NON-WORK RELATED TRAVEL BEHAVIOR OF MOUNTAIN AREA RESIDENTS

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Abstract: In this paper we discuss travel behavior of rural residents, particularly the city visit behavior of their discretionary trips. A simple conceptual model is proposed. A simulation study shows that the times of city visits on holidays depend on individual preference rather than the distance between the city and the village, and on both individual preference and the distance on working days. Actual investigation is executed by two travel diary surveys of 240 persons for seven consecutive days in a mountain area of Shikoku Island, Japan. It is found that 94% of households visit the city Matsuyama, consuming more than two hours drive in the round trip, at least once a week to get better goods or services, and their average number of trips is close to that of urban residents. Discrimination analyses between city visitors and those who remain in the village generally support the simulation results.

Key Words: rural transport, travel behavior, travel diary survey

1. INTRODUCTION

Road investment projects should generally be assessed by cost benefit analysis from the viewpoint of national efficiency. The benefits are usually measured in terms of users' travel time saving, vehicle operating cost saving and traffic safety benefits. The amount of these benefits relies heavily on the traffic volume projected on the planned road. Then the indices of cost benefit analysis always remain small in rural areas where traffic generation density is much lower. On the other hand, it is also desirable to correct the regional unbalance and to meet natural minimums in terms of fairness through the expected effects of a road project from the interregional equity viewpoint (SGRIE 2000). The effects of the project have various and intensive impacts on people living along the road. Such effects may have to be evaluated in a different way from traditional cost benefit analysis. Accordingly, we must fully understand the impact of effects on residents through their travel behavior studies to discuss the efficiency and equity problem of rural area road investments. However, rural transports takes second place to urban transport in many countries, with much less

being written about it (Sharon and Gordon 1998). Much of travel behavior analyses have been conducted in urban areas while such studies are not seen in rural areas as far as the authors know (Bowman and Ben-Akiva 2001).

In this paper we try to understand travel behavior of rural residents, particularly their city visit behavior. Here, it is assumed that rural residents have the identical preference inclination to that of urban residents. The main characteristics of the rural area are the lack of enough quality facilities to supply better goods and/or services indispensable for their daily lives. These places are located in remote distance from cities.

A simple conceptual model that allocates residents' discretionary time to city stay and their home village stay on every day in a week is presented in Section 2. Travel diary surveys are executed in a mountain area of Japan where one town and three villages are located. These surveys and results investigated are shown in Section 3. The conclusion and the future works are shown in section 4.

2. DISCRETIONARY TIME CONSUMPTION ALLOCATION BETWEEN A CITY AND A MOUNTAIN AREA

2.1 Analysis of Travel Behavior and Time Consumption

The studies to understand people's travel behavior focusing on the relationships between activities pursued and the time consumption or monetary consumption for them started in the 1960s (Becker, 1965, De Serpa, 1971). The successors of these studies have improved the model with regard to measurement (Kraan 1996, Fujii et al. 1999). But time itself has not always been treated realistically in their studies. The time constraint is not represented on each day but as a mass over days even if the range of time covers a week or a month.

Some scholars have insisted that peoples' travel behavior depends on the time cycle of a day or a week. Kitamura (1984) developed a simple time allocation model for a day. The model is based on the consumers' utility maximizing theory subject to the time constraint on a day. There have been many travel demand studies both theoretical and empirical (Bowman and Ben-Akiba 2001). However, there are fewer studies about travel behavior in a week's length of time. One reason is the difficulty in making models. We have to introduce a dynamic theory into the model or at least some devices to consider some dynamic aspects of week long travel behavior. Another reason is the awkwardness of the corresponding surveys. We need at least one week long consecutive travel diary data and it puts considerable burden on the respondents. Hirsh et. al. (1986) presented a dynamic scheduling model. They found some interesting characteristics of dynamic travel behavior by an empirical examination of shopping behavior but their model itself is abstract. Here, we present a utility maximizing model of a mountain area resident by time allocation between city stay and village stay subject to the time constraint on every day in a week.

