Chapter 7
Tourist Behavior Analysis for Sustainable Tourism Policy

Lingling Wu, Junyi Zhang, and Akimasa Fujiwara

Abstract Tourists' travel decisions usually involve a number of choices made over time and across space. Because tourists face many aspects of choices and must deal with spatial and temporal constraints, it is expected that there will be interdependences in their behavior. Accurate representation of such interdependences is essential for improving understanding of their behavior and consequently may provide insights into tourism marketing and policy decisions. This chapter investigates interdependences among several aspects of tourists' travel decisions, aiming to provide behavioral foundations for the development of an integrated tourism model system. It introduces two studies concerning integrated tourist behavior modeling. The first study jointly analyzes tourists' three interrelated choices by using a nested logit (NL) model. In the second study, tourist's time-use behavior, involving multiple activities, is analyzed using a multiple discrete–continuous extreme value (MDCEV) model. Application analyses are conducted using data collected in Japan. The findings have important practical implications for both destination management and policy making.

Keywords Integrated modeling • Interdependence • MDCEV model • Nested logit model • Tourist behavior

7.1 Importance of Tourist Behavior Analysis

UNWTO (2006) identified 15 megatrends of tourism in the Asia-Pacific region in the year 2006, of which more than half are directly related to tourist behavior. First, tourists tend to prefer activity- and interest-based travel to destination-based travel. At the

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same destination, tourists usually participate in the same activities according to the major tourism resources available, but they may be interested in and participate in other types of activities. This emphasizes the importance of understanding tourists' activity participation and time use at destinations. Second, tourists' tastes and travel spending are becoming polarized in the sense that some visitors seek comfort and/or luxury travel products, while others desire thrills and/or budget travel. Catering for heterogeneous traveling tastes and budget decisions is therefore of increasing importance. Third, tourists are more likely to pay for travel experiences than for products. Such experience-oriented consumer behavior has been observed in the more general marketing context (see Drotskie 2012). Fourth, rapid growth of business travel is expected, suggesting that exploring tourism demand generated by business trips is important.

The final trend in tourism results from growth in the number of seniors and women travelers. Travel safety and health will become major concerns for these tourists. This final trend supports the role of group package tours but at the same time encourages marketers of group package tours to consider these tourists' heterogeneous traveling tastes and budget decisions carefully. Review of the megatrends related to tourist behavior suggests that understanding tourist behavior is not merely of academic interest but is essential for effective tourism planning and policy making. To propose effective policies, it is necessary to understand how tourists make decisions. Better understanding of tourist behavior would provide information about how and when policy interventions are needed to obtain desirable results. Specifically, research concerning tourism participation behavior offers useful information on encouraging people to make full use of their free time to participate in tourism activities. A better understanding of tourist behavior during travel is essential for policy makers and destination planners to provide tourists with high-level services. Experiences during travel are the major factor influencing tourist satisfaction, and these in turn influence their intention to return and/or to recommend the destinations to other people. Therefore, providing tourists with good services is crucial for tourism marketers. At the same time, the public sector must provide high-quality infrastructure (e.g., convenient transportation networks, attractive transit malls in city centers and accessible tourist facilities) and public services (e.g., an uncongested driving environment and friendly tourist information centers) that can facilitate tourism. Thus, understanding tourist behavior is very important for both the public and private sectors.

7.2 Environmental Significance of Tourist Behavior

A considerable proportion of global passenger transport is linked to tourism activities, in which more than 10 % of the world's population participate annually (Budeanu 2007). The tourism industry is therefore of interest to those studying transport-related environmental problems and sustainable transport systems.

The environmental problems generated by tourism are related to various aspects of tourist behavior. Specifically, the temporal imbalance (especially the concentration)

of tourism generation usually raises serious problems such as air pollution and traffic congestion during peak seasons. Overcrowding of popular destinations creates environmental pollution and leads to overexploitation of local resources and overuse of tourism facilities. Related to destination choice are travel mode and route choices, which contribute to traffic congestion and air pollution. At destinations, tourists' on-site activities may also have a negative impact through resource consumption, waste generation, and facility overuse. Travel experiences are major influences on tourists' posttravel evaluations. Such evaluations influence future tourist behavior.

The overview of the environmental impact of tourist behavior suggests the complexity of measures to achieve sustainable tourism development. It is necessary to propose a combination of policies to address the diverse impacts of tourism. In addition, because the various dimensions of tourist behavior interact, any given policy influences the whole choice process and its resulting environmental impacts. To obtain an accurate evaluation of the policy effect, a comprehensive view of the whole tourism process before, during and after travel is required.

7.3 Framework of Tourist Behavior Analysis

Tourist behavior plays an important role in influencing tourism development and whether its interaction with the environment is positive or negative. It is therefore essential to gain a thorough understanding of tourist behavior to provide appropriate insights into tourism policy decisions.

Tourists' travel decisions usually involve a number of separate but interdependent choices over time and across space. Recently, a growing number of studies have been conducted focusing on different aspects of tourist behavior, such as tourism participation (Alegre et al. 2010), destination choice (Nicolau and Mas 2008), travel mode (Kelly et al. 2007) and route choice (Fujiwara and Zhang 2005; Lew and McKercher 2002), length of stay (Barros and Machado 2010; Thrane 2012), and activities during travel such as shopping and dining (Kemperman et al. 2009). However, because tourists face many choices and have to deal with spatial and temporal constraints and a degree of uncertainty, it is argued that tourist choice behavior is a multidimensional process and that decisions about these dimensions of behavior are interdependent (Dellaert et al. 1998).

