京都大学防災研究所年報　第 49 号 C　平成 18 年 4 月
Annuals of Disas. Prev. Res. Inst., Kyoto Univ., No. 49 C, 2006

Ambiguity, Risk and Earthquake Insurance Premiums: An Empirical Analysis

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Synopsis

Ambiguity of insurance payment in earthquake insurance can be one of main reasons of low purchase rate. We empirically investigate the influence of the ambiguity on the decision to buy hypothetical earthquake insurance and the relationship with individual characteristics based on MEU model using questionnaire data. The main results of this paper are summarized as follows. First, respondent's preferences to the insurance with 1, 5, and 10% unreimbursement risk are generally inconsistent with expected utility theory. Second, respondents demanded more than 50% reduction in premium to offset each unreimbursement risk. Third, the ambiguity premium is larger in men who purchase earthquake insurance, have never received insurance payment, and distrust insurance companies than each correspondents, and increases with age, education level.

Keywords: ambiguity, earthquake insurance, probabilistic insurance, Maximin Expected Utility

1. Introduction

Individual disaster-prevention efforts play important roles to mitigate the damage and to promote the emergency restoration. As for earthquake, the earthquake insurance can be helpful to repair or rebuild a damaged houses because the government can not sufficiently assist earthquake victims due to the financial budget constraint. However, purchase rate of earthquake insurance is low in Japan (only 17.2% households buy the earthquake insurance). There are several possible reasons: adverse selection, perception bias, and ambiguity of insurance payment. In the adverse selection mechanism, only people who live in area with frequent earthquake purchase earthquake insurance and this raise the insurance fee and prevent other people from buying the earthquake insurance. Perception bias is the underestimation of risk and anticipated damage from earthquake. Ambiguity of insurance payment means the lack of knowledge on earthquake insurance policy and insurance adjustment makes people hesitate to purchase it. I focus the last reason, ambiguity of insurance payment.

In this study, we empirically investigate the influence of the ambiguity on the decision to buy hypothetical earthquake insurance and the relationship with individual characteristics based on an econometric model using questionnaire data. Very few empirical studies on ambiguity are based on econometric models except finance field where aggregated data are used. Our study is new in that we deal with the ambiguity of disaster and use individual data. This makes it possible to examine the influence of individual characteristics to the ambiguity size that they perceive.

The paper is structured as follows. We start with a explanation why ambiguity of insurance payment prevents people from purchasing the earthquake insurance in Section 1.　Section 2 present the MEU model we will use, and Section 3 presents the estimation results.

2. Ambiguity

Ambiguity of insurance payment stems from the unclear criteria that the insurance adjuster will use to assess the damage from earthquake. Consumers feel ambiguity due to the following three reasons even if the criteria are clear on insurer's side. First one is asymmetric information. Earthquake insurance contract is too complicated for consumers to understand. In particular, expertise of house structure is required to assess the damage of house. Therefore, there is no way other than to believe the insurance adjuster's assessment. Second is the rarity of the payment of the earthquake insurance compared to other insurances such as mobile, fire or injury insurance. Earthquake that damages houses rarely occurs so that we don't have a sufficient number of cases to roughly grasp when and how mach earthquake insurance is paid. Thus, consumers feel concerned over the possibility that the claim is not paid as they expect. In this case, they think of earthquake insurance as "probabilistic insurance".

Insurance is a contract in which an individual pays a fixed premium and is promised to be paid in the event that a specific hazard occurs. Kahneman and Tversky (1979) introduced the notion of "probabilistic insurance", namely an insurance policy which, in the event that the hazard occurs, pay off with some probability strictly less than one. They showed, for a particular type of probabilistic insurance, that while consumers find such policy unattractive, an expected utility maximizer would actually perfect the probabilistic policy (at an appropriate reduced premium) to a policy that pays off with certainty.

we analyze a different type of PI than the one originally addressed by Kahneman and Tversky. The original version of probabilistic insurance was selected for study because it was analytically tractable and led to the surprising result that a risk averse expected utility maximizer favors probabilistic over standard insurance. However, it has the special feature that in the event that the claim was not paid, the premium would be refunded. This contingency dose not adequately capture the risk of default or fraud because in these instances a premium refund might be problematic. In this article we investigate a more natural form of probabilistic insurance that dose not involve refunding of premia.

