

ANALYSIS ON THE EFFECT OF FEAR OF DRIVING ON EXPRESSWAYS TO ROUTE CHOICE BEHAVIOR

Natsuki NAGASAKA¹, Shinya KURAUCHI², Toshio YOSHII³
and Akimasa FUJIWARA⁴

¹Member of JSCE, Graduate Student, Dept. of Graduate School of Advances Science and Eng., Hiroshima University
(1-5-1, Kagamiyama, Higashi-Hiroshima, Hiroshima 739-8529, Japan)

E-mail: m213999@hiroshima-u.ac.jp (Corresponding Author)

²Member of JSCE, Associate Professor, Dept. of Graduate School of Science and Engineering, Ehime University
(3, Bunkyo, Matsuyama, Ehime 790-8577, Japan)

E-mail: kurauchi@cee.ehime-u.ac.jp

³ Member of JSCE, Professor, Dept. of Graduate School of Science and Engineering, Ehime University
(3, Bunkyo, Matsuyama, Ehime 790-8577, Japan)

E-mail: yoshii@cee.ehime-u.ac.jp

⁴Member of JSCE, Professor, Dept. of Advances Science and Eng., Hiroshima University
(1-5-1, Kagamiyama, Higashi-Hiroshima, Hiroshima 739-8529, Japan)

E-mail: afujiw@hiroshima-u.ac.jp

Analysis of drivers' route choice behavior is important to promote the use of expressways for the purpose of reducing traffic congestion and accidents on general roads. In this paper, the effect of fear of driving on expressways, which has been pointed out as an influential factor in previous studies, is explicitly considered as a latent variable in a binary route choice model for general roads and expressways, and an analysis of the effect of fear on route choice behavior is carried out. The parameter of the emphasized traffic accident risk information such as "General roads are twice as likely to be involved in traffic accidents as expressways." was structuralized using the fear parameter. As a result, it was found that the effect of the emphasized information was offset by the parameter of fear. This indicates that drivers who have a strong fear of driving on expressways are less likely to respond to the value of the emphasized information, as their fear makes them more inclined to choose general roads.

Key Words : *traffic accident risk, information provision, Integrated choice and latent variable model*

1. INTRODUCTION

Promoting the use of expressways in sections where expressways and general roads run parallel and compete with each other has the advantage of reducing traffic congestion on general roads and eliminating through traffic to urban areas located in the middle of those roads. In addition, since general roads are about 10 times more likely to be involved in accidents than expressways¹⁾, the number of accidents and victims can be expected to be reduced. Although these advantages exist, the utilization rate of expressways in Japan is lower than that in both European countries and the United States. For this reason, a variety of analysis of factors and countermeasures have been considered in order to shift the use of expressways.

According to previous study, Kurauchi et al.²⁾ pointed out the

existence of a perceptual bias toward traffic accident risk, in that many drivers assume excessively that expressways are dangerous. They also reveal that this belief forms a fear of driving on expressways and has a greater negative impact on usage intentions than fare or time. The analysis only focused on the intention by using a 7-point Likert scale, and it is not clear to what extent the intention leads to the choice of expressways. On the other hand, Nishiuchi et al.³⁾ conducted an SP survey incorporating traffic accident risk information as an attribute, and constructed a route choice model with two choices, general roads and expressways. The analysis shows that the emphasized information (e.g., "general roads are twice as likely as expressways"), which is the ratio of probabilities between two roads, has a significant effect on route choice behavior rather than the numerical information (e.g., "once in 10,000

times") of accident probability. There are other analyses that show similar trends³⁾, but all of the explanatory variables are consisted of objective ones. To our knowledge, there is no case in which the fear of accident risk on expressways is explicitly taken into account in a direct discrete choice model.

Information on the risk of traffic accidents on expressways is a probability value that contains many uncertainties. Thus, each individual's fear of driving on expressways may have different effects on the way drivers perceive the information and on their choice behavior. Therefore, the purpose of this study is to explicitly consider fear of driving on expressways in a route choice model and to analyze the impact of fear on route choice through the provision of traffic accident risk information.