Therefore, to gain a thorough understanding of tourist behavior, it is necessary to represent these interdependences systematically and logically and to incorporate choice aspects into a system. The most systematic framework of tourist behavior analysis so far has been proposed by Woodside and Dubelaar (2002). They conceptualized a framework that consists of a multiphase process starting with information search and use, followed by travel to a destination, on-site experiences and activities, and posttravel evaluation. However, relevant research focusing on the integrated modeling of tourist behavior is currently very limited.

Under such circumstances, this study attempts to construct a model system incorporating all the major choice aspects of tourist behavior and taking all

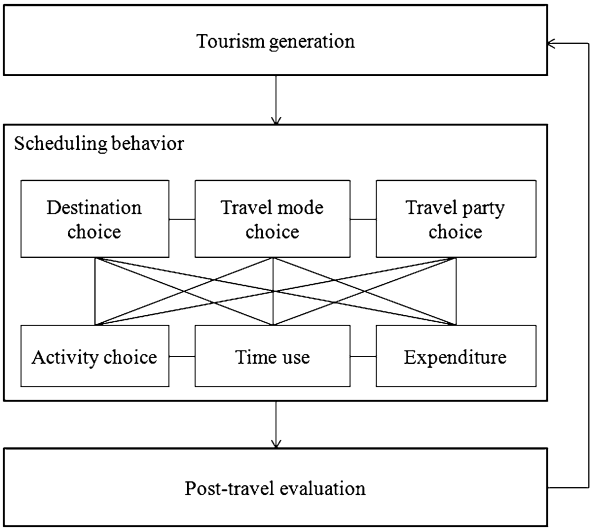

Fig. 7.1 Framework of tourist behavior analysis

multifaceted dependences and interactions into account. Figure 7.1 shows the framework for this study.

In the first stage, individuals recognize a need and are motivated to participate in tourism. A variety of factors influence this participation, including individual and environmental factors (Crompton and Ankomah 1993). The former include individual demographics, personality traits, lifestyles, values and emotions, while the latter are external factors including social, cultural, and market variables. All of these factors shape individuals' tourism motivation and have an impact on their decision to participate in tourism.

Subsequent to this decision is scheduling behavior, which involves a variety of choice aspects. To illustrate these aspects of behavior, we classify them into several dimensions: spatial choice, resource allocation, and social contexts.

Spatial choice usually has several levels according to spatial scale. Some choices are made before travel (e.g., destination, travel mode, and accommodation), while others are usually made during travel (e.g., route, and activities during travel, such as shopping and dining). As Seddighi and Theocharous (2002) have mentioned, a spatial choice needs a multistep decision-making process. A tourist is usually faced first with several destination alternatives when deciding to travel, and when that is determined, with a choice of travel mode. Although these choices can be made at different times, they may interact. Outcomes of first choices may influence subsequent choices. For example, a tourist first chooses a destination and then chooses accommodation considering prices and hotel room availability at the destination.

Time and money are the main resources for travel activities. Because of the availability and scarcity values of these two resources, participation in various activities is constrained. Resource allocation decisions include both long-term and short-term aspects. Long-term decisions concern when to travel, how long to stay and how

much to spend. Short-term decisions are mainly those made when traveling (time and money allocation). Because of limited time and finance, tourists must arrange and participate in the planned activities in a satisfactory order at a satisfactory time and must allocate a satisfactory length of time and amount of money to derive maximal satisfaction. Resource allocation behavior can directly constrain or expand the number and range of potential activities and the intensity to which individual activities can be experienced (Pearce 1988). Because the planned activities are usually conducted in different places, constraints 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. If traveling with other people, tourists must be influenced by coupling constraints, which refer to the necessity for remaining with companions at a specific place and point in time. Another aspect of social contexts 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 evaluate their trip. Experiences during travel are the major factors influencing these evaluations. Postconsumption evaluations result in a feeling of satisfaction or dissatisfaction (Westbrook and Oliver 1991), which strengthens or weakens attitudes toward the destinations visited and may in turn affect expectations for future visits (Kozak 2001). The tourists may also communicate information on their experiences to people around them (word-of-mouth information).

This study aims to incorporate all the major choice aspects related to tourist behavior into an integrated system (Fig. 7.1), which will contribute to a better understanding of complexity and interdependences involved in tourist behavior. It is expected that the result will enable policy makers to evaluate the effectiveness of policies in a systematic way.

7.4 Case Studies in Japan

In Japan, the site of this case study, the tourism industry directly and indirectly generated 7.5 % of GDP and 9.6 % of jobs in the year 2009 (Japan Tourism Agency 2010). In addition to its tremendous economic impact, the tourism industry has also contributed to infrastructure development, regional revitalization and cooperation. Especially in recent years, rural areas in Japan have suffered from depopulation. The development of the tourism industry in these rural areas supports those who have suffered from the negative effects of depopulation. However, the development of the tourism industry has also caused serious environmental problems. Because many people in Japan choose to travel during Golden Week (also called Large Consecutive Holiday, which is a collection of four national holidays within 7 days between the end of April and the beginning of May), the temporal imbalance (especially the concentration) of tourism demand usually causes serious traffic congestion, overuse of tourism resources and damage to natural features.

