

## **An Attitude Analysis of Elderly People toward Mobility and Community Bus in Rural Area - Case Study of the Osaki-Kamijima Island in Japan -**

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**Abstract:** Many of the rural areas in Japan have suffered from depopulation and population aging. When elderly people will age more, it will be difficult for them to drive a car and the people who can't drive will increase. Because of this, it will be important to prepare the mobility in these areas. For measures for this problem, community buses have begun being operated in some areas. However, many of them haven't been successful because demands of elderly people for mobility and the community bus haven't understood. In this study, on the basis of two questionnaire surveys, which were carried out in the Osaki-Kamijima Island, attitudes of the elderly people to mobility and a community bus are analyzed. Through these analyses, attitudes of the elderly people to relation between mobility and quality of their life and a service level of a bus that elderly people want are shown.

**Key Words:** *elderly people, rural area, community bus*

### **1. INTRODUCTION**

Many of the rural areas in Japan have suffered from depopulation and population aging. In many of these areas, the percentages of the people who are more than 65 years old have already been more than 40% and will be increasing more in the future. When elderly people will age more, it will be very difficult for many of them to drive a car and the people who can't drive a car will increase. Because of this, it will be very important to improve the mobility for them in the rural areas.

In general, elderly people in the rural areas have a different lifestyle than the people living in urban areas. Therefore, they have different demand for the mobility. In addition, recently, many of public services which are provided by the administrations are criticized because they aren't useful for the improvement of the quality of lives of the residents. For this reason, in improving the mobility, we have to take relation between their quality of life and the mobility into consideration. Moriyama, Fujiwara and Sugie (2002) analyzed relation between level of travel service and quality of life for the elderly people in depopulated communities. However, it's difficult to recognize that they found the relation between them because the model built in this study wasn't statistically significant.

By the way, for measures for improving the mobility in the rural areas, community bus has begun being operated in some areas. However, many of these buses haven't been useful for the residents, especially elderly people, because the service level of a community bus that the people in such an area demand hasn't been understood.

Although it is difficult to find studies about a community bus which is operated in a rural area, Yanagisawa *et al.* (2004, 2005) and Deguchi *et al.* (2007) analyzed a community bus in



**Figure-1 Study Area**

a rural area. However, these studies focused not on the service level of a community bus like this study but on the process of realization of community bus. Thus the study of the service level of a community bus in a rural area can't be found.

For these reasons, for planning or improving a community bus in a rural area, we need to reveal the relation between improving the mobility and quality of life of the people, especially elderly people, and the service level of the bus they want.

In this study, two questionnaire surveys are carried out in the Osaki-Kamijima Island, which is located in the middle of the Seto-Inland Sea in Japan and has suffered from depopulation and population aging. Requests of the elderly people to the mobility and service level of a community bus are analyzed on the basis of these surveys. Through these analyses, by focusing on the relation between the mobility, other public facilities and services, it is shown how the mobility to raise the degree of the quality of the life of the elderly people should be. And also service level of a community bus that the elderly people want, such as the fare and the number of services, are made clear.

First, an outline of the Osaki-Kamijima Island which is the study area and two questionnaire surveys which were carried out in this study are explained. Next, A Structural Equation Model are built by using the data obtained from the questionnaire survey and relations between the degree of the satisfaction of the elderly people with their lives, the evaluation of the public facilities and services, and the mobility in the island are analyzed by this model. Finally, service level of a community bus that the elderly people want, for example the fare, the number of the services, time of the first bus and time of the last bus, are analyzed by employing Conjoint Analysis and the differences of the wanted service level between their profiles, such as age, gender and so on, are also analyzed.

## **2. OUTLINE OF THE STUDY AREA**

Figure-1 shows the location of the Osaki-Kamijima Island. The Osaki-Kamijima Island is located in the middle of the Seto-Inland Sea in Japan, about 10km off the coast of Takehara City which is the nearest city in the main island to the island. Table-1 indicates an outline of the Osaki-Kamijima Island. The population of the Osaki-Kamijima Island is 9,238 in 2005. Its area is about 43km<sup>2</sup>.