2.2 Discretionary Time Allocation Model in a week

(a) Premise

Consider the question "How often do mountain residents visit the city to consume their discretionary time in a week and how long do they stay there on each day in a week?" Here, we propose a conceptual model to answer the question.

Suppose a resident who is living and working in a small village located in a mountain area. The resident has five consecutive working days and two holidays at weekend as do usual salaried workers. His/her village is denoted i. The service levels of daily life facilities are insufficient for his/her full needs. It is assumed too that there are some villages in the mountain area but the service levels of facilities in each village are identical. Then if the resident finds facilities unsatisfactory in his/her village he/she has to visit a city where he/she can consume every kind of services and goods needed. The city is denoted j and the distance between the city j and the village i is represented by t_{ij}. Of course, the resident can get some fundamental goods and services in his/her village without the burden of travel, or can enjoy his/her leisure time at home or in the neighborhood. Suppose the magnitude of activities is simply measured by the volume of time consumption. Then, the resident needs discretionary time consumption at both places. Representing the level of utility caused by time consumption at both places using the volume of staying time at t_i and t_j, his/her utility function U is shown below:

$$U = (t_j)^{\alpha}(t_i)^{\beta}, \tag{1}$$

where α and β are weighting parameter, $\alpha+\beta=1$.

The amount of available time for discretionary activities is limited. The one for each working day is denoted as T_w and that for a holiday T_e. Usually T_e is much longer than T_w. It is assumed that the resident can visit a city at most once in a day including holidays. The model is discussed for working days and holidays.

(b) Model for working days

Let us consider the working day k. Denoting the volume of time consumption for discretionary activities in the city w^k_j and that in a village w^k_i, the utility function U_k is shown below:

$$U = (w^k_j)^{\alpha}(w^k_i)^{\beta}. \tag{2}$$

Assume the resident visits the city on the k th working day. Time constraint on the day is shown below:

$$w^k_j + w^k_i + 2t_{ij} \le T_w. \tag{3}$$

Maximizing U^k subject to the constraint (3), the following equations are obtained:

$$w^k_j = \alpha(T_w - 2t_{ij}), \tag{4}$$

$$w^k_i = \beta(T_w - 2t_{ij}), \tag{5}$$

$$U^k = \alpha^{\alpha}\beta^{\beta}(T_w - 2t_{ij}). \tag{6}$$

However, it is natural to doubt whether the resident will visit the city if it is located too far away compared to the amount of his/her time budget. Here, we introduce the assumption of an imaginary time consumption utility on the day. Suppose the resident does not visit the city actually. The level of utility measured by equation (2) would be zero because the amount of city staying time is zero. Then we assume that the resident originally intended to visit the city but he/she postpones the visit until a holiday in the weekend, Saturday. When the resident actually executes the city visit on the holiday, the deducted utility term from Saturday to the working day is represented by the following term:

$$\alpha(T_w - 2t_{ij})^{\alpha} e^{-\gamma(6-k)},$$

where γ is discount rate per day. The term is called an imaginary utility since the city visit is not actualized on the working day, but the level of utility is measured using this term. In this case the resident can consume the entire of T_w in the village. Then the level of utility on the k th working day is shown as follow:

$$U^k = \alpha^\alpha (T_w - 2t_{ij})^\alpha e^{-\gamma(6-k)} T_w^\beta . \tag{7}$$

Summarizing the discussion, it is assumed that the resident has two options. One is to execute the city visit on a working day. Then the level of utility is represented by (6). Another is to postpone his/her city visit plan to Saturday. Then the level of utility on the working day is represented by (7).

