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Abstract

We investigate how people coped with unexpected losses caused by the 1995 Hanshin-Awaji earthquake by using an unusually rich household data. Several empirical findings emerged. We found that the coping means were specific to the nature of the loss caused by the earthquake. For example, borrowing was extensively used to recover the damages to housing, whereas dissavings were utilized to compensate for the loss to assets. Our analysis in this paper contains important policy implications in the preparation of well-designed social safety nets against future natural disasters. Since the economic losses caused by natural disasters are often too large for the government to support effectively, its role is to facilitate the self-insurance of the victims of the disasters. Our empirical results suggest that provisions of the subsidized loan programs to the victims can be a good example.

Keywords: Natural disasters; Risk-coping strategies.

1. Introduction

In the early morning of January 17, 1995, a major earthquake hit the Hanshin area of Japan, causing the losses of US\$114 billion to capital stock, the largest economic damage in the human history [Horwich (2000)]. It is fair to say that the earthquake was totally unexpected in this area, unlike in Tokyo, which was hit by a massive earthquake in 1923. This is reflected in the fact that only 3 percent of the property in Hyogo Prefecture (where Kobe is located) was covered by earthquake insurance [Skidmore (2001)].⁴ However, in retrospect, the negative impact of the earthquake on households' economic welfare was smaller than was originally expected, and recovery from the earthquake proceeded with unexpected speed. The sensible responses of households played an important role in coping with the shocks caused by the earthquake. The government, too, played an important role in providing public safety nets *ex ante* and *ex post* in the form of the safety infrastructure and temporal housing.

As an *ex ante* measure against economic losses from unexpected future events, Japanese households hold significant amounts of precautionary savings [Horioka and Watanabe (1997)]. Some researchers attributed the high frequency of catastrophes such as earthquakes, volcanic eruptions, landslides, and typhoons to the Japanese high propensity to save [Bronfenbrenner and Yasuba (1987); Skidmore (2001)]. Self-insurance through private savings seems to have become a major source of individual self-protection from natural disasters in Japan. Skidmore (2001) estimated that almost a third of Japan's private savings can be explained as a precautionary device to the unexpected losses from natural disasters. Moreover, a reduction in unnecessary expenditures, borrowing, and private transfers should have been a part of important risk-coping strategies. Yet, the role of self-insurance was not recognized as a major source of *ex post* disaster management [Horwich (2000)]. The only related paper known to us is by Horioka et al (2002), which found that Japanese households cope with risk primarily by drawing down their own savings.

While natural disasters are thought to be a correlated shock, there is an important heterogeneity among households with different vulnerabilities. Some households were insulated from the shocks, while the physical and human assets of others were seriously damaged. It is entirely an empirical question for whom, which, and how risk-coping devices worked against the negative shocks caused by the earthquake. In this paper, armed with a unique household-level data collected in Kobe shortly after the earthquake in 1995, we investigate how people coped with unexpected resource losses caused by the sudden natural disaster. Particularly, we compare the

⁴ Interestingly, Froot (2001) found that in the United States most insurers purchase relatively little catastrophe reinsurance against natural disasters. He concluded that this can be attributed to supply restrictions associated with capital market imperfections and market power exerted by traditional reinsurers.

effectiveness of the four risk-coping strategies quantitatively, i.e., a reduction in unnecessary expenditures, dissaving, borrowing, and receiving private transfers.

We believe that this study is the first to address these questions, investigating the relative effectiveness of different risk-coping devices against natural disasters. While the market might respond effectively to the risk of damage from natural disasters in the United States [Brookshire et al. (1985)], there are serious limitations in private insurance markets for earthquakes in Japan. Zeckhouser (1996) pointed out that the costs generated by natural disasters can be reduced with effective policies for insurance and government regulation. However, the government, in its attempt to provide ex post public support after a natural disaster, may create social costs that reduce or offset the effectiveness of its program if it fails to consider other risk-coping devices employed by its target group. It is therefore important to examine whether a government program crowds out existing private self- and mutual-insurance mechanisms and whether its coverage of public eligibility is limited only to those unprotected. Moreover, if substantial compensation were to be expected in future disasters, it could encourage people to place themselves in harm's way more than they might otherwise do. This is a moral hazard problem pointed out by Horwich (2000). In this context, we believe our integrated analysis of risk-coping devices has important policy implications in the preparation of well-designed social safety nets against future natural disasters.

