Representing Tourist’s Time Use Behavior
Based on a Multiple Discrete-Continuous Extreme Value Model

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Abstract: This study applies a multiple discrete-continuous extreme value (MDCEV) model to analyze tourist’s time use behavior involving multiple activities. 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 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.

Key Words: tourism, time use, multi-activity participation, MDCEV model

1. INTRODUCTION

In many countries tourism has becoming an increasing important sector of the development. The importance of tourism industry to the nation can be illustrated by its various economic impacts, providing a vital source of employment, income and foreign exchange. In the perspective of regional development, tourism industry can contribute to infrastructure construction, regional revitalization and cooperation. In Japan, the case study area in this study, it has been becoming a very important political issue how to promote tourism activities from both the international and domestic perspective. From the international perspective, the annual number of outbound tourists is always 2-3 times of inbound tourists. In the year 2008, for example, the number of outbound tourists was 15.99 million, while the number of inbound international visitors to Japan was only 8.35 million. To date, the Japanese government has made various efforts to further promote its inbound tourism. However, since international tourists, especially Asian tourists, are more likely to visit internationally and nationally famous attractions in Japan, it is still difficult to attract them to visit other attractions located
in various regions. Additional efforts are still required to encourage international tourists to visit local attractions. At the same time, it becomes more and more important to further encourage domestic tourists to visit local attractions. For this purpose, for example, a social experiment on toll-free expressways, mainly located in local areas across the whole countries, has just started since June 2010 and will be temporally implemented until the end of March 2011, where 50 sections of 37 expressways across the nation have become toll-free (http://www.mlit.go.jp/common/000116387.pdf). One of the purposes of this experiment is to encourage people to participate in tourism activities using expressways in order to activate regional economy.

For both international and domestic tourism, enriching the knowledge of tourists’ activity-travel patterns (e.g., where to go, how and with whom to go, what to do, how long to stay) is important not only to tourism marketing, but also to tourism destination management (including management of existing transportation infrastructure), which could contribute to the promotion of tourism generation. Generally speaking, tourists’ decision process is a complex multi-dimensional process consisting of a number of separate but interdependent choices that are made at different points in time and across space (Woodside and MacDonald, 1994; Dellaert et al., 1998). To represent such complex decisions, needless to say, some integrated modeling approaches are required. On the other hand, careful reviews suggest a lack of temporal studies, including long-term aspects (e.g., period effects, life cycle effects, and cohort effects) and short-term aspects (e.g., duration and timing) (Zhang et al., 2006). Therefore, recognizing the importance of developing integrated tourism behavior models, this study 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 study 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 paper, 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.

The rest of this paper is organized as follows. Section 2 gives a brief review of relevant existing studies. Section 3 describes the multiple discrete-continuous extreme value (MDCEV) model used in this study. The model is estimated using the data collected in Japan and model
estimation results are discussed in Section 4. Finally, conclusions are summarized along with a discussion about important future research issues in the last section.

2. REVIEW

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. Tourists’ temporal decisions include both long-term and short-term aspects. The long-term decision concerns, for example, when to go for a travel before departure. The short-term decision mainly refers to the decisions made during the travel, e.g., time use decision on different activities. Most of the existing studies focused on the total time that tourist spend during a tour trip (Alegre, et al., 2006; Gokovali, et al., 2007; Garcia, et al., 2008). However, few studies investigated what kinds of activities tourists participate in and how they allocate their limited time to different activities. 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 et al. (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., Kitamura, 1984; Zhang, et al., 2002, 2004, 2005; Bhat, 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. Similarly, Copperman et al. (2007) used MDCEV model to examine the out-of-home time use patterns of children. Because MDCEV model
assumes diminishing marginal utility as the level of consumption of any particular alternative increases, it allows for multiple discreteness and in theory it is applicable to resource allocation among any number of categories. Besides time use behavior, it can also be applied in other research aspect. For example, Fang et al. (2008) adopted MDCEV model to analyze household’s vehicle choice and usage. Jeong et al. (2011) identified household energy usage patterns using MDCEV model. In Pinjari’s (2011) study, MDCEV model is applied to analyze household annual expenditure patterns in various transportation-related expenses. 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. Relevant to this study, the advantage of the model developed by Fujiwara and Zhang 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.