Denoting the city visit on the k th working day by $Y_k = 1$, and only staying in the village by $Y_k = 0$, his/her city visit plan for five working days is represented a 0-1 Integer vector,

$$^t\boldsymbol{Y} = (Y_1, Y_2, Y_3, Y_4, Y_5) \tag{8}$$

His/her utility over time working days are shown as follows:

$$U^w(\boldsymbol{Y}) = \sum_{k=1}^{5} \left\{ \alpha^\alpha \beta^\beta (T_w - 2t_{ij})\ Y_k + \alpha^\alpha (T_w - 2t_{ij})^\alpha e^{-\gamma(6-k)} T_w^\beta (1 - Y_k) \right\}. \tag{9}$$

The number of trip to the city is as follows:

$$2\sum_{k=1}^{5} Y_k .$$

(c) Model for holidays

The amount of city staying time to be transferred to the first holiday, Saturday is shown as follows:

$$\sum_{k=1}^{5} \alpha (T_w - 2t_{ij})(1 - Y_k).$$

Here it is assumed that the resident can make a plan to allocate the amount of two days discretionary time between city visit and village stay while he/she must keep each day time budget constraint. Denoting the amount of city staying time on Saturday and Sunday by e^1_j and e^2_j respectively and that of the village staying time by e^1_i and e^2_i, the utility function for discretionary activities on holidays is shown as follows:

$$U^e = \left\{ e^1_j + e^2_j - \sum_{k=1}^{5} \alpha\ (T_w - 2t_{ij})(1 - Y^k) \right\}^\alpha \left\{ e^1_i + e^2_i \right\}^\beta \tag{10}$$

The time budget constraints are shown as follows:

$$e^1_j + e^1_i \le T_e - 2t_{ij} \qquad (e^1_j > 0), \tag{11}$$

$$e^2_j + e^2_i \le T_e - 2t_{ij} \qquad (e^2_j > 0), \tag{12}$$

$$e^1_i = T_e \qquad (e^1_j = 0), \tag{13}$$

$$e^2_i = T_e \qquad (e^2_j = 0). \tag{14}$$

There are four possible conditions to be examined to obtain the optimal solution of the equation (10)-(14).

(i) $e^1_j > 0$, $e^1_i \ge 0$ and $e^2_j > 0$, $e^2_i \ge 0$,

$$U^e_1 = \alpha^\alpha \beta^\beta \left\{ 2(T_e - 2t_{ij}) - m\alpha(T_w - 2t_{ij}) \right\}, \tag{15}$$

where $m = \sum_{k=1}^{5}(1 - Y^k)$.

The number of trips is four in this case.

(ii) $e_j^1 > 0$, $e_i^1 \geq 0$ and $e_j^2 = 0$, $e_i^2 = T_e$,

$$U_2^e = \alpha^\alpha \beta^\beta \{2T_e - 2t_{ij} - m\alpha(T_w - 2t_{ij})\}, \tag{16}$$

The number of trips is two in this case.

(iii) $e_j^1 = T_e - 2t_{ij}$ $e_i^1 = 0$ and $e_j^2 = 0, e_i^2 = T_e$,

$$U_3^e = \{T_e - 2t_{ij} - m\alpha(T_w - 2t_{ij})\}\{T_e\}^\beta \tag{17}$$

The number of trips is two in this case.

(iv) $e_j^1 = T_e - 2t_{ij}$, $e_i^1 = 0$ and $e_j^2 > 0, e_i^2 \geq 0$. (18)

The value of utility and the number of trips are identical to that of the case (i).

Then the maximal utility value generated by a resident's discretionary time allocation plan between a city and a village over a week is shown as below:

$\max[U^w(Y) + \max\{U^e_1, U^e_2, U^e_3, U^e_4\}]$.