For the purposes of achieving sustainable development of tourism industry, the "Tourism Nation Promotion Basic Law" was enacted in January 2007, and the Japanese government developed the "Tourism Nation Promotion Basic Plan" as a master plan for a tourism nation to promote various measures in a comprehensive and systematic manner. The plan proposed various policies to revitalize tourism development and to minimize negative environmental impacts at the same time. In this chapter, two case studies will be introduced to analyze tourist behavior related to these policy issues.

In the first case study, a dynamic analysis is conducted to represent three stages of tourists' choices: tourism participation, destination, and travel mode. In Japan, encouraging participation in domestic tourism has been a central political issue for many years. On the other hand, visits to domestic tourist destinations have followed an unbalanced regional trend. At the same time, various transport policies have been proposed to encourage travel. Under such policy considerations, it becomes important to represent tourism participation, destination choice and travel mode choice in combination. However, tourism demand shows monthly variations. To date, the above three aspects of tourism have not been satisfactorily analyzed in a dynamic fashion. Aiming to provide a better understanding of interrelated tourist behavior and a scientific tool to support tourism policy decisions, this study jointly analyzed the above three aspects of tourists' choices by building a dynamic nested logit (NL) model that takes the influence of state dependence into account.

The second case study focuses on tourists' time allocation decisions concerning various activities during travel. Careful reviews suggest a lack of temporal studies in the field of tourism research, including its long-term aspects (e.g., period, life cycle, and cohort effects) and short-term aspects (e.g., duration and timing) (Zhang et al. 2006). Therefore, recognizing the importance of developing an integrated tourism behavior model, this study focuses on the poorly represented temporal aspects of tourists' behavior, especially decisions about time allocation for activities during travel. Understanding tourists' time-use decisions is useful for transport decisions on improvements in transport services for convenient participation in activities and the effective use of time allocated to activities. Because different tourism activities have different impacts on the environment, investigation of tourist's time use during travel could provide a tool to estimate the overall environmental impact of tourism activities.

7.4.1 Case Study 1: Dynamic Analysis of Three-Stage Tourist Choices

Tourists' travel decisions usually involve a number of choices made over time and across space (Dellaert et al. 1998), including whether to participate in tourism, where to go (destination choice), how to go (travel mode choices), and with whom to go (travel party choice). Although the above choices can be made at different times, they may interact. Outcomes of first choices may influence subsequent

choices. Therefore, tourists' choice behavior should be regarded as a multistage choice process that consists of a number of separate but interrelated choices. Furthermore, tourist behavior may be interrelated over time and may show state dependence. In other words, tourists' previous behavior may influence current behavior. The purpose of this study is to analyze tourists' three interrelated choices (whether to travel, destination, and travel mode) jointly and to examine the influences of state dependence and other factors on these three choices.

7.4.1.1 A Nested Logit Model with Three Levels

In this study, tourist behavior is analyzed over a 1-year period divided into 12 waves (each month is a wave). In each wave, tourism participation, destination choice and travel mode choice are jointly analyzed using a nested logit (NL) model. The NL model has often been applied to incorporate logically interdependence among the behavioral elements with the help of expected maximal utility (i.e., a logsum variable or inclusive value). In this study, 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 the third level. The joint probability of an individual's choice at wave t can be described as:

$$P_{nt} = P_{nt}(y)P_{nt}(d|y)P_{nt}(j|d) \tag{7.1}$$

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

The third-level travel mode choice probability follows a standard multinomial logit equation and can be represented as:

$$P_{nt}(j|d) = \frac{exp(V_{jt}/\theta_d)}{\sum_{j'} exp(V_{j't}/\theta_{d'})} \tag{7.2}$$

where V_{jt} represents the observable components of the utility function of travel mode j in 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). A larger value of θ_d suggests greater 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 of travel mode choice V_{jt} are specified as:

$$V_{jt} = \alpha_{jt} + \lambda_j y_{jt'} + \sum_h \beta_h v_h \tag{7.3}$$

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, and v_h is the hth attribute describing travel mode choice.

The second-level destination choice probability can be derived as:

$$P_{nt}(d|y) = \frac{exp((V_{dt} + \theta_d \Gamma_{dt})/\theta_p)}{\sum_{d'} exp((V_{d't} + \theta_d \Gamma_{dt'})/\theta_p)} \tag{7.4}$$

$$\Gamma_{dt} = log(\sum_{j'} exp(V_{j't}/\theta_{d'})) \tag{7.5}$$

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

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

$$V_{dt} = \lambda_d y_{dt'} + \sum_g \beta_g X_g \tag{7.6}$$

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

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

$$P_{nt}(y=1) = \frac{exp(V_{pt} + \theta_p \Gamma_{pt})}{1 + exp(V_{pt} + \theta_p \Gamma_{pt})} \tag{7.7}$$

$$P_{nt}(y=0) = 1 - P_{nt}(y_{nt} = 1) \tag{7.8}$$

$$\Gamma_{pt} = \log(\sum_{d'} \exp((V_{d't} + \theta_d \Gamma_{dt'})/\theta_p)) \tag{7.9}$$

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

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

$$V_{pt} = \alpha_t + \lambda_p y_{p(t-1)} + \sum_s \beta_s z_s \tag{7.10}$$

where α_t is the constant term for the tth month, $y_{p(t-1)}$ is a dummy variable representing whether tourism participation occurred in the $(t-1)$th month (1, if occurred; 0, otherwise), and z_s is the sth explanatory variable.