The above review suggests that the MDCEV model 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 convincing way.

3. METHODOLOGY

Within a tour trip, it is expected that a tourist may decide to participate in several activities under the time constrain. 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 \( k \) \((k=1,2,\ldots,K)\). 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:

\[
U_n = \sum_{k=1}^{K} \gamma_k \psi_{nk} \ln(t_{nk} + 1)
\]  

(1)

\[
\psi_{nk} = \exp(\beta z_{nk} + \epsilon_k)
\]  

(2)

where,

- \( U_n \): the total utility of tourist \( n \) to allocate time to all the \( K \) activities
- \( \psi_{nk} \): 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 \( k \)
\( \gamma_k \): a satiation parameter (the larger the value of \( \gamma_k \), 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 \( n \)

\( \epsilon_k \): 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:

\[
\frac{\partial U_{nk}}{\partial t_{nk}} = \psi_{nk} t_{nk} (\gamma_k + 1)
\]  

From equation (3), we can see that \( \psi_{nk} \) 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 \( \gamma_k \) is introduced to influence this kind of satiation. The larger value of \( \gamma_k \) 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 \( \gamma_k \).

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:

\[
L = \sum_{k=1}^{K} \gamma_k \exp(\beta z_{nk} + \epsilon_k) \ln(\frac{t_{nk}}{\gamma_k} + 1) - \lambda (\sum_{k=1}^{K} t_k - T)
\]

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

\[
\exp(\beta z_{nk} + \epsilon_k) / (\frac{t_{nk}}{\gamma_k} + 1) - \lambda = 0, \quad \text{if } t_{nk} > 0
\]

\[
\exp(\beta z_{nk} + \epsilon_k) / (\frac{t_{nk}}{\gamma_k} + 1) - \lambda < 0, \quad \text{if } t_{nk} = 0
\]

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:

\[
\lambda = \exp(\beta z_{n1} + \epsilon_1) / (\frac{t_{nk}}{\gamma_k} + 1)
\]

Substituting equation (6) into equation (5) and taking logarithms, the Kuhn-Tucker condition can be rewritten as:
\[V_k + \varepsilon_k = V_t + \varepsilon_t, \quad \text{if} \quad t_{nk} > 0 \quad (k = 2,3,\ldots,K),\]
\[V_k + \varepsilon_k < V_t + \varepsilon_t, \quad \text{if} \quad t_{nk} = 0 \quad (k = 2,3,\ldots,K),\]
\[\text{where} \quad V_k = \beta\varepsilon_{nk} - \ln\left(\frac{t_{nk}}{\gamma_k}\right) + 1 \quad (k = 1,2,3,\ldots,K) \tag{7}\]

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

\[P(t_2,t_3,\ldots,t_M,0,0,\ldots,0) = \left[\prod_{k=1}^{M} \left(\frac{1}{t_k + \gamma_k}\right)\right] \left[\sum_{k=1}^{M} (t_k + \gamma_k)\right] \left[\frac{\prod_{k=1}^{M} e^{V_k}}{\left(\sum_{k=1}^{M} e^{V_k}\right)^M}\right] (M-1)! \tag{8}\]

Therefore, the log likelihood function of the model is:

\[\text{Log}L_m = \sum_m \ln\left[\prod_{k=1}^{M} \left(\frac{1}{t_k + \gamma_k}\right)\right] \left[\sum_{k=1}^{M} (t_k + \gamma_k)\right] \left[\frac{\prod_{k=1}^{M} e^{V_k}}{\left(\sum_{k=1}^{M} e^{V_k}\right)^M}\right] (M-1)! \tag{9}\]

To estimate equation (9), maximum likelihood estimation method is applied. The MDCEV model has a simple and elegant closed form which is easy to estimate.