The rest of this paper is composed of three sections. Section 2 sets up our theoretical and econometric framework. In Section 3, after a brief overview of our data set, we summarize the empirical findings. The final section summarizes with some concluding remarks.

2. The Model Framework

People in developed and developing countries alike are confronted by ex post shocks in their day-to-day lives. For example, crops and livestock—the sources of income of most farmers—may be destroyed by natural hazards such as hurricanes, floods, fire, and serious drought. There are also serious risks in business activities, since sales and prices of production inputs fluctuate even in developed countries. Moreover, accidents, sickness, or sudden death may disable a household head or an entire family. Macroeconomic instabilities or recessions, which tend to generate harsh inflation and widespread unemployment, may also significantly reduce the real value of household resources. Yet, among these unexpected shocks, natural disasters are the most serious.

Under these uncertainties, households face a problem of how to reconcile income fluctuations with a desired stable consumption. This problem can be theoretically captured as a

problem of intertemporal consumption smoothing under a stochastic income process. Based on such a framework, the recent literature addresses the effectiveness of formal and informal risk-mitigating mechanisms of households [Besley (1995), Hayashi (1996), Townsend (1994, 1995)]. Households have developed several ways, such as those involving self-insurance and mutual insurance, to cope with the ex-post risks of negative-income shocks and to protect their levels of consumption [Hayashi (1996)]. In other words, we can define risk-coping strategies as ex-post strategies to reduce consumption fluctuations, provided income fluctuations due to these ex-post risks.

The existing literature identifies the following four household risk-coping strategies. First, a household can change the quality and composition of expenditures by reducing unnecessary expenditures, such as those for luxuries. As revealed in recent studies on the aftermath of the currency crisis in Korea, Indonesia, and Thailand, consumption reallocation is indeed an important coping strategy [Kang and Sawada (2003), Frankenberg, Thomas, and Beegle (1999)]. Interestingly, Olney (1999) showed that cutting consumption was the only viable strategy of American households against a recession in 1930, given the high default cost on their loans. Accordingly, consumer spending collapsed in 1930, turning a minor recession into the Great Depression.

Second, households can use credit to smooth consumption by reallocating future resources to current consumption. It is straightforward to show theoretically that the lack of consumption insurance can be compensated by the access to the credit market [Eswaran and Kotwal (1989)]. In fact, the use of credit for consumption is the basic logic of the LC-PIH interpretation of household-consumption smoothing. However, households often have only a limited access to credit markets and are constrained from borrowing for a variety of reasons [Jappelli (1990)]. This can be due to high information cost, lack of assets for collateral, or policy-induced financial repression [Stiglitz and Weiss (1981), McKinnon (1973)]. In either case, the existence of credit constraints has important negative impacts on risk-coping abilities of poor households. However, Horioka and Kohara (1999) and Sawada et. al (2003) found that less than fewer than 10 percent of households face credit constraints in Japan.

Third, households can accumulate financial and physical assets as precautionary means against unexpected income shortfalls [Guiso et al. (1992), Carroll and Samwick (1998)]. Theoretically, positive precautionary savings exist when the third derivative of a utility function is positive [Leland (1968)]. The forms of precautionary savings include bank deposits, cash holdings, and jewelry.

Finally, formal or informal transfers can serve as self-insurance or mutual-insurance mechanisms. Even when a natural disaster occurs, a household can still hedge downside risk by

receiving remittances from family members who are altruistically linked [Altonji, et al. (1997), Cox and Jimenez (1990, 1992)]. These transfers can be interpreted as self-insurance behavior of a dynastic family which is composed of altruistically linked generations. Moreover, through informal arrangements of state-contingent mutual transfers among relatives, friends and neighbors, a household can also achieve consumption smoothing [Hayashi et al. (1996), Kohara et al. (2002), Townsend (1994, 1995)]. It is also important to note that the self-enforcement mechanisms of this informal self-interested mutual-insurance scheme could be sustained as sub-game perfect Nash equilibria in a repeated game framework [Coate and Ravallion (1993); Kocherlakota (1996)].