The log-likelihood function is given as follows:

$$LogL = \sum_{n=1}^{N} \sum_{t=1}^{T} \ln((P_{nt}(y=1) \times (P_{nt}(d|y) \times P_{nt}(j|d)^{\delta_{jt}})^{\delta_{dt}})^{\delta_{nt}} \times P_{nt}(y=0)^{1-\delta_{nt}}) \tag{7.11}$$

where N indicates the total number of samples; T is the number of waves (equal to 12 in this case); δ_{nt} is a dummy variable that equals 1 when individual n participates in tourism in the tth wave, otherwise 0; δ_{dt} is a dummy variable that equals 1 when individual n chooses destination d in the tth wave, otherwise 0; and δ_{jt} is a dummy variable that equals 1 when individual n chooses travel mode j in the tth wave, otherwise 0. The resulting model can be estimated using a standard maximum likelihood estimation method.

7.4.1.2 A Web-Based Nation-Wide Tourist Behavior Survey

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 according to the distributions of age, gender, and residential areas (prefectures) across the whole population in Japan.

The survey included very detailed information on individual tourism behavior in 2009. Respondents were first asked whether they had been on a holiday trip of more than one night in 2009. If the answer was yes, the respondents were asked specific questions about their tourism behavior in every month, including destination choice, travel date, motivation, travel mode, travel time, number in party, duration of stay, expenditure, and satisfaction. Sociodemographic data were also collected, including gender, age, occupation, education level, annual income, marital status, household composition, residential area, and car ownership. As a result, responses to 1,253 questionnaires were obtained.

The data characteristics are summarized in Table 7.1. It was observed that 64.0 % of the respondents were married, 46.4 % had a university degree, 51.8 % were employed, and 77.2 % had a private car. Table 7.1 also shows the distribution of travel frequency for each month and the whole year. Because we focus on domestic tourism in this study, information about international travel was eliminated. It can be seen that 25 % of the respondents took one tourist trip in the year 2009, and 40.5 % took more than one trip. In total, 65.5 % of the respondents participated in tourism during the whole year. The tourism participation percentage in each month is highest in August (19.6 %) and lowest in February (7.6 %). The percentages in May, September and October are quite high (around 15 %), while those in January and June are quite low (below 10 %).

In the survey, the destination alternatives are 47 prefectures in Japan. In this study, the 47 prefectures are further categorized into 18 zones based on geographical vicinity for the sake of model estimation (extremely low shares for some prefectures are avoided). Figure 7.2 gives a map of 18 zones.

Travel mode choice includes five alternatives: aircraft, *Shinkansen* (bullet train), railway, bus and car. Figure 7.3 shows the travel mode choice percentages to 18 destinations. We can see that aircraft is the dominant mode (97.7 %) to destination 18. As Okinawa prefecture is an island located separately from other parts of Japan, the surface travel modes are not available to get there. Likewise, destination 1 (Hokkaido

Table 7.1 Summary of data characteristics

Individual characteristic	Percentage	Travel frequency		Percentage
Gender	–	January	0	91.9
Male	49.6	–	1	7.6
Female	50.4	–	>1	0.5
Age	–	February	0	92.4
<30 years old	20.3	–	1	7.1
30–50 years old	34.0	–	>1	0.5
>50 years old	45.7	March	0	87.5
Occupation	–	–	1	11.9
Employed	51.8	–	>1	0.6
Student	3.5	April	0	88.7
Housewife	21.5	–	1	10.6
Others	23.2	–	>1	0.7
Education level	–	May	0	84.1
Having a university degree	46.4	–	1	15.1
Having no university degree	53.6	–	>1	0.8
Marital status	–	June	0	91.3
Single	36.0	–	1	8.5
Married	64.0	–	>1	0.2
Household income	–	July	0	88.4
<3 million yen/year	19.2	–	1	11.1
3–8 million yen/year	56.3	–	>1	0.5
>8 million yen/year	24.5	August	0	80.4
Household size	–	–	1	18.3
1 member	18.1	–	>1	1.3
2 members	28.4	September	0	85.2
3 members	24.9	–	1	14.0
>3 members	28.6	–	>1	0.8
Car ownership	–	October	0	84.3
Have a private car	77.2	–	1	14.8
Have no car	22.8	–	>1	0.9
Travel companions	–	November	0	86.0
Travel alone	13.2	–	1	13.4
Travel with others	86.8	–	>1	0.6
Travel motivation	–	December	0	86.2
Nature motivation	68.6	–	1	12.6
Culture motivation	29.7	–	>1	1.2
Shopping motivation	48.2	Whole year	0	34.5
Sport motivation	6.0	–	1	25.0
–	–	–	>1	40.5

prefecture) is an island located at the north end of Japan, and it is difficult for tourists from other places to get there by surface modes. On the mainland of Japan (destinations 2 to 17), car is the main travel mode for most of the destinations except 6, 7, 13 and 14. Because these destinations cover three important cities—namely, Tokyo, Kyoto and Osaka—the public transport systems in these regions are well developed.