2.3 Numerical Simulation

A numerical simulation using T_w = 4 hours, T_e = 12 hours, is executed varying the value of, α from 0.1 to 0.9 by 0.1 and t_{ij} from 10 minutes to 110 minutes. Figure 1 shows the time consumption patterns on holidays by the value of α and t_{ij}. It is seen that the time consumption pattern calculated depends on the value of α rather than the distance between the city and the village. Residents living in villages over all distances visit the city one day and stay for some shorter time smaller than or equal to the whole amount of available time on a holiday when the value of α is smaller equal to 0.3. On the other hand, they visit the city for two days regardless of the distance between the city and the village when the value of α is larger than or equal to 0.7. When the value of α lies in a range from 0.4 to 0.6 residents living in most villages chose a plan to stay one day in the city consuming the entire available time of the day and another day in their village for the entire holiday. Figure 2 shows the times of city visit on working days by the value of α and t_{ij}. It is apparent that they visit many times when the value of α is larger. The times of city visit decrease as the distance between the city and the village becomes larger for most of the range of α value. Thus, their city visit behavior depends on the distance from the city on working days but not on holidays. It is supposed that the difference is caused by the amount of available discretionary time in a day. It is shorter on working days and their behavior is affected by the travel time needed for a city visit. On the contrary, discretionary time is much longer on holidays and their behavior is not strongly affected.

3. A SURVEY IN A MOUNTAIN AREA AND INVESTIGATION RESULTS

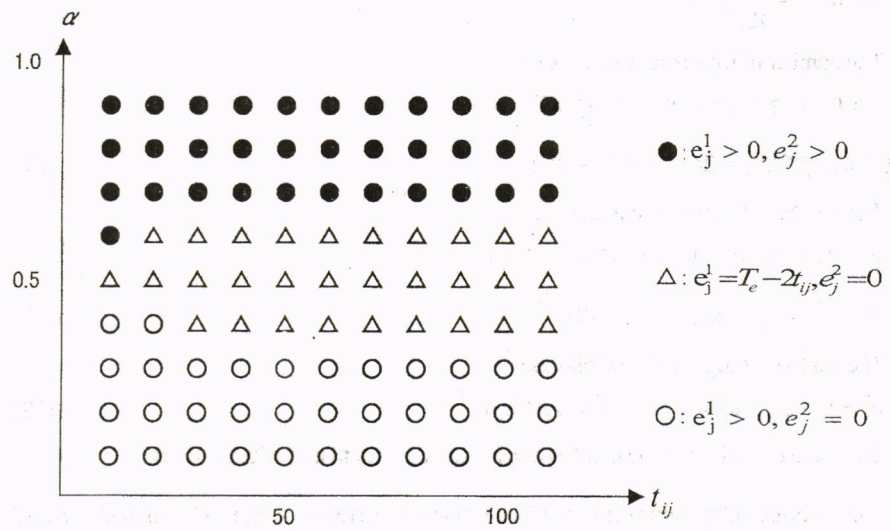

Figure 1. The time consumption pattern on holidays.

Figure 2. The times of city visit on working days.

3.1 Study Area

The study area is shown in Figure 3. There are four municipalities. Kuma town, Mikawa village,Yanadani village and Omogo village. They are located in a mountain area of the central Shikoku Island in Japan. Kuma town is about 34km far from Matsuyama, a major city in Shikoku with population of 470 thousand. It takes 54 minutes from Matsuyama to Kuma (Road time table 2000). It takes longer than expected considering that the average speed in rural area is usually faster than in the city. This is because a steep path, 714m at the highest point between Matsuyama and Kuma, burdens drivers with its winding drive. The three villages are farther than Kuma, Mikawa is 46km from Matsuyama and takes 70 minutes, Yanadani is 55km, 80 minutes and Omogo 62km, 91minutes. The entire population of the study area was 12,779 in 1995 and the total area 583.7 km^2. The average population density is 22-people/ km^2 and this number is about one fifteenth of the national average 332-people/ km^2.