In the next chapter of this paper, we first discuss the components behind fear from a psychological perspective, and then reconstruct the structure of the fear-specific model to make it easier to interpret. Regarding the factors, we will use as reference the "perception of the risk of traffic accidents on expressways", "controllability", and "confidence in driving skills", which have been pointed out as determinants of fear. Then, using the data obtained from the questionnaire survey including the SP survey and the discrete choice model which can take latent variables into account proposed by Morikawa and Sasaki⁴⁾, the analysis is carried out using a route choice model that takes into account the fear.

2. MEASUREMENT OF FEAR AS A LATENT VARIABLE

(1) Components of fear and their relationships

First, we incorporate the "perception of the risk of traffic accidents on expressways," which was identified as a component of fear in a previous study. This is consisted of two concepts, "perception of occurrence of traffic accidents" and "perception of severity of traffic accidents" (the probability that an accident, if it occurs, will be a major accident), and is based on the National Research Council's⁵⁾ definition that risk is calculated by multiplying the probability of occurrence of traffic accidents by the severity of traffic accidents.

In addition, this study incorporates "controllability" and "confidence in driving skills" as components of fear. Of the two basic factors of risk perception identified by Slovic⁶⁾, the fear factor scale includes the possibility of control over risk, such as "Controllable - Uncontrollable" and "Voluntary - Involuntary". This means that these factors may not only have an indirect route through the probability and severity of traffic accidents, but may also have a direct influence on the fear. Both routes

have already been analyzed in several previous studies²⁷⁾, but none has analyzed both at the same time. Therefore, in this study, we assume a direct path from controllability to fear, in addition to the paths via probability and severity in the previous studies, as shown in Fig. 1.

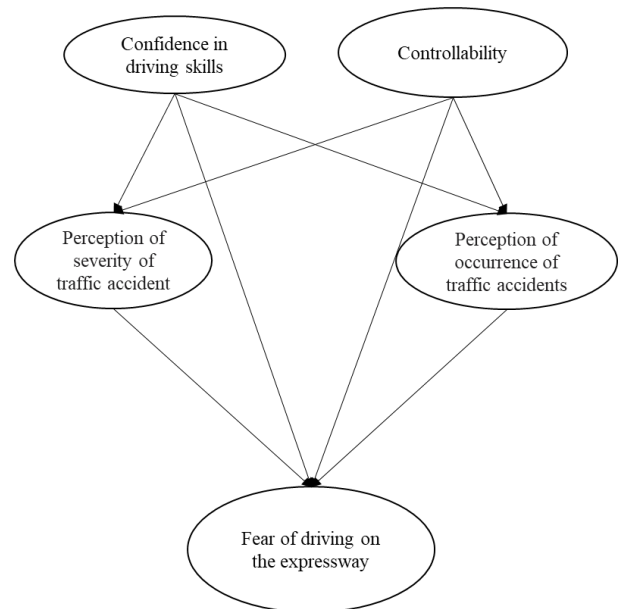


Fig. 1 Components of Fear

(2) Heterogeneity of perception of risk as a party

In the previous study, the individual's perception of the occurrence of an traffic accident was obtained using the questions shown in

Table 1. However, in reality, the drivers themselves need to choose it, and they will consider the risks when they actually drive. As Gigerenzer pointed out⁸⁾ in response to Tversky & Kahneman⁹⁾ who revealed that bias is introduced in the perception of probability, there are several types of probability, and the observed bias can be due to a disagreement between the interpretation that the questioner considers correct and the respondent's interpretation. In other words, it is possible that the perceptual bias that has been pointed out is not a bias, but is simply the respondent's evaluation as a party.

In this study, we assume that there are two interpretations of the traffic accident rate that people perceive, "the traffic accident probability based on objective facts," in which the values from statistics, and "the traffic accident probability as a party", and we measure perception of traffic accident risk by using a questionnaire (Table 1) that explicitly distinguishes between both of them.