Fig. 7.2 Map of destination alternatives

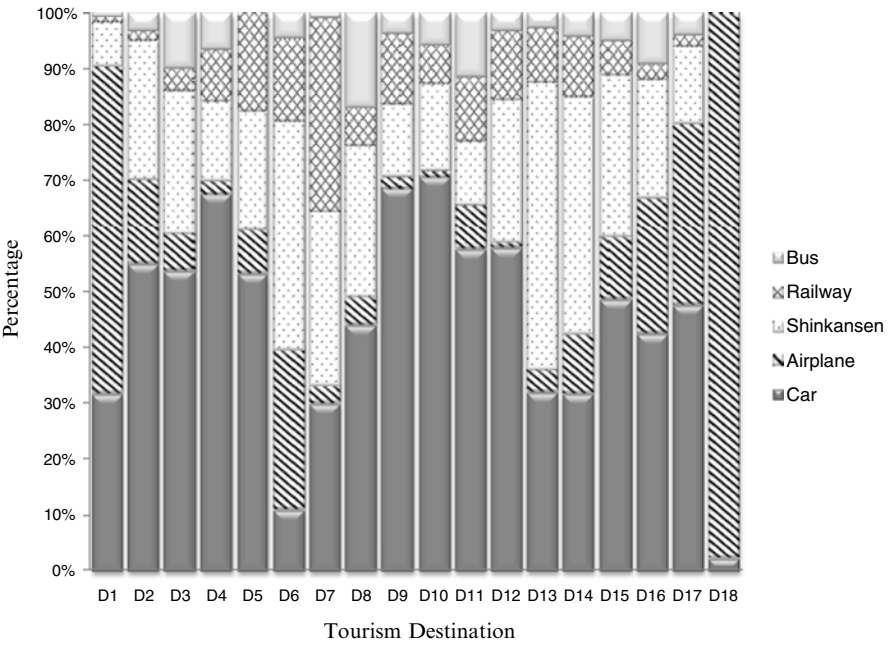

Fig. 7.3 Travel mode choice percentages to 18 destinations

Of travel mode choice percentages over 12 months, private car is the most popular travel mode for holiday trips, accounting for 30–50 % over 12 months. Especially in May, August and October, almost half of tourists choose to travel by car. The second most popular mode is aircraft, with a 20–36 % share over 12 months. In contrast to car, the aircraft share is lower in May, August and October than in other months. A considerable number of tourists choose to travel by *Shinkansen*, and this share is stable over 12 months (around 20 %). The least common travel modes are railway and bus. The shares for these two modes are around 8 % and 5 %, respectively.

7.4.1.3 Explanatory Variables

Based on the literature and previous research, variables including age, marital status, education level, household size, annual income, car ownership, and length of holiday are used as variables to explain utility of tourism participation in this study.

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

For travel mode choice, age, travel with others (yes or not), 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. The list of explanatory variables is given in Table 7.2.

7.4.1.4 Clarifying Behavioral Mechanisms and Factors

Estimation results are presented in Table 7.3. It can be seen that parameters of most of the explanatory variables are statistically significant at the 90 % or 95 % levels. Model accuracy is good enough to show the effectiveness of the model (i.e., McFadden's rho-squared is 0.64).

1. 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 a negative influence on participation during month t. This first confirms that tourism participation behavior surely depends on past behavior and then suggests that participation in a given month reduces the probability of participation in the following month.

   For destination choice, state dependence shows positive influence. Because the destination alternatives in this study are prefectures, the positive parameter for state dependence does not necessarily mean that tourists tend to

Table 7.2 Explanatory variables: nested logit model

Tourism participation	
Age	Actual age
Married	1: married; 0: otherwise
Education	1: having a university degree; 0: otherwise
Household size	Number of household members
Income	Annual household income (Million yen/year)
Car ownership	1: having 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

make repeated visits to exactly the same tourism attractions. They may acquire information about the area on an initial visit and return in a subsequent trip to visit places that were planned but not visited on the previous tour.

In terms of travel mode choice, the parameters of state dependence for all five alternatives are positive, which suggests persistence in tourists' travel mode choices. This kind of persistence is especially notable in the choice of bus but less so in the choice of aircraft.

2. Inclusive Value Parameters
   The estimated inclusive value parameters are all between 0 and 1, and it is especially notable that 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 greater influence of choice behavior on the lower level rather than the 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 travel mode choice. Taking Hokkaido prefecture (Destination 1) as an example, the parameter is the highest at 0.64, indicating that choice of this destination is influenced most strongly by

Table 7.3 Model estimation results: nested logit model

–	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	−2.55	*	–	–	–	–	–	–	–	–	–	–
Married	0.29	*	–	–	–	–	–	–	–	–	–	–
Education	0.09	+	–	–	–	–	–	–	–	–	–	–
Household	−0.08	+	–	–	–	–	–	–	–	–	–	–
Income	0.01	+	–	–	–	–	–	–	–	–	–	–
Car	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	+						

(continued)