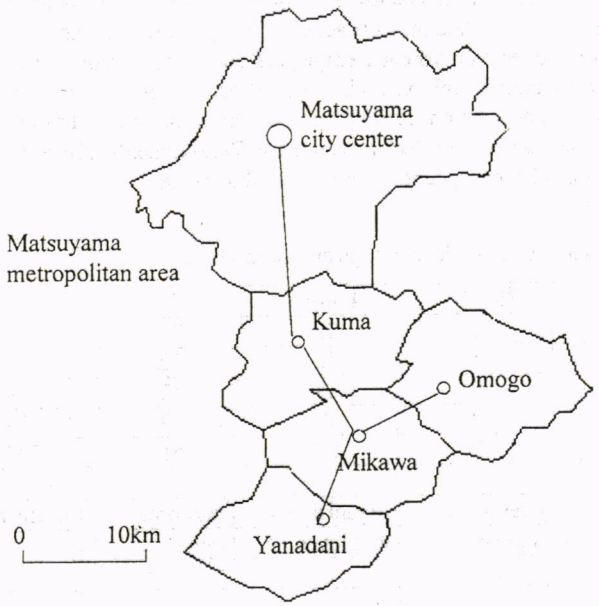

Figure3. Study area

The population has decreased in the area by 13.4% from 1985 to 1995 while the national population has increased 3.7% in the term. The rate of elder people (over 65 years old) to the whole population is 31.9% in the area while the national rate is 14.5%. The proportion of workers by industry is 26.3% in agriculture, 6.1% in forestry, 14.5% in construction and 5.3% in government in the study area. These numbers exceed those of the nation 5.3% in agriculture, 0.1% in forestry, 10.3% in construction, 3.4% in government. Thus the study area is less densely populated, depopulated and economically inferior. These demographic characteristics are quite common in Japanese mountainous areas.

The rate of commuters to Matsuyama city to all the workers living in these municipalities is 4.3% for Kuma and 2.7% for Mikawa. The rate in Yanadani or Omogo is too small to be reported in the

National Census. The study area is judged to be located out of Matsuyama metropolitan area considering these numbers.

3.2 Travel Behavior Survey

Travel Behavior Surveys are executed in the study area using an ordinary travel diary method. One survey was done for 60 households, 120 adult persons, working in Kuma from May 20th to 26th in 1999. Another survey was done for the workers in three villages of Omogo, Yanadani, and Mikawa. 20 households, 40 adult persons at each village are chosen and their travel behavior from October 20th to 26th in 2000 is investigated. The households surveyed are needed to have at least two adult persons. Actually, we asked local government workers of these municipalities to record their travel diary with their partners. In this study we assume rural residents have the identical preference inclination to that of urban residents. Therefore, we intended to investigate travel behavior of active people who have an inclination to keep their living standards up to the same level as that of people living in cities while they are actually living in a remote mountain area. We focused our main survey respondents on younger employees and local government offices have mostly young employees concentrated work places in the study area. Table 1 shows the number of effective respondents by age and occupation. These proportions are quite different from those of all residents in the study area. The number of effective samples is 59 households, 116 respondents for Kuma data and 60 households, 117 respondents for the three village data.

Table 1 .The number of effective respondents by age and occupation.

age	-29	30-39	40-49	50-	total
Kuma	33	37	25	21	116
Mikawa	7	11	12	10	40
Yanadani	4	5	18	12	39
Omogo	9	9	12	8	38
total	53	62	67	51	233

occupation	company employee	government employee	organization employee	part time employee	independent
Kuma	12	61	4	10	6
Mikawa	6	20	2	2	1
Yanadani	9	9	6	2	5
Omogo	8	20	0	2	2
total	35	110	12	16	14

	farmer	house wife	total
Kuma	3	20	116
Mikawa	1	8	40
Yanadani	1	7	39
Omogo	2	4	38
total	7	39	233

3.3 Outline of Survey Data

The total number of trips is 3,328 for Kuma data and 3,451 for the three villages data. The average number of trips per day of each respondent is 4.07 for Kuma data and 4.30 for the three villages data. These numbers are similar to that of Matsuyama city residents, 4.02 investigated by the same kind of travel diary survey in 1999 (Kashiwadani, 2000). Thus, the basic characteristic of trip generation to pursue daily activities of residents in the mountain area is almost identical to that of city residents.