Table 1 Comparison of questionnaire (some excerpts)

Name	Questions (Previous)	Response options (Previous)
Perception of occurrence of traffic accidents (Caused)	If you drive the same distance on a regular road and an expressway, which do you think would be more likely to cause an accident (more likely to be the perpetrator of an accident)?	1. General roads are 100 times more likely to accidents. 2. General roads are 10 times more likely to accidents. 3. Approximately the same.
Perception of occurrence of traffic accidents (Involved)	If you drive the same distance on a regular road and an expressway, which do you think would be more likely to be involved in an accident (more likely to be the victim of an accident)?	4. Expressways are 10 times more likely to accidents. 5. Expressways are 100 times more likely to accidents.
Perception of severity of traffic accident	If an accident does occur, which do you think is more likely to result in severe injury, the general road or the expressway?	1. General roads are 10 times more likely to severe injury accidents. 2. General roads are 3 times more likely to severe injury accidents. 3. Approximately the same. 4. Expressways are 3 times more likely to severe injury accidents. 5. Expressways are 10 times more likely to severe injury accidents.
Name	Questions (New)	Response options (New)
Perception of occurrence of traffic accidents (Caused, for statistical values)	Please answer the option that you believe is statistically correct regarding the likelihood of causing an accident (being the perpetrator of an accident) if you drive the same distance on a general road as on an expressway.	1. General roads are 1000 times greater. 2. General roads are 100 times greater.
Perception of occurrence of traffic accidents (Involved, for statistical values)	Please answer the option that you believe is statistically correct about the likelihood of being involved in an accident (being the victim of an accident) if you drive the same distance on a general road as on an expressway.	3. General roads are 10 times greater. 4. Approximately the same.
Perception of occurrence of traffic accidents (Caused, as a party)	If you drive the same distance on a general road as on an expressway, please choose the option that best describes your likelihood of causing an accident (being the perpetrator of an accident).	5. Expressways are 10 times greater. 6. Expressways are 100 times greater.
Perception of occurrence of traffic accidents (Involved, as a party)	If you drive the same distance on a general road as on an expressway, please choose the option that best describes your likelihood of being involved in an accident (being the victim of an accident).	7. Expressways are 1000 times greater.
Perception of severity of traffic accident (For statistical values)	If an accident does occur, please answer the option that you believe is statistically correct about the likelihood of it becoming a severe accident.	1. General roads are 30 times greater. 2. General roads are 10 times greater. 3. General roads are 3 times greater. 4. Approximately the same.
Perception of severity of traffic accident (as a party)	If you are driving and an accident does occur, please answer the option that best describes the likelihood of it becoming a severe accident.	5. Expressways are 3 times greater. 6. Expressways are 10 times greater. 7. Expressways are 30 times greater.

3. OUTLINE OF SURVEY

In this study, we conducted a questionnaire survey and SP survey on fear of driving on expressways, as described in Chapter 2. A summary is shown in **Table 2**.

Next, a summary of questions other than perception of traffic accident risk is presented in the **Table 3**. The question on controllability asked whether or not the event of a traffic accident had characteristics that would allow the occurrence probability of it to be controlled. The responses were given on a 7-point Likert scale, ranging from 1. Disagree strongly to 7. Agree strongly.

The confidence in driving skill indicates whether the driver has the ability to control the occurrence probability of accidents by driving, namely, whether the driver thinks that they are a good driver or not. The same 7-point Likert scale was used. As in the previous studies, three concepts of accident are employed: "accident causing," "accident involvement," and

"accident scale".