**Table-1 Outline of Osaki-Kamijima Island**

Location	The middle of the Seto-Inland Sea
Gross Area	43.3km <sup>2</sup>
Population	9,238 (in 2005)
Percentage of the People Who Are More Than 60 Years Old	40.4% (in 2004)
Public Transportation	Bus Services, Community Bus Services, Ferry Lines and Rapid Boats

Although there is the private regular bus service in the island, many people don't use this bus because of its expensive fare and few services. For this reason, almost all people depend on cars for the mobility in the island. In addition to this situation, there is possibility that this bus service will be stopped because the subsidy to the bus will be stopped

The ratio of the elderly people is increasing dramatically and the elderly people for whom it is difficult to drive a car for their aged are also increasing.

For a measure for these problems, especially for retaining the mobility of the elderly people, the community bus service called 'Oto-Hime Bus' has begun operating. However, this community bus hasn't been successful because this service hasn't fit the demands of the elderly people, and their life style.

It can be expected this study gives some useful ideas to not only the operation of 'Oto-Hime bus' in the Osaki-Kamijima Island but also community bus in other rural areas.

### 3. QUESTIONNAIRE SURVEYS AND DATA

In this study, two questionnaire surveys conducted in the Osaki-Kmijima Island. The outlines of these surveys are explained in this chapter.

The first survey was carried out to the elderly people, who lived in the Osaki-Kamijima Island and were more than 60 years. Though more than 65 years people generally are regarded as elderly people in Japan, more than 60 years old people were targeted in this study with a view to taking the future situation of the island into consideration. In November 2005, the questionnaire sheets were distributed to 200 elderly people chosen at random in cooperation with NPO(Non-Profit Organization) Kamijimano-Kaze, which was established to revitalize the Osaki-Kamijima Island. The purpose of this survey is to investigate the shopping behaviors of the elderly people in the island but some questions in the sheet are related to the evaluation of the facilities and the public services to support them. The main contents of the questionnaire are as follows.

- (1) Profile of the respondents (gender, age and so on)
- (2) Shopping behaviors in the island
- (3) Shopping behaviors outside the island
- (4) Shopping behaviors in case that the respondents will be not able to drive a car after more ageing
- (5) Evaluation of the respondents about the facilities and public services to support the people in the island

In this study, (5) is analyzed mainly.

161 questionnaire sheets were collected. The more than 60 years old people living in the

island are about 4000. As this result, the sampling rate is about 4%. These 161 sheets are analyzed in chapter 4.

The second survey was conducted in the island in November 2007. The purpose of this survey is to analyze the attitudes of the people in the island toward 'Oto-Hime bus and the conventional private bus. The questionnaire sheets were distributed to 1000 of more than 10 years old people chosen at random in cooperation with the Kamijimano-Kaze. The main contents of the questionnaire sheet are as follows.

- (1) Profile of the respondents (gender, age and so on)
- (2) Use attitudes of 'Oto-Hime bus' and the Conventional Private Bus
- (3) Necessity for 'Oto-Hime bus' in the future
- (4) Attitudes of the respondents toward some service levels of a community bus suggested in this survey

In this study, (4) is analyzed mainly.

697 questionnaire sheets were collected and 149 sheets which were responded by the people who are more than 60 years old are analyzed in chapter 5.

#### 4. ATTITUDE ANALYSIS OF RELATIONS BETWEEN THE FACILITIES, THE SERVICES AND THE DEGREE OF THE SATISFACTION WITH THE LIVES

##### 4.1 LATENT VARIABLES FOR EVALUATION OF THE PUBLIC FACILITIES AND SERVICES

There are 17 items in the first questionnaire sheet to survey the degree of satisfaction of the elderly people with the facilities and the public services to support their lives, such as medical facilities, the public transportation and so on. In these items, the respondents chose degree of the satisfaction with the facilities and the services from five levels: "Satisfied", "Somewhat Satisfied", "Neutral", "Somewhat Dissatisfied" and "Dissatisfied".

