in Japan. The effectiveness of the established model is empirically confirmed. It is revealed that the correlation between tourism participation and tourism expenditure is positive and statistically significant at 95% level. The impacts of several attributes on tourism participation and tourism expenditure are investigated. It is revealed that individual's age, marital status, education level, income, household size, existence of children in the household, car ownership and length of holiday have significant influence on their choice of participation in tourism. For tourism expenditure, marital status, income, household size and travel distance have significant influence. Furthermore, the results derived from Scobit model and binary Logit model are compared. The Scobit-based model is proved to be superior to Logit-based model. In terms of marginal effects, the Logit-based model overestimates the marginal effects of holiday length on participation probability by almost 80%. The overestimate of marginal effects will result in the inaccurate estimation and expectation of tourism policy.

Some implications for both academic research and tourism organizations can be drawn from the study. The academic contribution of this study is to build a

discrete–continuous choice behavior model to represent tourist's two-dimensional choice: tourism participation and tourism expenditure. It could be also applied in other discrete–continuous choice, such as tourism participation and stay duration, tourism participation and frequency. In addition, the study also has important practical implications. On the one hand, the analysis of tourism participation behavior can help government/firms propose policies/measures to effectively eliminate tourism barriers and encourage tourism participation. Furthermore, representing tourism expenditure in a more appropriate way can provide more accurate assessment of revenue from tourism so that effective policies/measures to increase economic benefit of tourism can be implemented. On the other hand, it can offer important information about tourist's expenditure patterns, which are useful for a tourism destination to formulate better marketing strategies.

8.1.6 Tourists' time allocation decisions on various activities

This study has attempted to explore tourists' time use behavior involving multiple activities by explicitly distinguishing between activity participation and the time allocated to activities. For this purpose, this study has examined the applicability of the multiple discrete-continuous extreme value (MDCEV) model, which has several advantages over other existing time use models, including the joint representation of multiple activities (corner solutions: zero consumption of each activity type) as well as the allocated time, diminishing marginal utilities (satiation effects), and different baseline utilities. The established time use model for tourists were examined using a questionnaire survey data collected from 761 tourists who visited various tourism attractions located in a prefecture of Japan.

We confirmed the effectiveness of the multiple discrete-continuous extreme value (MDCEV) model in representing tourist's time use behavior with multiple activities. The good

feature of the MDCEV model is that it can flexibly represent activity participation for any number of tourism activities. Since the model has a multinomial logit (MNL) form-equivalent structure, it is easier to apply the MDCEV model to the real world.

Influential factors related to time allocation in different activities were explored. Concretely speaking, individual attributes including age, employment status, residential area, travel experience, and trip-related attributes including travel mode, travel party, travel season are found to be important influential factors. It is worth noting that tourists who resided outside Tottori Prefecture have lower baseline utilities for all activities. This may be because that they are less familiar with the tourism attractions in Tottori prefecture. Therefore, efforts should be made to introduce these local attractions to tourists from other place. In addition, the effects of travel mode indicate that tourists who traveled by private car have a higher baseline preference for sport and amusement activities but have a lower baseline preference for culture and heritage.

It is observed that the level of satiation is high for shopping activities and low for sport and hot spring activities. In other words, tourists will be satisfied quickly by participating in shopping activities. But when they participate in sport and hot spring activities, it will be less possible for them to be satiated.

The above findings provide some insights into understanding tourist's time use behavior. Furthermore, some policy implications can be drawn. For example, the low level of satiation for sport activities suggests that tourists who participate in sports usually have long duration. Therefore, some infrastructure should be constructed to satisfy tourists' needs in a long time period.