Table 2 Overview of the survey

Implementation method	Nationwide web survey
Subjects	Monitors of Macromill, Inc.
Screening survey	<ul style="list-style-type: none"> • Driver's License (Holders) • Frequency of driving on general roads (at least once a month)
Number of valid responses	2793
Implementation period	March 22 to 24, 2021
Survey Items	Individual attributes (age, gender, personal income, presence of children, experience of traffic accidents on each road, frequency of driving) Questions regarding fear of driving on expressways (Table 2 , Table 3) Route choice SP survey (Table 4)

Table 3 Questions other than perception of traffic accident risk

Name	Questions
Controllability	In general, it is said that the ease of causing accidents can be reduced on expressways rather than on general roads.
	In general, it is said that the ease of being involved in an accident with another vehicle can be reduced on expressways rather than on general roads.
	In general, it is said that expressways can minimize damage in the event of an accident more than general roads.
Confidence in driving skills	I am more confident that I can drive on the expressway than on the general road so as not to cause an accident.
	I am more confident that I can drive on the expressway so as not to be involved in an accident than on the general road.
	I am more confident that I can drive on the expressway than on the general road so that if an accident does occur, the damage will be minimized.
Fear of driving on expressways	It is more frightening to cause an accident on the expressway than on a general road.
	It is more frightening to be involved in an accident on the expressway than on the general road.
	It is more frightening that accidents with severe damage are more likely to occur on expressways than on general roads.

(2) Route choice SP survey

The SP survey was conducted on the same respondents as the questionnaire survey. In the SP survey, the attributes and levels shown in the **Table 4** and are presented three times to one respondent in a screen, as shown in **Fig. 2**, and the respondent chooses between expressways and general roads.

Furthermore, the number of attributes differs for each SP number in this survey. It is not a format in which one individual represents multiple responses. For the same individual and the same attribute, the level is fixed at SP 1, SP 2, and SP 3. This is to measure the effect of newly added information.

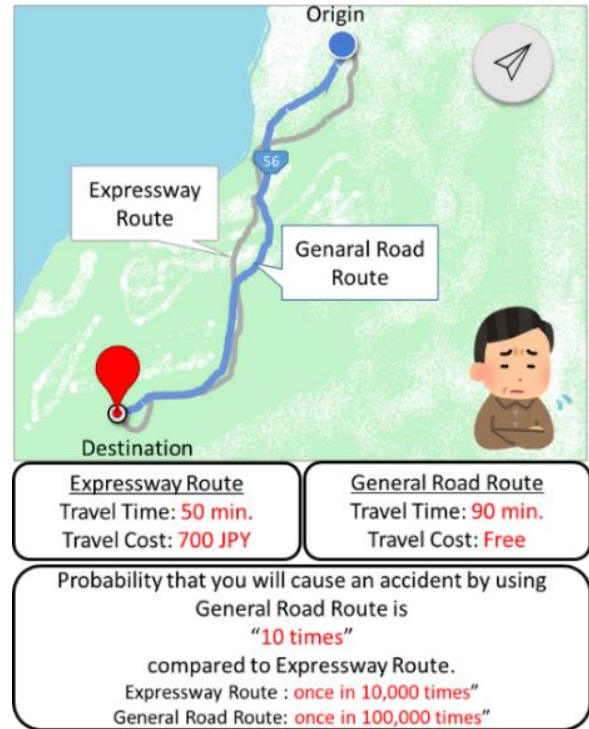


Fig. 2 Screen shown to respondents

Table 4 Level of each attribute

Scenario	Time (Expressway)	time (General roads)	Fare (Expressway)	Fare (General roads)	Numerical information (Expressway)	Numerical information (General roads)	Emphasized information	
	SP1							
	SP2							
	SP3							
1	50	70	300	0	1/20000	1/10000	2	
2	50	70	700	0	1/100000	1/10000	10	
3	50	90	300	0	1/100000	1/10000	10	
4	50	90	700	0	1/20000	1/10000	2	

(3) Results of basic analysis

The age and gender distribution of the survey respondents is shown in the **Fig. 3**. The ratio of men to women is about 6:4, and no particular age group is predominant, indicating that the data is not biased.