These items were classified into several latent variables to evaluate the public facilities and services. Table-2 shows this result. In this table, Cronback's Coefficient alphas are shown to confirm validity of classifying the 16 items into these 7 latent variables. The values of all

**Table-2 Items and Latent variables for Evaluation of Public Facilities and Services**

Items	Latent Variable Name	Cronbach's coefficient alpha
Location for Bus Stops	Mobility	0.73
The Number of Service of the Buses		
Roads and Road Network		
Sidewalks		
The Number of Meeting Places	Easiness to Use Meeting Places	0.91
Location for Meeting Places	Easiness to Use Medical Facilities	0.81
The Number of Medical Facilities		
Location for Medical Facilities	Easiness to Use Nursing Facilities	0.70
The number of Nursing Facilities		
Location for Nursing Facilities	Easiness to Shop	0.81
The number of Retail Stores		
Location for Retail Stores		
Variety of Goods in Stores	Easiness to Use Public Gardens	0.94
Location for Public Gardens		
The Number of Public Gardens	Community Spirits	0.79
Exchange with Acquaintances		
Exchange with Relatives		

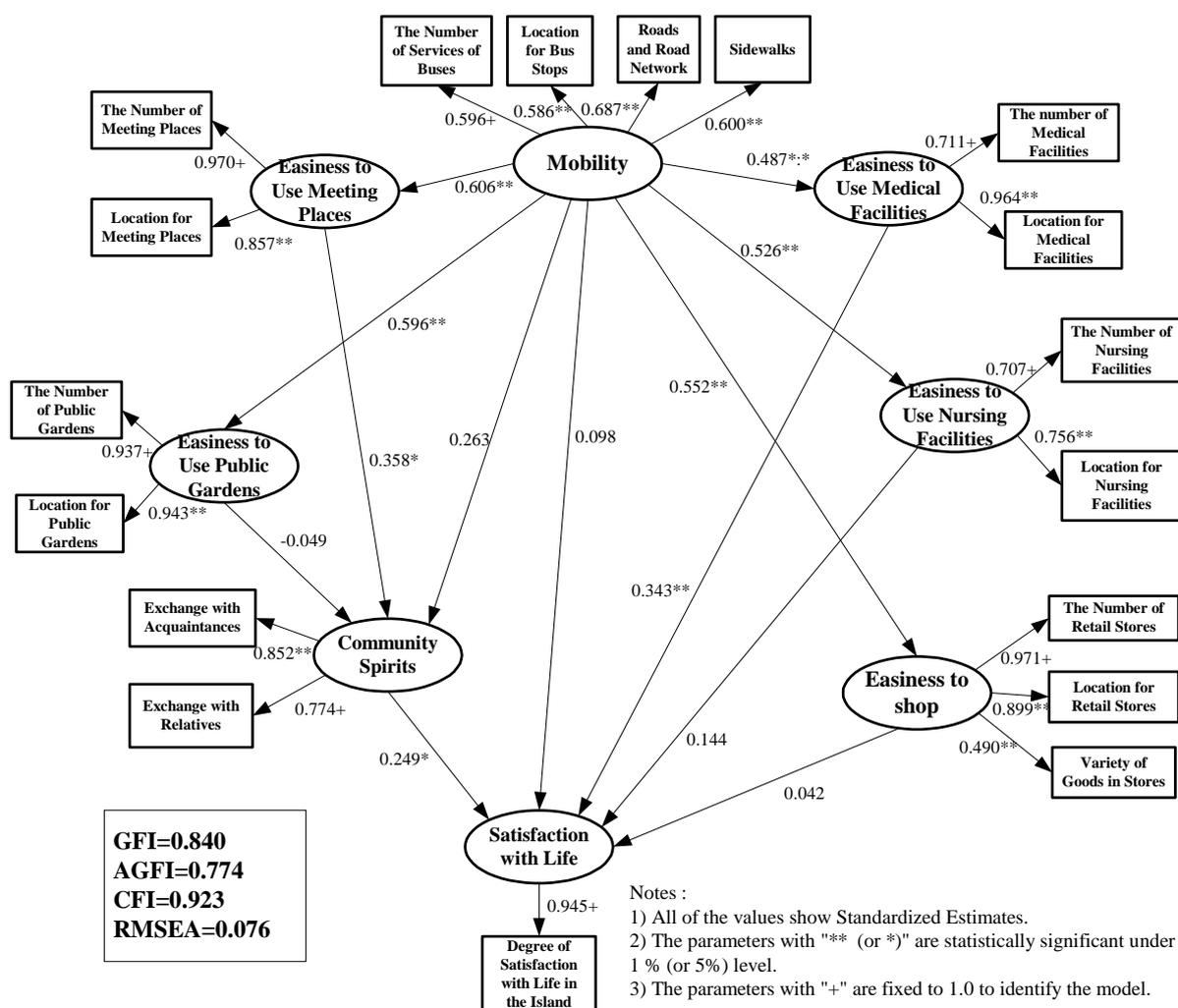
these Cronback's Coefficient alphas in this table show more than 0.7. From this result, the validity of these classifications was proved. These latent variables are used in the following analyses.