8.1.7 Overall findings: multi-faceted dependencies and interactions

This research confirmed the interactions involved in tourist behavior, including the interactions between destination and travel party choice; interrelation among tourism participation, destination and travel mode choice; interrelated choice underlying multi-destination behavior; interrelated choices of tourism participation and expenditure. From the methodological perspective, this study provided appropriate approaches to represent interactions between different choice aspects. Firstly, it is indicated that the nested logit (NL) model is appropriate to jointly describe two or more discrete choice elements, by incorporating the interaction among the behavioral elements with the help of expected maximal utility (also called logsum variable or inclusive value). Secondly, the latent class (LC) modeling approach was proposed to represent heterogeneous nested choice structures in the nested logit (NL) model. Thirdly, this study represented the influence of future dependence on tourists' destination choice behavior by applying the universal logit model. Fourthly, a discrete-continuous choice model was developed to represent tourists' two interrelated choice aspects (i.e., tourism participation and expenditure) simultaneously. Finally, this study confirmed the effectiveness of the multiple discrete-continuous extreme value (MDCEV) model in representing tourist's time use behavior with multiple activities.

8.2 Limitations

Tourist choice behavior involves a range of psychosocial process and is influenced by a number of individual and environmental factors. In order to get a better understanding of tourist behavior, it is necessary to clarify the influence of these factors. Although this study included social interactions and constraint effects to investigate tourism participation behavior,

more psychological factors are still needed to be investigated. In addition, these psychological factors are expected to have great influences on other behavior aspects as well, including destination choice, activity choice, etc. However, these aspects remain unexplored in this study.

Many relevant choice aspects involved in tourist behavior (as indicated in Figure 2-3) are not included in this study, including group choice, information search and use, route choice, post-travel evaluation, etc. The developed model system should be extended to cover more decision aspects of tourist behavior and incorporate more behavior mechanism in the future research.

There are unexplored issues in representing dependencies and interactions in tourist behavior as well. It remains unclear how the dependencies and interactions vary in different contexts. In terms of temporal dependence, this study examined the influence of state dependence on tourist three choice aspects, namely, tourism participation, destination choice and travel mode choice. However, such dynamic influences are not limited to these three choices, further studies should be conducted to cover more behavior aspects. In addition, this study only represented the first-order state dependence, without taking higher-ordered state dependence into account. Furthermore, dynamics of monthly tourism participation behavior might not be a closed process within a single year. It might be worth conducting dynamic analysis based a panel data covering two or more years. Concerning with social interaction, this thesis only focused on the influence of social group on tourism participation behavior, while other important aspects are not taken into account, for instance, the WOM information, coupling constraint, group decisions, etc.

This thesis adopted survey-oriented approach to analyze tourist behavior. In other words, the model development is based on the available data derived from survey. Therefore, the results can only reflect the tourist behavior in the study area. With such consideration, the

generalization of the proposed model should be further tested by conducting comparative analysis between different tourists (e.g., domestic and international tourists).

8.3 Future study

Further effort is required in survey design. In order to conduct integrated analysis of tourist behavior, a data set is needed to cover the whole process of tourist behavior before, during and after the travel. Concretely speaking, information about tourism participation behavior; scheduling behavior including where to go (destination choice), when and how to go (travel season and travel mode choices), with whom to go (travel party choice), and so forth; on-site behavior including visited attractions, within destination route choice, time and money allocation; and post-travel influence are required. And to conduct dynamic analysis, panel survey is necessary to obtain information over a certain time period. It remains as a future task how to include such comprehensive information in the survey.

It is expected that various interactions might exist in tourist behavior. For example, time and money constraints may result in interactions between spatial choice and resource allocation behavior (e.g., interrelation among destination choice, length of stay, and monetary expenditure); choices before travel (e.g., destination, travel mode) might interrelated with behavior during travel (e.g., route choice, on-site activities); experiences during the travel are the major factors to influence tourists' post-travel evaluation, which may in turn affect their future behavior. Future study should be conducted to clarify such complexity and interactions involved in tourist behavior. Moreover, appropriate methodology should be developed to incorporate these interrelated behavior aspects in a systematical and logical way.

From the practical perspective, some simulations should be conducted to predict the changes in tourist behavior that would occur due to the changes in travel style and socio-economic situations and to explore what kinds of destination management policies

could effectively support the stable growth of tourism demand. Since tourist choice behavior is a multi-dimensional process and decisions about different dimensions of behavior are interrelated with each other, changes in travel style or socio-economic situations will influence the whole process of tourists' choice. In future research, simulation can be conducted under different scenarios by using the model estimation results derived from this study. Based on the simulation, policies could be proposed to support the stable growth of tourism demand.

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