Ambiguity is generally defined as indeterminacy of an unique subjective probability due to missing information about the decision problem. Many empirical studies have found significant evidence of ambiguity affecting decision making. For example, Kunreuther et. al (1995), Einhorn and Hogarth (1985, 1986) studied lottery choice in experiment; Heath and Tversky (1992), Fox and Tversky (1995) analyzed lottery choice in actual events; Maenhout (2004) and Lin, Pan, and Wang (2005) showed the effect of ambiguity on portfolio selection in finance. We empirically investigate the influence of the ambiguity on the decision to buy hypothetical earthquake insurance and the relationship with individual characteristics based on an econometric model using questionnaire data.

3. Survey data

Questionnaires was sent out by mail to 3,000 households in Joyo city, Kyoto in the middle of January, 2006. Samples are randomly selected from the NTT telephone book. 681 responses have been collected (the response rate is 23.4%).

Necessarily, this survey is hypothetical. It is impossible to have real incentives paid to the respondents. One could devise similar experiments for real money. In earthquake insurance setting, however, the probability and loss of the relevant event have to be considerably lower and larger than the lottery choice in experiment respectively. Therefore, the stake would have to be affordably low, which makes the experiment completely different from the earthquake insurance setting we want to consider. Hence, we believe that in this domain, thought experiments for large sums can be more instructive than real experiments for pennies.

Fortunately, there is evidence indicating that there is no difference in response for respondents with and without real payments. Beattie and Loomes (1997) designed an experiment to investigate the relevance of real incentives in decision problems and concluded that "in simple pairwise choices, incentives appear to make very little difference to performance." Further evidence is presented by, among others, Grether and Plott (1979), and Conlisk (1989), and is surveyed in Camerer (1995). Binswanger (1981) reports absence of significant difference in his analytical results between individuals participating in an experiment with real money or only playing a hypothetical game. Similarly, Camerer and Hogarth (1999) compare 74 experiments and conclude that financial versus hypothetical incentives in experiment occasionally improve performance although often do not.

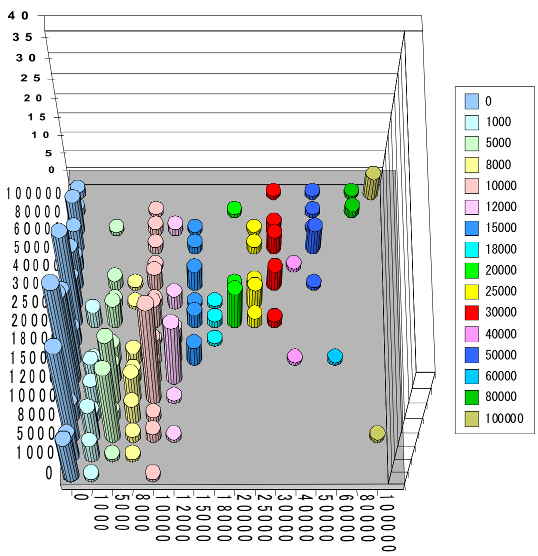
The questionnaire are structured as follows. First, the hypothetic situation is presented. Then the willingness to pay for full covered insurance and for probabilistic insurance are asked.

(H) Imagine that you have a house worth 10 million yen and the other asset (e.g. cash, stocks, or land) worth 20 million yen. Assume that earthquake with a seismic intensity 7 on the Japanese scale will occur with probability of 5% in 25 years (or, 0.205% per year). If such earthquake happens, your house will be half destroyed (¥5 million loss) with 50% probability and completely destroyed (¥10 million loss) with 50% probability.

(A). What is the most you would be willing to pay for an insurance policy that will cover all damages due to earthquake?