#### 4.2 A STRUCTURAL EQUATION MODEL

In this study, the effects of the mobility upon the evaluation of the facilities and the public services to support the island people's lives and these effects on the degree of the satisfaction with the people's lives were analyzed (Okayama, 2008).

In this analysis, the 17 items in Table-2 and the item to survey the degree of elderly people's satisfaction with their lives in the first questionnaire sheet were used and Structural Equation Modeling (Klein, 1998; Randall and Richard, 1996) was employed. The model to analyze was built according to the following process.

First, the 17 items in Table-2 were used as observed variables which were influenced by the 7 latent variables, which were described in Table-2 and each of the items was linked with the latent variable relating to itself. Second, the latent variable named "Satisfaction with life" was assumed as a variable which influences the item of degree of elderly people's satisfaction with their lives. Finally, for the structure of the model built in this study, it was assumed that the latent variable for evaluation of "Mobility" influences the 6 latent variables for evaluation



**Figure-4 the Structural Equation Model to Analyze Relations between the Mobility, the Facilities, Public Services and Degree of the Satisfaction with their Lives**

of other public facilities and services and that all these latent variables influence the latent variable named “Satisfaction with life”. The model built according to this process is indicated in Figure-4.

In general, in analyses by using Structural Equation Modeling, we can recognize that a built model fits data, if values of GFI and CFI are more than 0.9 and value of RMSEA is less than 0.1. The model in Figure-4 shows that the value of CFI is 0.923(>0.9) and the value of RMSEA is 0.076(<0.1) though GFI is 0.840(<0.9). Thus, it can be recognized that the model built in this study fits the data obtained from the questionnaire survey.

All the parameters of the measurement equations, which describe the relations between the observed variables and the latent variables, are statistically significant under 1 % level. This means that the existences of the 8 latent variables assumed above are proved.

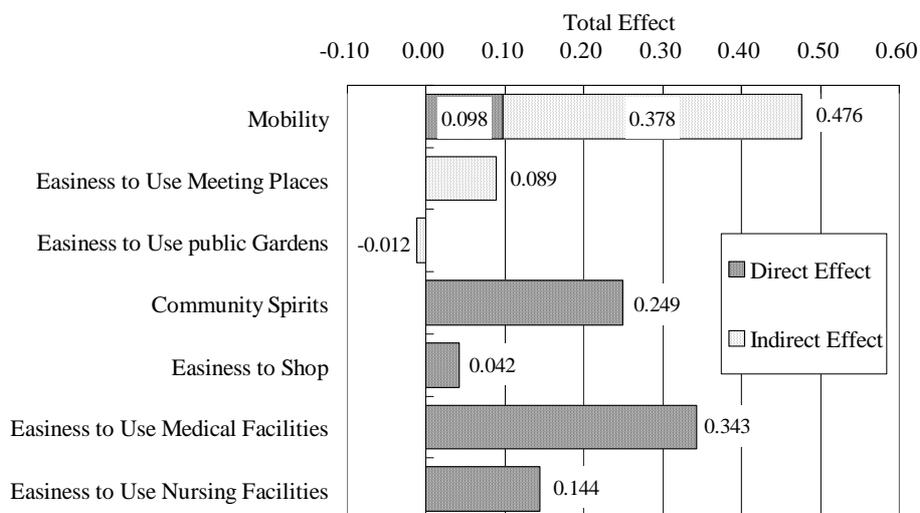
Some of the parameters of the structural equations, which describe the relations between the latent variables, are also statistically significant under 1 % or 5% level. In particular, the parameters between “Mobility” and the other latent variables, except for “Community Spirits” and “Satisfaction with life”, are statistically significant under 1 % level. This result shows that the improvement of the mobility makes it easier to use various facilities and services like the medical facilities, the meeting places and shopping.