Table 7.3 (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							1,253					

Inside the parenthesis: null hypothesis "parameter=1"; Outside the parenthesis: null hypothesis "parameter=0"

+ significant at the 90 % level; * significant at the 95 % level

travel mode choice. Travel mode choice conditioned on this destination shows weaker substitution. In other words, the change in the utility of an alternative travel mode in this destination nest could dramatically change the probability of the destination being chosen. Weaker substitution suggests that tourists tend to use a certain mode when they travel to this destination. As explained previously, Hokkaido prefecture is separated from the rest of Japan, so it is difficult for tourists to reach it by surface modes. However, for some destinations, such as 5, 6, 7 and 8, the inclusive value parameters are rather small, suggesting that the choices of these destinations are less influenced by travel mode choice, or that travel

mode choice conditioned on these destinations shows higher substitution. This may be because the transport systems in these regions are well developed, and it is therefore convenient for tourists to use any of the five travel modes to reach them.

The result that tourist destination choice is influenced by travel mode choice is consistent with previous research. Fukuda and Morichi's (2002) study also confirmed the interrelations between these two choice aspects. They developed a modeling framework for 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 a NL model can incorporate multiple-choice alternatives and at the same time can represent the relation between various aspects of choice.

3. Influential Factors

This section discusses the influences of explanatory variables.

(a) Tourism participation: It can be seen that the parameters of marital status, education level, income and car ownership are positive and statistically significant at the 95 % level, while the parameters of age and household size are negative. This may be because married people have a partner to travel with, and a person with a higher education level may have more interest in tourism, may have better access to information and may possess greater knowledge of tourism. A higher income level can eliminate monetary constraints on participation in tourism, and car ownership makes travel more convenient. The negative parameter for household size implies that individuals from larger households may face financial constraints and family commitments, so they are less likely to participate in tourism. From the value of the constant term, we can see that if other variables are the same, individuals are more likely to travel in March, April, May, August, September and October and less likely to travel in January, February, June, July, November and December.

(b) 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 may find destinations visited by more people more attractive. In addition, the number of festivals has been proved to have a significant influence on destination choice. The parameter for the interaction term of household size and distance is negative, which implies that tourists from larger households are more likely to choose destinations that are closer to their residential area. This may be to reduce the overall travel cost, and group decisions may be easier if they choose closer destinations.

In the existing research, it has been argued that motivation for tourism has an important impact on destination choice. In this survey, respondents were asked about their motivation to travel, including motivations for nature activities, cultural activities, shopping and sport activities. This study examines the influence of motivation by incorporating it as an interaction term with certain

destination characteristics. The results show that tourists with motivation for nature activities are more likely to choose destinations with larger areas devoted to nature parks. Tourists motivated by cultural activities are more likely to choose destinations with more cultural facilities. Tourists with the motivation of shopping are more likely to choose destinations with more department stores, while those with sporting motivations are more likely to choose destinations with more sports facilities. Density of sport facilities is especially influential, which indicates that increasing the number of sports facilities will significantly increase the number of tourists motivated by sports.

(c) Travel mode choice: The results show that travel time and cost have negative influences 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). 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 older tourists are more likely to choose aircraft or bus travel. This result is intuitive, because older people may find it exhausting to drive a long distance. Regarding the influence of travel companions, it is confirmed that those who travel with others are more likely to use private cars, potentially to reduce the overall travel cost or because cars can provide a private space in which to communicate.

The constant terms reflect the inherent preference for travel mode (car is chosen as the base mode). The negative parameters for all public transportation modes indicate that tourists have a preference for car travel if other variables are equal. This preference is especially strong in certain months, such as May and October. This may be caused by unobserved factors. To promote the use of public transportation modes, it is essential to understand these unobserved factors.

7.4.1.5 Policy Implications of Modeling Analysis

These results have important policy implications. Research into tourism participation behavior offers one means of assessing the latent demand for tourism, which is essential for both tourism forecasting and policy making. In Japan, the question of how to encourage people to make full use of their free time to participate in tourism activities, especially domestic tourism, has recently become an important political issue. The Japanese government has proposed various policies to encourage people to participate in tourism. This study provides a tool for evaluating the effectiveness of these policies. An additional policy implication is that the study addresses environmental issues resulting from the temporal imbalance of tourism demand. Specifically, the result indicates that length of national holiday has a significant influence on decisions to participate in tourism. Based on this result, having region-specific Golden Weeks (where the Golden Week holiday falls at different times according to region) will certainly eliminate the concentration of tourism demand.

Destination management is of concern because there is an imbalance in visits to regional domestic tourist destinations. It is increasingly important to encourage tourists to visit local attractions. Especially in recent years, the rural areas of Japan have suffered from depopulation. The development of a tourism industry in these rural areas will support those who have suffered from depopulation. Some strategies of destination management can be derived from this study. For example, a prefecture can market its tourism destinations by targeting larger families in nearby regions; some prefectures (e.g., Hokkaido, Yamanashi, Shizuoka and Okinawa) could increase their numbers of tourist arrivals dramatically by improving their transportation services.

Furthermore, policy implications of promoting public transport modes can be drawn from this study. Because travel mode choices conditioned on some destinations (e.g., Chiba, Tokyo, Kanagawa, Toyama, Ishikawa, and Fukui) show higher substitution, the use of public transport modes to these destinations will increase significantly if the service levels of public modes increase.