(B) Imagine that you have been offered a different policy that is identical to the previous one expect that there is **about** 1% (or 5%, 10%) unreimbursement risk. That is, there is a possibility with **about** 1% (or 5%, 10%) that your claim will not be paid in case of half collapse and only half of your claim will be paid in case of complete collapse. This risk is caused by the adjuster's too strict assessment. What is most you would be willing to pay for probabilistic fire insurance?

These data indicate that probabilistic insurance is relatively unattractive. Figure 1 shows the number of the respondent in each category of willingness to pay. (A) is full covered insurance and (B) is probabilistic insurance respectively.



(A)

(B)

Fig. 1 Willingness to pay for (A) full insurance and (B) probabilistic insurance

From this figure, we can see that most respondents are located in upper left, which means the large reduction of the value by switching from the full covered insurance to the probabilistic insurance. It is noteworthy that while the majority of the respondents were willing to pay above the actuarially fair premium for full covered insurance, the majority of respondents were not willing to pay the actuarially fair premium for probabilistic insurance.

4. Model

To examine the influence of ambiguity of insurance payment, we analyze the data based on both the Expected Utility (EU) model and Maximin Expected Utility (MEU) model. EU is most widely used to model decision making under uncertainty. However it can not represent observed individual choice under ambiguity. MEU is the generalized expected utility model to deal with the ambiguity developed by Gilboa and Schmeidler (1989). we explain EU first, then describe MEU.

4. 1 Expected Utility Model

In the full covered insurance setting above, a decision maker has the prospect

$$\Pi = (1-\pi_1-\pi_2, W+Y;\ \pi_1, W+Y/2;\ \pi_2, W)$$

where Y is the value of the house (10 million yen) and W is the value of the other assets (20 million yen). π_1 is the probability of half collapse (0.1025% per year) and π_2 is the probability of half collapse (0.1025% per year).

Under EU, willingness to pay for the full covered insurance wtp_f is determined by the equation below.

$$V(wtp_f) \equiv u(W+Y-wtp_f) = \tilde{v} \qquad (1)$$

where $u(\cdot)$ is a utility function and $\tilde{v}$ is expected utility without any insurance.

$$\tilde{v} \equiv (1-\pi_1-\pi_2)u(W+Y) + \pi_1 u(W+Y/2) + \pi_2 u(W)$$

In the probabilistic insurance setting, the objective prospect is written as

$$Q = (q_0, W+Y; q_1, W+Y/2; q_2, W),$$

where $q_0 = 1-\alpha(\pi_1+\pi_2)$, $q_1 = \alpha(\pi_1+\pi_2)$, $q_2 = 0$ and α is unreimbursement risk (1, 5, 10%). Q can be interpreted as the objective probability distribution when the decision maker has the probabilistic insurance. Under EU, the willingness to pay for the probabilistic insurance wtp_p is determined by the equation below.

$$\begin{aligned} &V(wtp_p) \\ &\equiv q_0 u(W+Y-wtp_p)+q_1 u(W+Y/2-wtp_p) \\ &+q_2 u(W-wtp_p) \\ &=\tilde{v} \end{aligned} \quad (2)$$

4. 2 Maximum Expected Utility Model

Maximin Expected Utility (MEU) model is generally written as below.

$$V_{MEU}(f)=\min_{P\in C}\int_S u(f(s))dP(s) \quad (3)$$

where $s\in S$ is a state of world, $f:S\rightarrow\Re$ is an act that maps a state into an outcome, P is a subjective probability, C is the set of subjective probability distributions that the decision maker has. That is, C represents the ambiguity that the decision maker may perceive in the decision problem. This idea is supported by the fact that we can naturally accept the prediction with some range such as "some event will occur with 0%~5%". Each probability distribution P in C is a "possible scenario" that the decision maker envisions. MEU implies that a decision maker behaves in the worst case of his expected scenarios.