We can recognize that the improvement of “Easiness to use Medical Facilities” and “Community Spirits” can give good influence on “Satisfaction with Life” because the parameters which are from “Easiness to use Medical Facilities” and “Community Spirits” to “Satisfaction with Life” are positive numbers and statistically significant under 1 % or 5% level.

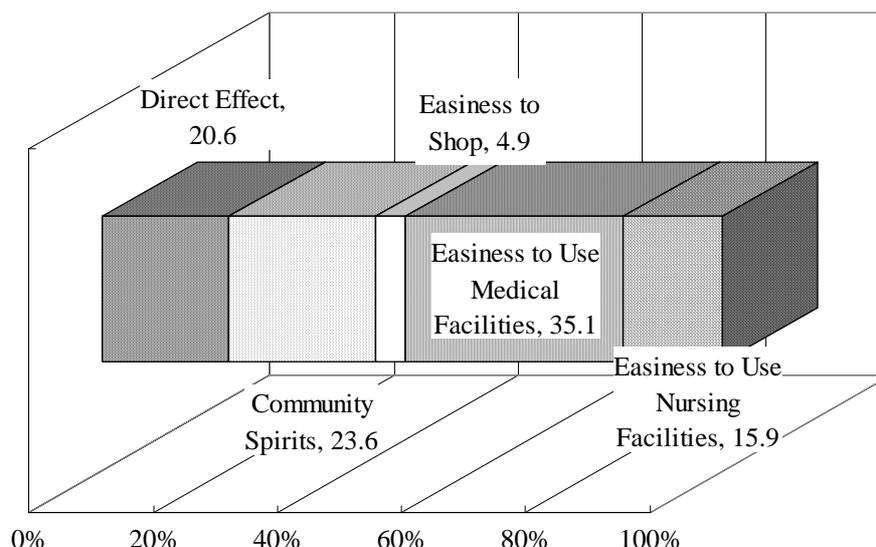
### 4.3 EFFECTS OF THE FACILITIES AND THE SERVICES ON DEGREE OF THE SATISFACTION WITH THE LIVES

The effects of the facilities and the services, including the mobility, on degree of the satisfaction with their lives were analyzed by using the result from Figure-4. Figure-5 indicates the result of this analysis. In this figure, not only these total effects on degree of satisfaction with their lives but also the direct effects and the indirect effects are shown.

This figure shows that the total effect of “Mobility” is 0.476 and is the biggest. And “Easiness to Use Medical Facilities” has the second biggest total effect, value of which is 0.343. The total effect of “Community Sprits” is 0.249 which is the third biggest. From these results, we



**Figure-5 Effects of the Facilities and the Services on Degree of the Satisfaction with their Lives**



**Figure-6 the Content of the Indirect Effect of the Mobility**

can see that it is very effective to improve “Mobility”, “Easiness to Use Medical Facilities” and “Community Spirits” to raise the degree of the elderly people’s satisfaction with their lives.

The total effects of “Easiness to Use Medical Facilities” and “Community Facilities” consist of only direct effects. On the other hand, the total effect of “Mobility” consists of not only direct effect but also indirect effect. The reason for this is as follows.

In the Figure-4, it can be found that there is a path (or an arrow) from “Mobility” to “Satisfaction with Life”. This means that “Mobility” can directly give influence to “Satisfaction with Life”. Figure-4 also shows that there are paths from “Mobility” to other latent variables, such as “Easiness to Use Medical Facilities”, “Easiness to Use Meeting Places” and so on. In addition, there are paths from the latent variables, which have the paths from “Mobility”, to “Satisfaction with Life” directly or via other latent variables. These show that “Mobility” can indirectly give influence to “Satisfaction with Life” through these latent variables.

As mentioned above, several routes to give the indirect effect exist. The indirect effect of each route is measured by the product of the parameters of all arrows involved in the route from “Mobility” to “Satisfaction with Life”. The “indirect effect” in Figure-5 shows the sum of the indirect effects of all the routes.

According to Figure-5, the indirect effect of “Mobility” on "Satisfaction with Life", the value of which is 0.378, is bigger than the direct effect, whose value shows 0.098. This means that it is necessary to build up a closer connection between the mobility and other facilities or services to improve degree of the people’s satisfaction with their lives by improving their mobility.