**4. MODEL ESTIMATION AND RESULTS**

**4.1 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 data characteristics are summarized in Table 1. Nearly 80% of the sample travelled with family and more than 90% of the sample travelled by private car. 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 worth noticing 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 2 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 1 Summary of data characteristics

<table>
<thead>
<tr>
<th>Individual attributes</th>
<th>Percentage</th>
<th>Trip attributes</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td>Transportation mode</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>55.4</td>
<td>Public transportation</td>
<td>7.9</td>
</tr>
<tr>
<td>Female</td>
<td>44.6</td>
<td>Private car</td>
<td>92.1</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>Travel party</td>
<td></td>
</tr>
<tr>
<td>Young (&lt;30)</td>
<td>8.3</td>
<td>Alone</td>
<td>5.2</td>
</tr>
<tr>
<td>Middle (30-50)</td>
<td>40.7</td>
<td>With family</td>
<td>78.3</td>
</tr>
<tr>
<td>Old (&gt;50)</td>
<td>51.0</td>
<td>With friends</td>
<td>16.5</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td>Travel season</td>
<td></td>
</tr>
<tr>
<td>Employee</td>
<td>37.6</td>
<td>Winter</td>
<td>21.2</td>
</tr>
<tr>
<td>Student</td>
<td>1.2</td>
<td>Other season</td>
<td>78.8</td>
</tr>
<tr>
<td>Housewife</td>
<td>14.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>46.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential location</td>
<td></td>
<td>Number of activities</td>
<td></td>
</tr>
<tr>
<td>Inside the prefecture</td>
<td>41.3</td>
<td>1</td>
<td>25.0</td>
</tr>
<tr>
<td>Outside the prefecture</td>
<td>58.7</td>
<td>2</td>
<td>31.9</td>
</tr>
<tr>
<td>Travel experience</td>
<td></td>
<td>3</td>
<td>21.5</td>
</tr>
<tr>
<td>Visited Tottori before</td>
<td>44.5</td>
<td>4</td>
<td>17.0</td>
</tr>
<tr>
<td>Otherwise</td>
<td>55.5</td>
<td>&gt;4</td>
<td>4.6</td>
</tr>
</tbody>
</table>
Table 2 Activities participation percentage and duration

<table>
<thead>
<tr>
<th>Activity</th>
<th>Participation Percentage (%)</th>
<th>Mean Duration of Participation (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature</td>
<td>44.4</td>
<td>184</td>
</tr>
<tr>
<td>Hot spring</td>
<td>36.3</td>
<td>227</td>
</tr>
<tr>
<td>Culture</td>
<td>39.4</td>
<td>102</td>
</tr>
<tr>
<td>Heritage</td>
<td>17.2</td>
<td>106</td>
</tr>
<tr>
<td>Shopping</td>
<td>63.7</td>
<td>86</td>
</tr>
<tr>
<td>Sport</td>
<td>5.6</td>
<td>347</td>
</tr>
<tr>
<td>Amuse</td>
<td>28.3</td>
<td>119</td>
</tr>
</tbody>
</table>

Figure 1 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 1 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 2 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 2 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.
Figure 3 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

Figure 3 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.

4.2 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>
<thead>
<tr>
<th>Table 3 Explanatory variables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual Attributes</strong></td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Employment status (dummy variable)</td>
</tr>
<tr>
<td>Residential area (dummy variable)</td>
</tr>
<tr>
<td>Travel experience (dummy variable)</td>
</tr>
<tr>
<td><strong>Travel Related Attributes</strong></td>
</tr>
<tr>
<td>Travel mode (dummy variable)</td>
</tr>
<tr>
<td>Travel party (dummy variable)</td>
</tr>
<tr>
<td>Travel season (dummy variable)</td>
</tr>
</tbody>
</table>
4.3 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 4. 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.

4.4 Variable Effects

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 $\gamma_k$, 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 $\gamma_k$.

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).

5. 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.
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.

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.

REFERENCES