In our earthquake insurance setting, MEU model is formulated as below.

$$V_{MEU}(wtp_p)=\min_{P\in C}\begin{bmatrix} p_0 u(W+Y-wtp_p) \\ +p_1 u(W+Y/2-wtp_p) \\ +p_2 u(W-wtp_p) \end{bmatrix} \quad (4)$$

where $P=(p_0,W+Y;\ p_1,W+Y/2;\ p_2,W)$ is a subjective probability distribution. As for the full covered insurance, MEU is reduced to EU since no ambiguity exists.

To estimate the model, the form of C is necessary to be specified. We apply robust control theory of Hansen and Sargent (2001). The right side of equation (4) can be seen as "a constraint robust control problem" if C is specified as below.

$$C=\{P:R(P,Q)\le\eta\}$$

where $R(P,Q)$ is relative entropy between P and Q. η is a parameter that represents the size of ambiguity.

$$R(P,Q)=\sum_{K-1}^{3}\ln\frac{p_k}{q_k}$$

Hansen and Sargent (2001) shows that the constraint robust control problem has a same solution with "a multiplier robust control problem" as below.

$$\min_{P\in C}\begin{bmatrix} p_0 u(W+Y-wtp_p)+p_1 u(W+Y/2-wtp_p) \\ +p_2 u(W-wtp_p)+\theta R(P,Q) \end{bmatrix} (5)$$

The parameter θ in the last problem (5) can be interpreted as an implied Lagrange multiplier on the constraint $R(P,Q)\le\eta$. Since $R(P,Q)$ is convex in p_0, p_2 and p_2, the first order condition gives the solution of (6).

$$P^*=(p_0^*,W+Y;\ p_1^*,W+Y/2;p_2^*,W)$$

where

$$p_0^*=\frac{q_0}{q_0+q_1e^{(u(W+Y-wtp_p)-u(W+Y/2-wtp_p))/\theta}+q_2e^{(u(W+Y-wtp_p)-u(W-wtp_p))/\theta}}$$

$$p_1^*=\frac{q_1e^{(u(W+Y-wtp_p)-u(W+Y/2-wtp_p))/\theta}}{q_0+q_1e^{(u(W+Y-wtp_p)-u(W+Y/2-wtp_p))/\theta}+q_2e^{(u(W+Y-wtp_p)-u(W-wtp_p))/\theta}}$$

$$p_2^*=\frac{q_2e^{(u(W+Y-wtp_p)-u(W-wtp_p))/\theta}}{q_0+q_1e^{(u(W+Y-wtp_p)-u(W+Y/2-wtp_p))/\theta}+q_2e^{(u(W+Y-wtp_p)-u(W-wtp_p))/\theta}}$$

Thus, the probabilistic insurance purchase decision can be modeled by MEU where wtp_p is determined by the equation below.

$$\begin{aligned} &V_{MEU}(wtp_p) \\ &=p_0^*u(W+Y-wtp_p)+p_1^*u(W+Y/2-wtp_p) \\ &+p_2^*u(W-wtp_p) \\ &=\tilde{v} \end{aligned} \quad (6)$$

5. Examination of Risk Aversion

To examine the effect of risk aversion on the decision to purchase the earthquake insurance, we estimate the Pratt-Arrow coefficient of relative risk aversion γ. We assume that the relative risk aversion is constant in wealth, which derives the specific utility form,

$$u(x)=\frac{x^{1-\gamma}}{1-\gamma}.$$

The relative risk aversion may vary across demographic groups. Thus we connect it with respondent's social characteristics in linear

$$\gamma=\gamma_0+\mathbf{x}'\boldsymbol{\beta}$$

where γ_0 is a intercept, $\mathbf{x}$ is a vector of respondent's characteristics variables, and $\boldsymbol{\beta}$ is a parameter vector.