In order to know what kind of facilities and services should connect with the mobility to raise the degree of the people’s satisfaction with their lives, the content of the indirect effect of the mobility was analyzed in detail. The result of this analysis is shown in Figure-6. This figure indicates that the rate of “Easiness to Use Medical facilities” is 35.1% and is the largest of them. This result means that a closer connection between “Mobility” and “Easiness to Use Medical Facilities” is very effective to raise the degree of the elderly people’s satisfaction with their lives. The rate of “Community Spirits” is 23.6% which is the second largest. “Mobility” not only directly connects with “Community Spirits” but also indirectly connects through “Easiness to Use Meeting Places” and “Easiness to Use Public Gardens”. For this

reason, the effect of “Mobility” through “Community Spirits” was analyzed in more detail. From this analysis, it was recognized that 48% of the effect of “Mobility” through “Community Spirits” was the effect through “Easiness to Use Meeting Places”. Thus, if an improvement of the mobility makes it easier to use the meeting places, it improves the community spirits of the people in the island effectively and also raises the degree of their satisfaction with their lives.

## 5. ANALYSIS OF SERVICE LEVEL OF COMMUNITY BUS THAT ELDERLY PEOPLE REQUEST

### 5.1 CONJOINT ANALYSIS FOR SERVICE LEVEL OF COMMUNITY BUS

As described above, the community bus called “Oto-Hime Bus” has already operated in the Osaki-Kamijima Island. However, it has been said that the people in the island, especially the elderly people, are dissatisfied with the service level of the Oto-Hime Bus. In the second survey, service level of a community bus the elderly people want was investigated by suggesting various service plans of a community bus.

In this chapter, a service level of a community bus like ‘Oto-Hime bus’ that the elderly people demand is analyzed by employing Conjoin Analysis (Okayama and Sawai. 2007), on the basis of this investigation. Various service levels of a community bus were suggested in the second questionnaire sheet. “The fare”, “the number of services”, “time of the first bus” and “time of the last bus” were chosen as factors that the elderly people consider in using a community bus. The service levels of these factors are shown in Table-3. These levels were decided by taking the present service level of Oto-Hime bus and its feasibility into consideration. The plans for a community bus were built of combination of the service levels in Table-3. However, the number of these plans which were built of all of the combinations was too many for the respondents to rate them. For this reason, the number of the plans was decreased to 16 plans by using Orthogonal Table. In the second questionnaire sheet, the respondents rated these 16 plans into 5 categories like “want to use”, “can use”, “neutral”, “difficult to use”, “can’t use”.

The data obtained from this procedure are analyzed by employing Conjoint Analysis (Carrol and Green, 1995; Yuzawa *et al.*, 1990). Table-4 indicates the result from this analysis. In this

**Table-3 Factors and Levels of Service of Community Bus**

Factor	Level
The fare	100yen
	200yen
	300yen
The Number of Services	3 services/day
	6 services/day
	9 services/day
	12 services/day
Time of the First bus	Between 6 and 7 o'clock
	Between 7 and 8 o'clock
	Between 8 and 9 o'clock
Time of the Last bus	Between 18 and 19 o'clock
	Between 19 and 20 o'clock
	Between 20 and 21 o'clock

**Table-4 Conjoint Analysis for Community Bus**

Factor	Level	Utility Estimate	Importance Value	Coefficient
Time of the First bus	Between 6 and 7 o'clock	0.074	18.7	-
	Between 7 and 8 o'clock	-0.068		
	Between 8 and 9 o'clock	-0.006		
Time of the Last bus	Between 18 and 19 o'clock	-0.017	16.7	-
	Between 19 and 20 o'clock	-0.058		
	Between 20 and 21 o'clock	0.075		
Fare	100yen	-0.361	23.8	-0.361/100yen
	200yen	-0.721		
	300yen	-1.082		
The Number of Services	3 services/day	0.512	40.7	0.171 / service
	6 services/day	1.025		
	9 services/day	1.534		
	12 services/day	2.050		
Constant		2.231		
Pearson's R		0.947		

analysis, it was assumed that the fare and the number of services had a liner relationship with utility of the community bus.

We can decide that the result from this analysis is very good because Pearson’s Correlation Coefficient in table-3 is 0.947.

We can see that “the number of services” is the most important factor for the elderly people because the importance value of “the number of services” is 40.7 and bigger than any other factors’. The second most important factor is “the fare”.