The analysis also offers a tool for forecasting future tourist behavior. Because the population in Japan is aging, tourism patterns are expected to change accordingly. In addition, the demographic change may also change motivations for tourism, which will further influence tourist behavior. Improved understanding of such changes will provide insights into policy decisions.

7.4.2 Case Study 2: Analysis of Tourists' Time Allocation in Multiple Activities

It is expected that tourists will participate in many kinds of activities during trips to satisfy various needs. Temporal constraints force tourists to decide how to make effective use of limited time during travel. Therefore, tourists need to decide which activities to participate in and how long to spend on each activity. Considering tourists' joint decision-making process concerning their participation in activities and time allocation, this study adopts Bhat's (2008) multiple discrete–continuous extreme value (MDCEV) model.

7.4.2.1 Multiple Discrete-Continuous Extreme Value Model

When traveling, a tourist under a time constraint may decide to participate in several activities. The tourist needs to decide which activities to participate in and how much of his/her limited time to allocate to each activity. For such a decision, it is expected that the tourist will 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 to which a tourist can allocate time. Let t_k be the time spent on activity k $(k=1, 2, \ldots, K)$. 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 to tourist n of allocating time to all K activities,
ψ_{nk} : the marginal utility of tourism activity k when tourist n allocates 0 time to it,
t_{nk} : the time that tourist n allocates to activity k,
γ_k : a satiation parameter,
z_{nk} : a set of attributes characterizing activity k performed by tourist n, and
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 Eq. (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 activity k and tourist n. As time allocation t_{nk} increases, the marginal utility will decrease. This diminishing marginal utility reflects tourists' satiation when the duration of one activity increases. The parameter γ_k is introduced to influence this kind of satiation. A larger value of γ_k indicates the lower diminishing rate of marginal utility, which means that tourists are less likely to be satiated with activity k and to be willing to spend more time on it. Tourists may have different levels of satiation with different activities, which can be represented by the parameter γ_k.

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 total time. Then the Lagrangian function can be defined to solve the optimal time allocation:

$$L = \sum_k \gamma_k \, exp(\beta z_{nk} + \varepsilon_k) \, \mathrm{In}(\frac{t_{nk}}{\gamma_k} + 1) - \lambda(\sum_{k=1}^{K} t_k - T) \tag{7.15}$$

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

$$\begin{aligned} &exp(\beta z_{nk} + \varepsilon_k) / (\frac{t_{nk}}{\gamma_k} + 1) - \lambda = 0, \quad if \; t_{nk} > 0 \\ &exp(\beta z_{nk} + \varepsilon_k) / (\frac{t_{nk}}{\gamma_k} + 1) - \lambda < 0, \quad if \; t_{nk} = 0 \end{aligned} \tag{7.16}$$

When tourist n participates in activity k, $t_{nk} > 0$; otherwise, $t_{nk} = 0$. This represents discrete choice (i.e., whether to participate in activity k). Because the tourist should participate in at least one of the K activities, let activity 1 be one to which a tourist allocates a nonzero 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 Eq. (7.17) into Eq. (7.16) and taking logarithms, the Kuhn–Tucker condition can be rewritten as:

$$\begin{aligned} V_k + \varepsilon_k &= V_1 + \varepsilon_1, \quad if\ t_{nk} > 0\ (k = 2,3,\ldots,K) \\ V_k + \varepsilon_k &< V_1 + \varepsilon_1, \quad if\ t_{nk} = 0\ (k = 2,3,\ldots,\boldsymbol{K}) \end{aligned} \tag{7.18}$$

where, $V_k = \beta z_{nk} - ln(\frac{t_{nk}}{\gamma_k} + 1)\ (k = 1,2,3,\ldots,K)$.

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 a tourist participates in M instances of the K activities given ε_1 can be calculated based on the study of Bhat (2008):

$$P(t_2,t_3,\ldots,t_M,0,0,\ldots,0) = [\prod_{k=1}^{M}(\frac{1}{t_k+\gamma_k})][\sum_{k=1}^{M}(t_k+\gamma_k)][\frac{\prod_{k=1}^{\boldsymbol{M}} e^{V_k}}{(\sum_{k=1}^{K} e^{V_k})^M}](M-1)!. \tag{7.19}$$

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

$$LogL_n = \sum\nolimits_n \ln\{[\prod_{k=1}^{M}(\frac{1}{t_k+\gamma_k})][\sum_{k=1}^{M}(t_k+\gamma_k)][\frac{\prod_{k=1}^{M} e^{V_k}}{(\sum_{k=1}^{K} e^{V_k})^M}](M-1)!\}. \tag{7.20}$$

To estimate Eq. (7.20), the maximum likelihood estimation method is applied. The MDCEV model has a simple and elegant closed form that is easy to estimate.