Next, we tabulated the indicators for the latent variables. First, to check for internal consistency, Cronbach’s alpha was calculated for each of the indicators and is shown in the **Table 5**. Although the coefficient for controllability is a little low, the overall measurement is appropriate.

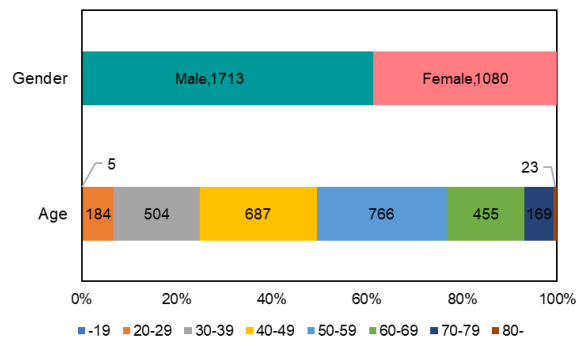


Fig. 3 Summary of age and gender

Table 5 Calculation result of Cronbach's alpha

Name of latent variable	Cronbach's alpha
Fear of driving on the expressway	0.82
Perception of occurrence of traffic accidents	0.84
Perception of severity of traffic accident	0.86
Controllability	0.69
Confidence in driving skills	0.82

Fig. 4 shows the distributions of responses for each indicator. For all indicators, the middle value is high, the number of responses tends to decrease toward the extremes. In the route choice model described in the following chapter, it is considered safe to make the assumption that each of these observation indices follows a normal distribution.

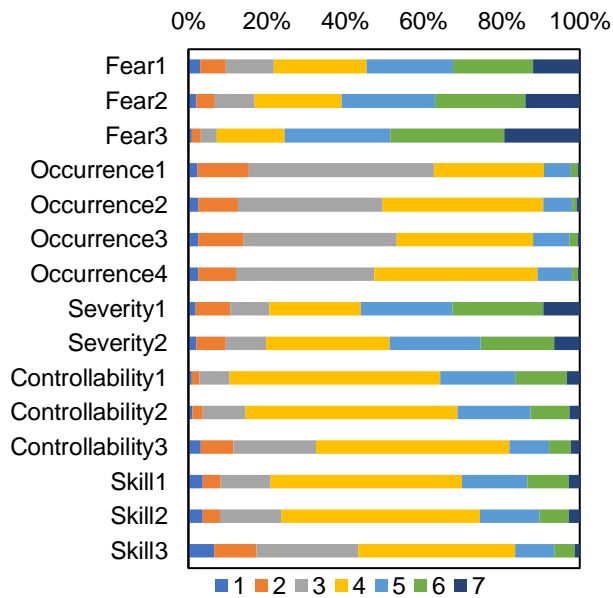


Fig. 4 Distribution of each indicator

4. ROUTE CHOICE MODEL CONSIDERING FEAR OF DRIVING ON EXPRESSWAYS

(1) Formulation of a route choice mode

In this study, we use a discrete choice model proposed by Morikawa and Sasaki⁴⁾ that takes subjective factors into account. The model can incorporate latent variables, which are factors that influence selection behavior but that cannot be directly observed. It is also widely known as the integrated choice and latent variable model¹⁰⁾ and has been applied in many cases¹¹⁾. Usually, this model consists of several submodels. In this study, the structural equation submodel and discrete choice submodel are employed. First, the structural and

measurement equations in the structural equation submodel are defined below:

Structural equation

$$\mathbf{w}^* = \mathbf{B} \begin{bmatrix} \mathbf{s} \\ \mathbf{w}^* \end{bmatrix} + \zeta \quad (1)$$

Measurement equation

$$\mathbf{Y} = \mathbf{\Lambda} \mathbf{w}^* + \varepsilon \quad (2)$$

where \mathbf{w}^* is vector of latent variables, \mathbf{s} is Vectors of objective variables (exogenous variables) and \mathbf{Y} is Vector of subjective values for each latent variable. Parameters \mathbf{B} and $\mathbf{\Lambda}$ will be estimated. ζ and ε are error term vectors following a multivariate normal distribution.