By using these utility estimates and the coefficients of these factors obtained from this analysis, increase of one service of bus was converted to its fare. From this result, value of increase of one service of bus was almost same as about 47.4yen (about \$0.5) for the fare. This means that the elderly people could use the Oto-Hime bus if the number of services of the bus is increased by three services than the present number, which is 6 services a day in maximum route, even though the fare of the bus which is 200yen (about \$2.1) at present is increased to 300yen (about \$3.2).

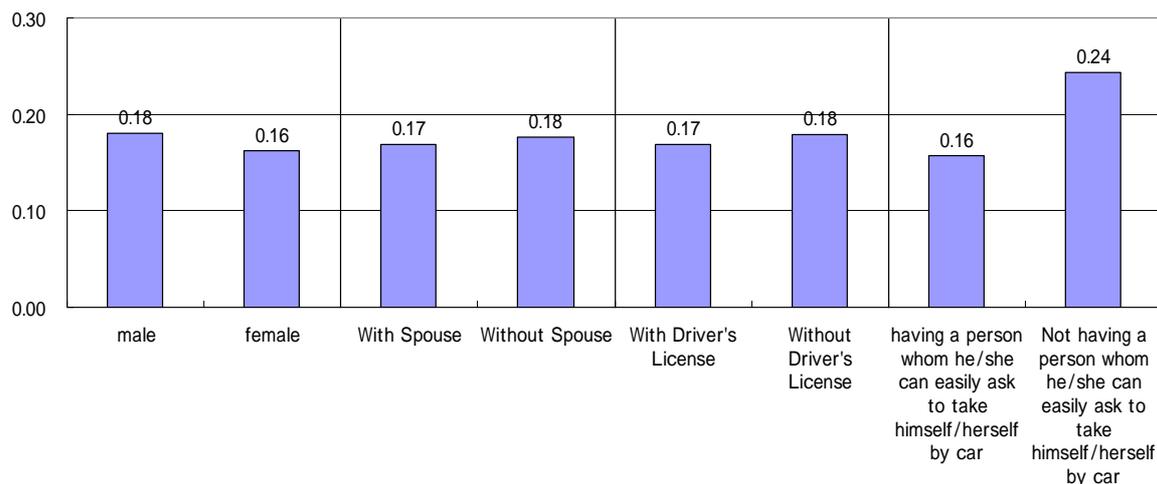
**5.2 DIFFERENCES IN USE ATTITUDE TO COMMUNITY BUS BETWEEN PROFILES**

Differences in the use attitude to a community bus between the profiles of the respondents are analyzed in this chapter. “Gender”, “with the spouse or without it”, “with driver’s license or without it” and “having a person he/she can easily ask to take by car or not having such a person” are chosen from their profiles and the utility estimates and the coefficients of each respondent which were obtained in the analysis in Table-4 are used.

The rate of male in the data used in this analysis, the number of which was 149, was 45% and the rate of female was 55%. The rate of the respondents who have the spouse was 74% and it of the respondents who don’t have the spouse was 26%. 68% of the respondents had a driver’s license and 32% of them didn’t have it. The rate of the respondents who had a person they can easily ask to take themselves by car was 81% and the rate of the respondents who didn’t have such a person was 19%.

In the analyses below, the averages of the coefficients and the utility estimates of each level of every factor are calculated by the respondents’ profiles and they are compared between respondents’ profiles.

In Figure-7, the averages of the coefficients of “the number of services” are compared



**Figure-7 Differences in the Averages of the Coefficients of the Number of Services**



**Figure-8 Differences in the Averages of the Coefficients of the Fare**

between the respondents' profiles. All of the averages except for "Not having a person whom he/she can easily ask to take himself /herself by car" are from 0.16 to 0.18 and aren't much different. On the other hand, only the average of "Not having a person whom he/she can easily ask to take himself /herself by car" is more than 0.20. From these results, the attitude to the number of services isn't much different between gender, between "with the spouse" and "without the spouse" and between "with driver's license" and "without driver's license". However, the respondents who don't have a person they easily ask to take themselves by car regard the number of service as more important factor than the respondents who have such a person. The people who don't have a person they easily ask to take themselves by car can't help using such a community bus in going out not only usually but also unexpectedly because they can't ask anyone to take themselves by car. From this reason, we can understand that these people hope for more frequent service of the bus.