Random utility model is applied to estimate the model. The value function consists of random part and non-random part. Respondent i choose B_j if

Table 1　The estimation results under EU

Indicator Variables	(N=506)	mean
Age	Age (in yeas)	62.0
Gender	Dummy; 1 if respondent is male	0.912
Married	Dummy; 1 if respondent is married	0.945
Childe	Dummy; 1 if respondent has a childe (under 10 years old)	0.077
Education	Dummy; 1 if respondent graduated an university or graduate school	0.379
Unemployed	Dummy; 1 if respondent is unemployed	0.279
Self-employed	Dummy; 1 if respondent is self-employed	0.103
Civil servant	Dummy; 1 if respondent is a civil servant	0.073
Experience	Dummy; 1 if respondent has experienced a economic loss from earthquake	0.074
Purchase	Dummy; 1 if respondent has purchased an earthquake insurance	0.311
Never_Paid	Dummy; 1 if respondent has never received any insurance payment	0.337
Distrust	Dummy; 1 if respondent distrust insurance companies	0.454

$$V_i(B_{j+1}) < V_i(wtp_i) + \varepsilon \le V_i(B_j),$$

where *Bs* are bids $(B_1 < \cdots < B_j < B_{j+1} < \cdots < B_J)$ shown to the respondent as insurance fee. Assume that ε follows normal distribution with mean 0 and variance σ^2. The log likelihood can be written as

$$\ln L = \sum_{i=1}^{N}\left[\ln\Phi\left(\frac{V_i(B_{j+1}) - \tilde{v}_i}{\sigma}\right) - \ln\Phi\left(\frac{V_i(B_j) - \tilde{v}_i}{\sigma}\right)\right].$$

where $\Phi(\cdot)$ is the normal distribution function. This log likelihood is maximized to estimate parameters.

Table 1 provides the explanation of independent variables and these sample means. Table 2 shows the estimation results for full covered insurance and probabilistic insurance. "Estimated gamma" represents the estimate of relative risk aversion. Positive value of γ implies risk aversion and negative value means risk prone. The γ of the full covered insurance is plausible value, 1.6276 while that of the probabilistic insurance is -17.176, which is too low to accept. The unreasonably low value of γ for the probabilistic insurance implies that EU is unable to represent the decision to buy that insurance.

Ljungqvist and Sargent (2000) and Gollier (2001) said by the thought experiment that the coefficient of relative risk aversion lies within the range from 1 to 4. The empirical literature support this. Friend and Blume (1975) studied the demand for risky assets and conducted that γ generally exceeds unity and is probably greater than 2. Using expenditure data, Weber (1975) estimated γ to lie within a range from 1.3 to 1.8, and Szpiro (1986) obtained a similar range using aggregate time-series data on property insurance. In a careful study of consumption, Hansen and Singleton (1982) found relative risk aversion parameters ranging from 0.68 to 0.97. In a subsequent study of investments,

Table 2　The estimation results of γ under EU

	Full covered insurance		Probabilistic insurance	
	Coeff	p-value	Coeff	p-value
Intercept	1.2561	0.000	-17.635	0.000
Age	0.0047	0.000	0.0091	0.000
Gender	0.1267	0.001	0.0616	0.259
Married	0.0123	0.056	-0.1044	0.126
Childe	0.0792	0.038	0.1083	0.024
Education	-0.0775	0.000	-0.0897	0.002
Unemployed	-0.1246	0.000	-0.0941	0.005
Self-employed	0.0118	0.483	0.0299	0.476
Civil servant	0.0746	0.077	-0.1090	0.043
Experience	0.0118	0.493	-0.0836	0.110
sigma	7.6284 E-5	0.212	4.7355 E+23	0.946
Estimated gamma	1.6276		-17.176	
N	506		506	
Log likelihood ratio	0.0456		0.0676	

*The p-value are based on a two-tailed test that true coefficient is zero.

Hansen and Singleton (1983) found numerical estimates of γ, most of which ranged from 0.26 to 2.7, with outliers as low as -0.359 and as high as 58.25. Mankiw's γ study of consumption spending obtained relative risk aversion estimates ranging from 2.44 to 5.26 for nondurable consumption and from 1.79 to 3.21 for durable goods consumption.