Next, in the discrete choice submodel, the systematic terms V_{ex_k} and V_{gen_k} of the utility functions for expressway and general road use are given by

$$V_{ex_k} = \beta_0 + \beta_1 time_{ex} + \beta_2 cost_{ex} + d_{num} \beta_3 num_{ex} \quad (3)$$

$$V_{gen_k} = \beta_1 time_{gen} + \beta_2 cost_{gen} + d_{num} \beta_3 num_{gen} + d_{emph} \beta_5 emph \quad (4)$$

where β_0 to β_5 are parameters in discrete choice component. k is SP number in the SP survey from 1 to 3. d_{num} and d_{emph} are dummy variables whether or not attributes are shown in SP survey. $time$, $cost$, num , $emph$ are levels from attributes SP survey, time, fare, and numeric information, emphasized information, respectively.

Based on the hypothesis that the way individuals receive information about accident risk depends on the fear of driving on expressways, the parameters are structuralized as equation given following equation (5).

$$\begin{cases} \beta_3 = \beta_{3a} + \beta_{3b} fear^* \\ \beta_4 = \beta_{4a} + \beta_{4b} fear^* \end{cases} \quad (5)$$

The probability of choosing an expressway and a general road, respectively, is calculated by applying a binomial logit model to:

$$P_{ex_k} = \frac{\exp(V_{ex_k})}{\exp(V_{ex_k}) + \exp(V_{gen_k})} \quad (6)$$

$$P_{gen_k} = 1 - P_{ex_k} \quad (7)$$

In the discrete choice submodel, when all individuals n are in SP number k , the concurrent probability L^* of choosing a

response option in the SP survey is given by:

$$L^* = \prod_{n=1}^N \prod_{k=1}^{K=3} P_{ex_{kn}}^{\delta_{ex_{kn}}} \times P_{gen_{kn}}^{\delta_{gen_{kn}}} \quad (8)$$

where $\delta_{ex_{kn}}, \delta_{gen_{kn}}$ is a dummy variable that takes 1 if the subscript option is chosen and 0 otherwise.

Based on the above formulation, the likelihood function is the product of the probabilities of simultaneous occurrence of $\delta_{ex_{kn}}, \delta_{gen_{kn}}$ and \mathbf{Y} , integrated by \mathbf{w}^* , the composite vector of the five latent variables.

(2) Estimation results from route choice model

Based on the data from the questionnaire and the SP survey, parameters were estimated for the route choice model. Parameter estimates for the measurement equation, structural equation, and discrete choice submodel are shown in **Table 6**, **Table 7** and **Table 8**, respectively.

a) Structural equation submodel

First, an interpretation of the factors behind the fear is conducted. From the estimation results of the structural equation submodel, we focus on the paths between latent variables in the lower part of **Table 6**.

Only the parameter from Perception of occurrence of traffic accident to fear was significant. On the other hand, the parameter from perception of severity of traffic accident to fear was not significant. As for the parameters from perception of occurrence, the sign was positive. It is consistent with Sugimori et al.¹²⁾ who pointed out that the severity of risk increases the evaluation of risk, even if the probability is the same. This suggests that there is the availability heuristics, which accidents in the news with high damage and other prominent features are memorable and form a feeling of fear.

Controllability and confidence in driving skills had a negative effect on the perception of occurrence of traffic accidents and the severity. On the other hand, controllability had no significant effect on fear, and only confidence in driving skills was significant. It can be seen that low confidence in driving skills is itself a factor that directly generates fear without involving an evaluation of traffic accident risk on expressways. Although controllability has no direct effect, it influences fear through the perception of the severity of traffic accident. The overall effect of confidence in driving skills on fear was $-0.267 + (-0.182 \times 0.381) = -0.336$, and the overall effect of controllability was $-0.599 \times 0.381 = -0.228$, indicating that the

two effects were equivalent, although not direct.