Figure-8 shows the differences in the averages of the coefficients of "the fare" between their profiles. In this figure, we can't recognize much difference in the averages between the respondents having a person they can easily ask to take themselves by car and not having it and between the people with the spouse and without the spouse. The average of female is about 0.1 smaller than male's. The average of the respondents without driver's license is also 0.1 smaller than the average of the people with it. These mean that female and people without



**Figure-9 Differences in the Averages of the Utility Estimates of time of the first bus**



**Figure-10 Differences in the Averages of the Utility Estimates of time of the last bus**

driver’s license are more sensitive to changes in the fare.

Figure-9 indicates the differences in the utility estimates of each level of “time of the first bus”. From this figure, we can find that the people who don’t have driver’s license or who don’t have a person whom they can easily ask to take themselves by car have a different characteristic from the others. It can be seen that these people hope that the first bus is between 8:00 and 9:00 because the utility estimate of “between 8:00 and 9:00” is the bigger than any other levels. On the other hand, the other people hope for the first bus to be between 6:00 and 7:00.

In Figure-10, “time of the last bus” is analyzed. In this figure also, we can find that the people who don’t have a person whom they can easily ask to take themselves by car have a different characteristic from the others. Because the utility estimates of “between 20:00 and 21:00” of the others are biggest of all levels, they want the last bus to be between 20:00 and 21:00. For the people who don’t have a person whom they can easily ask to take themselves by car, it is the best that the last bus is between 19:00 and 20:00 although for others it is the worst.

From these results, we can see that the use attitude to a community bus is much different especially between the people having a person they can easily ask to take by car and not having such a person. The elderly people living alone are increasing in the island and it will be more difficult for many of them to find a person they can ask to take by car in the future.

Because of this, we need to take the requests of these elderly people into consideration in planning a community bus.

## 6. SUMMARY

In this study, on the basis of two questionnaire surveys to the people in the Oasaki-Kamijima Island, we analyzed how the mobility for elderly people in a rural area should be and we revealed the request of elderly people for service level of a community bus. The main findings of this study are as follows.

- 1) A structural equation model was built in order to analyze the relations between the mobility, the facilities, the public services and the degree of the elderly people's satisfaction with their lives in the island. From this result, it was shown that improvements of the mobility, the easiness to use the medical facilities and the community spirits could raise the degree of the elderly people's satisfaction with their lives. In this case, it was recognized that it was very important for improvement of the mobility like introducing a community bus to make it easier to use the medical facilities and to raise the community spirits, such as by making it easy to use the meeting places.
- 2) Service level of a community bus like 'Oto-Hime bus' that the elderly people demand was analyzed by employing Conjoin Analysis. From this result, we found that the number of services was the most important factor for the elderly people to use a community bus and the fare was the second. By investigating value of increase of one service of bus, we showed that it was almost same as 47.4yen (about \$0.5) for the fare.
- 3) Differences in the use attitude to community bus between the profiles of the elderly people were analyzed. From this result, we found some differences in the use attitude to bus between the people who have a person whom they can easily ask to take themselves by car and who don't have such a person. The people who don't have a person whom they can easily ask to take themselves by car wanted frequent services more strongly and also have different attitude to time of the first bus and the last bus.

The results described above can give some useful ideas as follows to introduction and improvement of a community bus in order to improve mobility of elderly people in a rural area. According these results, such a community bus should be planned to help to use medical facilities and to raise community spirits by helping to use meeting places and so on. In making a time table of the community bus, number of the services should be regarded as the most important. It is necessary that number of services doesn't become too small number by becoming too sensitive to cutting the cost of operation of the community bus or to making its fare cheap. In addition, it is expected that people who don't have a person whom they can easily ask to take themselves by car also increase because elderly people living alone are increasing in many rural areas in Japan. Under such a situation, number of services of a community bus should be decided more carefully.

In the Osaki-Kamijima Island, the community bus called "Oto-Hime Bus" has been operated by the administrator but the use actual condition of "Oto-Hime bus" hasn't been investigated yet. In the future, we have to investigate the use actual condition of "Oto-Hime bus". On the basis of the results from this study and the investigation of the use actual condition of "Oto-Hime bus", it is necessary to analyze how "Oto-Hime Bus" should be for the island people, especially the elderly people.

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