Hereafter we discuss tour data instead of trip data to analyze city visit behavior of respondents. A tour is a chain of consecutive trips which starts from a trip home base and ends there. The tours of respondents are classified into city visit and inside visit according to the location of the main destination of a tour. A tour is judged to be a city visit when the main destination is located in Matsuyama metropolitan area or other municipalities outside of the study area and to an inside visit when it is located inside of the study area. Matsuyama metropolitan area is composed of Matsuyama city and the connected municipalities. Actually 305 tours to outside of the study area are observed excluding business trips. The main destinations of 288 of these tours are located in Matsuyama metropolitan area. The destinations of 9 tours of the remaining of 17 tours are located farther away than Matsuyama city and respondents have to go through Matsuyama city to arrive there. Therefore, the number of tours whose destination has no relation to Matsuyama metropolitan area is only 8, 2.6% of observed city visit tours. These 305 tours are all regarded as city visits because we considered that they go outside the study area due to dissatisfaction with facilities in the area.

Examining the data in terms of household unit, almost every household visits Matsuyama metropolitan area for shopping, amusement, or personal business at least once a week. The number is 55 of the 59 households in Kuma, 18 of the 20 households in Mikawa, 19 of the 20 households in Yanadani and all 20 households in Omogo. Thus, it is indispensable for the most households in the mountain area to visit Matsuyama metropolitan area at least once a week to accomplish their daily lives even if their residences are farther away from the city.

The average number of city visit tours by age is 1.79 for respondents less equal to 29, 1.39 for 30-39, 1.04 for 40-49, and 0.78 for more equal to fifty years old respectively. It is seemed that younger respondents visit city more times than older respondents. 33 of 53 respondents less equal to 29 are single and their average number of city visit tours is 1.73. The other 20 respondents are married and their average number of city visit tours is 1.90. Most respondents more than thirty years old are married. Thus, age is an important demographic character for the average number of city visit but the condition of married or single dose not effect the number. The average number of city visit tours by occupation is 1.35 for full time workers, 0.81 for part time workers, 0.95 for independent and farmers, and 1.54 for house keeping wives. House keeping wives visit city more often than other occupation respondents. They often visit with husbands on holidays and sometimes do by themselves on weekdays. The results suggest that they have more discretional time to their disposal.

3.4 City Visit Behavior of Employees

We are interested at city visit travel behavior of respondents on working days and holidays respectively. But it is difficult to make exact distinctions between working days and holidays as for part time workers, independent and farmers, and house keeping wives. Then employee worker respondents are chosen from all respondents to investigate off work discretionary travel behavior both on working days and holidays. They are full time workers employed by local governments,

private companies and local public organizations. The total number of employee respondents is 157. Table 2 shows the number of respondents by the number of holidays and the number of city visits on holidays. Actually some of them have more than two holidays in the week surveyed but they are classified into two days. The rate of city visitors to the whole respondents by municipality is 0.808 for Kuma, 0.708 for Mikawa, 0.625 for Yanadani and 0.846 for Omogo except the respondents who have no holiday in the week surveyed. These numbers are rather different among municipalities. The number of Yanadani looks smaller while that of Omogo larger in spite of its farther distance. However, the average rate of city visit times to the total number of holidays is 0.624 for Kuma, 0.571 for Mikawa, 0.512 for Yanadani and 0.583 for Omogo. These numbers are generally similar except for Yanadani. Table 3 shows age distribution of employee respondents. The rate for those more than forty years old is 0.342 for Kuma, 0.516 for Mikawa, 0.666 for Yanadani and 0.500 for Omogo. It is suggested that the rate of city visitors or the average city visit times depends on demographic characteristics rather than geographical distances.