Next, the estimation results in the structural equations are then interpreted in terms of the effects of each individual attribute on the latent variables. First, although the value for the retirement dummy is small, it has a negative effect on fear and a positive effect on confidence in driving skills. This may be due to the fact that drivers over retirement age have relatively more driving experience, which may affect their confidence and fear reduction.

In the female dummies, all parameters are significant. Positive effects were observed for fear, perception of occurrence, and perception of severity, while negative effects were observed for controllability and confidence in driving skills. Thus, women are less likely to feel a sense of control over the uncertainty of accident risk, and are more likely than men to overestimate accident occurrence, the severity of traffic accident, and fear.

The dummy with children has a positive effect on controllability and confidence in driving skills. Despite the high sense of control over accident risk, the parameter of fear is positive. This can be interpreted as meaning that the presence of children makes them more cautious in their choice of expressways due to the greater range of risks that the choice of route entails.

A notable point in the estimation results of the experience of traffic accident dummies is that the sign of the perception of occurrence and perception of severity of are opposite. This means that drivers who have experienced an accident on a general road or heard about it from others tend to estimate the occurrence probability of traffic accident to be low, while they tend to estimate the severity of traffic accident to be high. It is possible to interpret this as meaning that while encountering a traffic accident and being aware that it is a rare event, the evaluation of the severity of the accident is more serious than that of a person who has never been involved in a traffic accident.

The parameter of fear is positive for the dummy that drives every day on general roads. Drivers who use the general roads every day are more likely to have a fear of highways than drivers who do not use the general roads every day.

Finally, the estimation results for the measurement equations (**Table 7**) show that the coefficients of the paths for all the observed values are significant, indicating that the latent variables are measured stably.

b) Discrete choice submodel

This section provides an interpretation of the parameter

Table 6 Estimation result of structural equation component

Fear		Occurrence		Severity		Controllability		Skill		
Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value	
-0.01	-10.665							0.002	3.695	<i>Aged</i>
0.634	12.867	0.187	4.262	0.306	4.262	-0.184	-4.075	-0.616	-16.375	<i>Female</i>
0.123	2.625					0.101	3.066	0.137	3.478	<i>Child</i>
						0.296	3.937			<i>Income (Personal)</i>
0.110	2.452	-0.151	-4.963	0.193	5.934					<i>Accident (gen)</i>
0.196	4.740									<i>Frequency (gen)</i>
										<i>Fear</i>
										<i>Occurrence</i>
0.381	13.737									<i>Severity</i>
		-0.614	-8.035	-0.599	-7.199					<i>Controllability</i>
-0.267	-7.637	-0.220	-6.467	-0.182	-5.561					<i>Skill</i>

Aged: 1 if respondent is retirement age (65) or older, otherwise 0
Female: 1 if respondent is female, 0 if male
Child: 1 if respondent have child, otherwise 0
Income: 1 if respondent's income exceeds 8Milion JPY per year, otherwise 0
Accident: 1 if respondent have an experiences traffic accident in the general road / have heard from others about traffic accidents on general roads, otherwise 0
Frequency (gen): 1 if respondent drives general road every day, otherwise 0

Table 7 Estimation result of measurement equation component

Fear		Occurrence		Severity		Controllability		Skill		
Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value	
0.927	34.159									<i>Fear1</i>
0.948	35.941									<i>Fear2</i>
0.730	32.297									<i>Fear3</i>
		0.596	27.123							<i>Occurrence1</i>
		0.605	25.530							<i>Occurrence2</i>
		0.655	27.403							<i>Occurrence3</i>
		0.645	26.697							<i>Occurrence4</i>
				0.904	22.608					<i>Severity1</i>
				0.957	21.294					<i>Severity2</i>
						0.540	17.537			<i>Controllability1</i>
						0.609	21.228			<i>Controllability2</i>
						0.523	16.559			<i>Controllability3</i>
								1.023	44.878	<i>Skill1</i>
								1.014	46.533	<i>Skill2</i>
								0.781	30.743	<i>Skill3</i>

estimates of the discrete choice submodel in **Table 8**. In the estimation, parameters related to numerical information were not significant. Similar trends to previous studies³⁾ were observed. For the sign conditions of the parameters that were significant, time and fare were negative.