7.4.2.2 A Tourist Time Use Survey

The data used in this study were collected from a tourist time use survey 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 the prefecture. The interview survey was conducted over four seasons in 1 year at 16 major tourism destinations in Tottori. As a result, 761 valid responses were obtained, including data on individual characteristics and travel-related attributes. Individual characteristics included gender, age, occupation, and residential location, while travel-related attributes included destination, travel party, travel mode, departure time, duration of stay and expenditure. The survey included very detailed information on each tourist attraction visited, from which we obtained information about

Table 7.4 Explanatory variables: MDCEV model

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

Table 7.5 Model estimation results: MDCEV model

Explanatory variables	Nature	Hot spring		Culture		Heritage		Shopping		Sport		Amuse	
Constant term	–	−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	*

+ significant at the 90 % level; * significant at the 95 % level

the activities in which that tourist participated. In this study, the activities are divided into seven categories: nature (e.g., sand dunes), hot springs, culture (e.g., museums), heritage, shopping, sport and amusement. It was observed that 75 % of the tourists participated in more than one activity during their trips.

7.4.2.3 Factors and Variations in Activity Preference

By excluding missing values of explanatory variables, a final sample of 612 responses was used in this study. The model is estimated by the maximum likelihood estimation method using R statistical software. To estimate the model, it is necessary to fix all the parameters to zero for one alternative. In this study, activity 1 (visit natural attractions) is chosen as the base alternative; all the parameters for activity 1 are fixed at zero. Explanatory variables for the developed model are shown in Table 7.4 and estimation results are presented in Table 7.5. The log-likelihood value at convergence of the final 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.

The parameters of age are significant at the 95 % level for activities involving hot springs, culture or heritage. The positive parameters indicate that as age increases, the baseline preference of these three activities also increases. The effects of employment status indicate that employees have a higher baseline preference for sporting activities, while they have a lower baseline preference for amusement activities. The parameters of residential area suggest that tourists residing outside Tottori Prefecture have a lower baseline preference for all activities, especially for sporting activities. The results for travel experience indicate that travel experience has a significant effect on shopping and sporting activities. Tourists who have visited Tottori Prefecture previously 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 sporting 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 springs, culture and sporting activities. This indicates that tourists are more likely to participate in these activities with others. The parameters of travel season show that the baseline preferences for hot springs, culture, shopping and sport are higher in the winter season. The main sporting activity for tourists in Tottori is skiing, so it is reasonable that tourists are more willing to participate in sport in winter.

The satiation parameter γ_k is significant for all activities at the 95 % level. The results indicate the high level of satiation for shopping and the low level of satiation for sport and hot spring activities. This is consistent with the observation that for shopping, the participation rate is high but the average duration is short, while for sport, the participation rate is low, but if the tourist participates in sport, the duration is quite long. This variation in satiation levels for activities cannot be reflected without the parameter γ_k.

7.4.2.4 Implications for Sustainable Tourism

Enjoying tourism activities is an important factor in quality of life for many people, and it is therefore important for public policy makers, including transport policy makers, to support such activities. 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 findings of this study provide some insights into tourists' time-use behavior. Some implications for tourism management can be drawn from the results. Tourists' behavior patterns are an important issue for tourism destination management. Specifically, the kinds of activities in which tourists participate, how long they spend on each activity and the factors that influence behavior can provide information on the management of tourism infrastructure (e.g., how many pieces of infrastructure need to be constructed/improved, or the business hours for tourism

attractions). This information may contribute to the promotion of tourism and thereby increase revenue. Moreover, the study offers a tool to forecast demand for attractions when the current situation changes. In addition, because tourist activities have varying degrees of impact on the environment, forecasts of tourists' time allocation could provide a tool for estimating overall environmental impact resulting from tourism activities. Policies for sustainable tourism development could be proposed accordingly. For example, an environmental tax on tourism could be introduced based on the analysis of tourist energy consumption (e.g., consumption of transport, food, water, or accommodation) and pollutant emissions derived from their activities.

7.5 Conclusion

A successful tourism policy relies heavily on policy makers' understanding of tourist behavior and the incorporation of this knowledge into the decision-making process. Tourists' travel decisions usually involve a number of interrelated choices made over time and across space under various constraints, including choices of destination, composition of the travel party, dates of departure, choices of accommodation and travel modes, travel routes, activities, and time and money expenditure. To obtain a better understanding of tourist behavior, it is necessary to deal with all the relevant choice aspects of tourist behavior in an integrated way.

The chapter provides two integrated behavior models that can be used to evaluate the effects of policies to achieve sustainable tourism development. The first model jointly represents three interrelated tourist choices: whether to travel (i.e., tourism participation), destination, and travel mode. The model is based on a nested logit model with three levels: tourism participation choice, destination choice and travel mode choice. Choices regarding tourism participation and destination are indispensable for exploring economic sustainability and social equity. Travel mode choice, together with the other two parts, provides information necessary for calculating environmental loads from tourism activities. On the other hand, the second model considers tourists' time use involving multiple activities by using an MDCEV model. Such time-use behavior analyses are required for evaluating economic and environmental sustainability because time use is closely linked with spending at destinations. Information on type of activity and length of time is necessary to calculate the environmental loads of tourism activities. The most important feature of the above two models is that the behavioral interdependences are explicitly incorporated into the modeling process. This feature allows policy makers to evaluate comprehensively the heterogeneous effects of a specific tourism policy on various aspects of tourists' choice decisions as well as the synergic and/or canceling out effects of a combination of policies in a consistent way. Furthermore, it is also possible to predict changes in tourist behavior that occur because of changes in travel style and socioeconomic situations, and to explore the kinds of policies that could effectively support the sustainable growth of tourism demand.

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