Table 2. The number of employee respondents by number of holidays and city visits on holidays

No. of holidays	2	2	2	1	1	0	total
No. of city visits	2	1	0	1	0	0	
Kuma	24	31	5	4	9	1	74
Mikawa	10	10	5	2	4	0	31
Yanadani	6	6	5	3	4	0	24
Omogo	6	13	3	3	1	2	28
total	46	60	18	12	18	3	157

Table 3. Age distribution of employee respondents

age	-29	30-39	40-49	50-	total
Kuma	26	23	19	6	74
Mikawa	7	8	8	8	31
Yanadani	4	4	10	6	24
Omogo	8	6	8	6	28
Total	45	41	45	26	157

Table 4 shows the calculation results of a discrimination analysis between city visitors and non-visitors for all days data including working days and holidays by use of a qualification theory model. Here, the number of non-visitors is 30. But the family partners of 24 respondents of them are observed to visit city. The most significant variable is age. It is seen that younger people tend to be city visitors while old people do not. The value of the range for location is about one fourth of that for age. It is less significant than age. The value is about the same as that of the variable of living with old people or male/female classification. It is not easy to explain the effect of location because the category score value is not in order of distance. On the contrary, the effects of other variables are reasonable. Females tends to be city visitors, people who have their own cars do, people living without children or old people do. Table 5 shows the calculation result of a discrimination analysis between city visitors and non-visitors for holidays. The most significant variable is age as well. The value of range for location is the second largest in this case but it is still less than half of that for age. It is remarkable that the category score value of location is largest at Omogo and smallest at Yanadani in both tables 4 and 5.

Table 4. Result of a discrimination analysis, city visitors vs. non-visitors, on all days.

item	category	frequency	score	range	Partial corelation
gender	male	95	-0.22641	0.57332	0.13485
	female	62	0.34691		
age	-29	45	0.62568	2.39814	0.38304
	30-39	41	0.61968		
	40-49	45	-0.16619		
	50-	26	-1.77246		
free access to car	yes	140	0.04872	0.44996	0.07033
	no	17	-0.40124		
live with children	yes	61	-0.18888	0.30890	0.07154
	no	96	0.12002		
live with old	yes	25	-0.61042	0.72603	0.12990
	no	132	0.11561		
location	Kuma	74	-0.01349	0.66639	0.10224
	Mikawa	31	0.14320		
	Yanadani	24	-0.42500		
	Omogo	28	0.24140		
constant	non-visitor	30	- 0.93031		
	visitor	127	0.21976		
Correlation ratio			0.20445		

Table 5. Result of a discrimination analysis, city visitors vs. non-visitors, on holidays.

item	category	frequency	score	range	Partial corelation
gender	male	92	-0.13591	0.33758	0.07028
	female	62	0.20167		
age	-29	45	0.89564	2.32869	0.33766
	30-39	40	0.43663		
	40-49	44	-0.49870		
	50-	25	-1.43305		
free access to car	yes	137	0.07024	0.63625	0.08787
	no	17	-0.56601		
live with children	yes	59	0.12240	0.19842	0.04163
	no	95	-0.07602		
live with old	yes	23	-0.32419	0.38111	0.05828
	no	131	0.05692		
location	Kuma	73	0.05401	1.05562	0.13552
	Mikawa	31	-0.21306		
	Yanadani	24	-0.49568		
	Omogo	26	0.55994		
constant	non-visitor	36	-0.73752		
	visitor	118	0.22501		
Correlation ratio			0.16595		

Table 6 shows the number of city visitors on working days. Most of them also visit the city on holidays. The rate of city visitors on working days to the whole respondents by municipality is