As for full covered insurance, this estimation results suggest that EU works well. The obtained relationship between risk aversion and respondent's characteristics is mostly consistent with the previous knowledge in the empirical literature. In previous studies, the relation between risk aversion and age is not unequivocal. Barskey et al. (1997) report a negative relation (up to age 60-64), while Riley and Chow (1992) and Halek and Eisenhauer (2001) for over 65 age and Donkers et al. (1999) for all age show a positive relation. Our result supports that risk aversion increase in ages. we found in our loss-gambling that men are statistically significantly more risk averse than women. It is also founded by Schubert et al. (1999). Married respondents exhibit significantly risk aversion than unmarred ones. It is also founded by Halek and Eisenhauer (2001). We found that self-employed are less risk averse than employee. Praag (1996), Cramer et al. (2002), and Barskey et al. (1997) report a lower risk aversion for the self employed. The effect of education on risk aversion is negative. The result is also reported by Binswanger (1980, 1981) and by Donkers et al. (1999).

6. Examination of Ambiguity Aversion

The previous section shows EU can not explain the decision to purchase the probabilistic earthquake insurance while it works well for full covered insurance. We now show that the aversion to probabilistic insurance is consistent with MEU. From the viewpoint of risk (or objective probability distribution), full covered insurance and probabilistic insurance are very close. Therefore, ambiguity parameter θ will be estimated given that the coefficient of relative risk aversion for probabilistic insurance is same with that for full covered insurance.

The ambiguity size may vary across demographic groups. Hence we connect it with respondent's characteristics in linear,

$$\theta = \theta_{0.01} + \theta_{0.05} + \theta_{0.10} + \mathbf{x}'\boldsymbol{\beta}$$

where $\theta_{0.01}$, $\theta_{0.05}$ and $\theta_{0.05}$ are dummy variables (=1 if unreimbursement risks are 1%, 5%, and 10% respectively), $\mathbf{x}$ is a vector of respondent's characteristics variables, and $\boldsymbol{\beta}$ is a parameter vector.

Table 3 shows that the estimation results for full covered insurance and probabilistic insurance. "Estimated theta for 0.01, 0.05, and 0.10" represent the estimate of ambiguity parameter for unreimbursement risks 1%, 5%, and 10% respectively.

Table 3 The estimation results of θ under MEU

	Coeff	p-value
dummy_1%	2.9073E-3	0.000
dummy_5%	4.9419E-3	0.000
dummy_10%	6.4812E-3	0.000
Age	0.1160E-4	0.188
Gender	8.5604E-4	0.003
Education	-1.2247E-4	0.161
Experience	-1.1230E-4	0.586
Purchase	1.1807E-3	0.027
Never_Paid	0.6195E-4	0.121
Distrust	4.2387E-4	0.070
sigma	9.1406E-5	0.000
Estimated theta for 0.01	4.9338E-3	
Estimated theta for 0.05	6.9684E-3	
Estimated theta for 0.10	8.5078E-3	
N	506	
Log likelihood ratio	0.0377	

We cannot compare this result with previous knowledge in literature since this paper is first to estimate the ambiguity parameter with cross-section data. However, some empirical studies using aggregated data exist in finance. Maenhout (2004) calibrated θ to be 71.428 E-3 and 4.2194 E-3 respectively using a long annual sample from 1891 to 1994 and quarterly postwar sample from 1947.2 to 1996.3. These values are not so different from our results.

The relationship between risk aversion and respondent's characteristics is consistent with the common sense except *Purchase*. Positive parameters means the correspondent variables increase ambiguity and enlarge the gap between objective and subjective probabilities. The ambiguity increase with age and is larger for male. High education (university or graduate school) and experience of a economic loss from earthquake reduce the ambiguity though these effects are not statistically significant. Respondents who have never received any insurance claim (including mobile, injury, fire, and life insurance) or distrust the insurance company perceive more ambiguous to insurance pay-

Table 4 Subjective probability under MEU

	α= 1%	α= 5%	α= 10%
Objective probability	0.00205%	0.01025%	0.02050%
Subjective probability	0.2104%	0.2717%	0.3000%
Ratio (subjective/objective)	102.7	26.5	14.6

ment. The positive coefficient of *Purchase* means that purchase of the actual earthquake insurance raise the ambiguity. This seems against our expectation. However, we can interpret this result as meaning that only people with high ambiguity tolerance buy the actual earthquake insurance because it has some unreimbursement risk.