The constant term part of the emphasized information was also negative. It is possible to conclude rationally that "the higher the cost of time and fares, the lower the utility" and "the higher the multiplier presented in the emphasized information, the lower the utility of the general road". However, the parameter of fear used as an explanatory variable for the emphasized information was positive. As the constant term portion of the structured parameter is negative, it is normal for the utility of general roads to decrease as the value of the

multiplier increases.

Table 8 Estimation result of discrete choice component

Parameter	Estimate	t-value	
Constant(express)	-0.133	-1.494	
Time	-0.297	-13.173	***
Cost	-0.139	-12.321	***
Numeric (Constant)	-0.003	-0.094	
Numeric (Fear)	0.003	0.104	
Emphasize (Constant)	-0.043	-5.972	***
Emphasize (Fear)	0.039	6.374	***

*** p<.001, ** p<.01, * p<.05

This means that the more fearful a person feels about driving on the expressway compared to the general road, the harder it is for them to react to the value of the multiplier for the presented emphasized information. This result can be interpreted as meaning that drivers who are frightened of driving on expressways are more inclined to choose the general roads because of their fear, which offsets the negative effect of the emphasized information and makes them more insensitive to the value of the multiplier.

6. CONCLUSIONS

In this study, we analyzed the effect of fear on route choice behavior by means of a route choice model that explicitly takes fear into account. The analysis revealed that fear comes from lack of confidence in driving skills and high perception of the severity of traffic accidents due to low evaluation of controllability.

As for the effects of individual attributes on each component of fear, drivers over retirement age (65 years old) tended to have more confidence in driving and less fear. Women tended to have less confidence in their controllability and driving skills, and were more likely to evaluate the occurrence, severity of accident, and sense of fear as large. Drivers who have children are confident in their controllability and their own driving skills, but are more cautious about choosing expressways because of the presence of their children. Drivers who had experienced an accident on general roads or had heard about accidents on general roads from others tended to estimate the occurrence of traffic accidents at a low, while they tended to estimate the severity of traffic accidents at a high level. It was also revealed that drivers who drive on general roads every day are more likely to have a fear of highways than those who do not.

In the analysis with the discrete choice model, the first conclusion is that emphasized information is significantly more effective than numerical information as a part of risk communication. In addition, by structuralizing the parameters of information on accident risk by fear, it was found that the effect of the parameter of the multiplier of the emphasized information was offset by that of the parameter of fear. In other words, drivers who have a strong fear of driving on expressways are more willing to choose general roads and are more insensitive to the value of the multiplier.

In the interpretation on the analysis in this study, we categorized drivers by the degree of their latent variable values, such as "drivers with a strong sense of fear" and "drivers who lack confidence in their own driving skills", in addition to

individual attributes such as gender and age, for the route choice behavior on expressways and general roads. However, drivers do not necessarily take all factors into consideration when choosing a route, including the time, fare, and also fear. Especially with regard to general roads, it is highly possible that the choice is based on the reason that the driver uses the road on a regular basis. It cannot be denied that this may result in measurement errors due to cognitive dissonance, such as placing fear or confidence in driving skills as the reason for choosing a road even though that was selected for other reasons. In the future, a more realistic model that can take into account the usual inertia of behavior will be needed.

In addition, this study assumed a binary route choice under the condition that expressways and general roads run parallel and compete as a means to reach the destination. However, in addition to these choices, for example, there might be other options that would cancel the trip to begin with, depending on the characteristics of the activity. As it is said that a trip is generated from the execution of an activity¹³⁾, it is necessary to focus on the characteristics of the activity in the future, such as what kind of activity causes the choice behavior in this study.

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