0.243 for Kuma, 0.161 for Mikawa, 0.083 for Yanadani and 0.214 for Omogo. The rank order is identical to that of holidays. Table 7 shows the calculation result of a discrimination analysis of city visitors on the working days. Here, the employee respondents who visit on working days including visitors on only working days are discriminated from those who visit on holidays but do not on working days. Here, the variable, which indicates whether they live with old people or not is rejected because the result with the variable showed the wrong sign on the variable. Age is the most significant variable as well in this case. However, the category score value is not necessarily in order of age. Then the significant level of age looks a little weaker compared to the former results. On the contrary, the range of category score for location is relatively larger compared to that for age. The value of range for location is about 70% of that for age. The rank of category score is in the order of Kuma, Omogo, Mikawa and Yanadani. The result shows that employees in Kuma are most likely to visit the city. It is reasonable and the rank order corresponds to that of distance from Matsuyama city, except Omogo. Thus, the location variable is more significant in travel behavior analysis on working days compared to the results on holidays.

Table 6. The number of city visitors on working days.

	on both holidays and working days	on only working days	total
Kuma	14	4	18
Mikawa	4	1	5
Yanadani	2	0	2
Omogo	6	0	6
total	26	5	31

Table7. Result of a discrimination analysis, city visitors on working days vs. city visitors on holidays but non-visitors on working days.

item	category	frequency	score	range	Partial corelation
gender	male	72	-0.18591	0.42928	0.05952
	female	55	0.24337		
age	-29	43	-0.88117	1.71322	0.19462
	30-39	37	0.83206		
	40-49	34	-0.08223		
	50-	13	0.76152		
free access to car	yes	115	-0.05395	0.57102	0.04679
	no	12	0.51706		
live with children	yes	49	0.36295	0.59095	0.07655
	no	78	-0.22801		
location	Kuma	63	-0.30768	1.22335	0.11189
	Mikawa	25	0.25944		
	Yanadani	16	0.91567		
	Omogo	23	-0.07622		
constant	non-visitor	96	-0.48367		
	visitor	31	0.15619		
correlation ratio			0.07544		

4. Conclusion

Recently rural road investments have often been criticized as being too inefficient in Japan. On the contrary, residents and local governments in rural areas argue that road networks are an indispensable infrastructure for them, but they still remain in poorer conditions compared to urban road networks. However, their opinions sound vague in opposition to the logical cost benefit analysis. To discuss the efficiency and equity problem of road investment in rural areas the effects generated by them should be examined carefully. We need correct knowledge of rural residents' travel behavior to do so. Nevertheless there have been few studies about it so far.

In this paper we discussed travel behavior of rural residents, particularly the city visit behavior of their discretionary trips. A simple conceptual model is proposed. It is found that the times of city visit depends on individual preference rather than distance between the city and the village on holidays and on both individual preference and the distance on working days by a numerical simulation.

Actual investigation is executed by two travel diary surveys for 240 persons and for weeklong consecutive days in a mountain area of Shikoku Island, Japan. Most of respondents are local government employees and their family partners. They are younger compared to the age distribution of the whole population in the area and their preference is expected to be similar to that of urban residents. The investigation results support the expectation by the facts that 94% of households visit Matsuyama, consuming more than two hours drive in a round trip, at least once a week to get better goods or services, and their average number of trips is close to that of urban residents. Discrimination analyses between city visitors and those who remain in the village suggest that age is the most significant variable. The effect of the location variable is much weaker than that of age on city visit behavior on holidays but the degree is a slightly moderated on working days.

However, these characteristics are not necessarily strongly supposed. We should examine their city visit behavior more thoroughly and improve the analysis to develop a projection model. Particularly, the relationships between the service levels of facilities located in the mountain area and residents' city visit behavior have to be studied in the near future. We should also grasp the total characteristics of their travel behavior, including trips to destinations inside the mountain area.

ACKOWLEGEMENT

We greatly appreciate four local governments and their employees in the study area. They gladly answered the troublesome and long-term questionnaire while it may have intruded on their privacy. We also thank the Japanese Ministry of Education (grant No.12650532) and the Shikoku Construction Workers Aid Association for their financial support.

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