Table 4 shows the subjective and objective probability that the respondent's hypothetical wealth is 25 million less insurance fee. In our setting, the case of 20 million wealth level has never happened if he buy the probabilistic insurance. Thus, we can focus on the probability 20 million wealth level since the probability of 20 million can be calculated by it. This shows that the subjective probability become 10 ~ 100 times bigger than the objective probability due to the ambiguity aversion. We can notice that the subjective probability dose not so vary across the unreimbursement risks while the objective probability proportionally changes with them.

Table 5 shows the risk and ambiguity premium that are additional payments to buy earthquake insurance because of risk and ambiguity, respectively. Here, a willingness to pay consists of expected loss, risk premium, and ambiguity premium.

$$\begin{aligned}&\text{Wlllingness to pay}\\&= \text{Expected loss} + \text{Risk premium} + \text{Ambiguity premium}\end{aligned}$$

Table 5 Risk and ambiguity premium (Yen)

	α= 1%	α= 5%	α= 10%
Expected loss	15,273	14,863	14,350
Risk premium	5,725	5,661	5,551
Ambiguity premium	-13060	-16132	-17151
Willingness to pay	7937	4391	2750

A 1% unreimbursement risk reduces more than half value of earthquake insurance. This result is similar with the outcome of the experiment survey conducted by Wakker, Thaler, and Tversky (1997) where respondent exhibit more than a 20% reduction in the willingness to pay in order to compensate for 1% unreimbursement risk in life insurance setting. The difference between 1% and 5% is larger than that between 5% and 10%, which suggest that the marginal effect of ambiguity aversion with respect to unreimbursement risk declines.

7. Conclusion

In this paper we used data from the survey where a set of questions on hypothetical earthquake insurance is present. We empirically investigated the effect of ambiguity on the decision to buy hypothetical earthquake insurance and the relationship with individual characteristics. The main results of this paper may be summarized as follows.

First, we have observed that people dislike probabilistic insurance: Most respondents demanded more than 50% reduction in premium to offset a 1% unreimbursement risk. Second, we have demonstrated that such preferences are generally inconsistent with expected utility theory. Third, we have shown that the reluctant to buy probabilistic insurance is predicted by the Maximin Expected Utility model. Forth, the ambiguity that respondents perceive is larger in men who purchase earthquake insurance, have never received insurance payment, and distrust insurance companies than each correspondents. And it increases with age, education level.

In the classical economic analysis, insurance is explained by concavity of utility. In MEU theory, insurance is explained by ambiguity aversion. The observed aversion to probabilistic insurance suggests that the purchase of insurance is driven primarily by the robust-prone to ambiguity rather than by diminishing marginal utility.

Although this paper dealt with the earthquake insurance, there are many other decision problems in which one perceive the ambiguity for the outcome from the investment to reduce the probability of some hazard. Examples are earthquake retrofit, medical check-ups and the installation of burglar alarm. Our result suggests that guarantee of their performance or complete recompense in case of failing may dramatically increase their value.

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地震保険購入行動における曖昧性回避傾向の実証分析

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要旨

わが国の地震保険の普及率は低い。本稿では、その原因として地震保険の保険金支払いの曖昧性に着目した。保険の不払いリスクのある仮想的な地震保険に関する意識調査データを用い、曖昧性回避傾向を扱うことのできるマキシミン期待効用理論に基づいた、曖昧性プレミアム（曖昧性の存在によって追加的に生ずる保険料の支払い意思額）の金額の推定を試みた。その結果、保険金不払いリスクは曖昧性により過大に評価され、たとえ1%であっても地震保険の価値をほぼ半減することが明らかになった。

キーワード:曖昧性，地震保険，確率保険，マキシミン期待効用