In addition to the above coping strategies, the government can also complement the risk-coping behaviors of households in various ways. Direct public transfers through means-tested targeting or geographical/group targeting can act as a formal safety net for vulnerable households who face temporary difficulties. Moreover, a provision of self-targeting workfare programs can be used as a self-insurance of poor households.

The Theoretical Framework

To illustrate the role of different household responses in coping with unexpected damages caused by a natural disaster, we follow Zeldes (1989) and Deaton (1991) and construct a model that provides optimal consumer behavior under uncertain income and possible credit constraints. Suppose a household decision maker has a concave instantaneous utility, $U(\bullet)$, of the household consumption, C_t . The household decision is then to choose C_t , which maximizes the conditional expectation of discounted lifetime utility with a subjective discount rate, \mathbf{d} , subject to intertemporal budget constraints:

$$\begin{aligned} & \underset{\{C_t\}}{\text{Max}} E_t \sum_{j=0}^T \left(\frac{1}{1+\mathbf{d}} \right)^{t+j} U(C_{t+j}) \\ \text{s.t. } & A_{t+1} = (1+r_t)(A_t + y_t - C_t) \\ & A_t + y_t - C_t + z_t \geq 0, \\ & z_t \geq 0 \\ & A_0 \text{ given} \\ & A_T \geq 0, \end{aligned}$$

where A is the household asset at the beginning of the period. The maximum amount of credit possible for this household is represented by z_t .⁵ Note that r and y represent the interest rate and

⁵ When z is sufficiently large, this household can lend and borrow freely at a rate of interest r_t . A case of

stochastic household income, respectively.

When income is stochastic, analytical solutions to this problem cannot generally be derived [Zeldes (1989)]. However, we can derive a set of first-order necessary conditions by forming a value function and Bellman equation to obtain an optimum solution. Let \mathbf{I} represent the Lagrange multiplier associated with credit constraint $A+y-C+z \geq 0$. Combining the envelope condition derived from the first-order conditions, we obtain a consumption Euler equation, which is augmented by the possibility of a binding credit constraint:

$$(1) \quad \begin{aligned} U'(C_t) &= E_t \left[U'(C_{t+1}) \left(\frac{1+r_t}{1+d} \right) \right] + \mathbf{I}_t, \\ A_t + y_t - C_t + z_t &\geq 0 \text{ if } \mathbf{I}_t = 0, \\ A_t + y_t - C_t + z_t &= 0 \text{ if } \mathbf{I}_t > 0. \end{aligned}$$

Note that this augmented Euler equation was first derived by Zeldes (1989). We can interpret the Lagrange multiplier, \mathbf{I} , as an indicator of negative welfare effects generated by binding credit constraints.⁶ Note that the Lagrange multiplier \mathbf{I}_t is a negative function of the current asset, income, and the maximum value of borrowing. It is straightforward to show that, given other variables, a decrease in these variables of a credit-constrained household leads the marginal utility of current consumption to increase, causing the Lagrange multiplier to increase.

The Econometric Framework

The aim of our econometric framework is to test the implications of the augmented Euler equation (1). When the credit constraint is binding, we have:

$$(2) \quad U'(C_{it}) = E_t \left[U'(C_{i,t+1}) \left(\frac{1+r_{it}}{1+d_i} \right) \right] + \mathbf{I}_{it}(A_{it}, y_{it}, z_{it}),$$

where i is the household index. In equation (2), recall that \mathbf{I} is a negative function of the current asset, income, and the maximum value of borrowing. Hence, given the first term of the right-hand side of equation (2), i.e., the expected value of the marginal utility of the targeted consumption at

complete borrowing constraint, in which a household cannot borrow at all, can be represented by $z=0$.

⁶ This term, \mathbf{I} , is equal to the increase in expected lifetime utility that would result if the current constraint were relaxed by one unit. Because the household is constrained from borrowing more, but not from saving more, \mathbf{I} enters with a positive sign.

$t+1$, possible risk-coping strategies to a household is to reduce consumption, to dissave, to receive transfer income, or to borrow additional amounts. Formally, the roles of four different coping strategies are represented by the following partial derivatives based on equation (2):

$$(3) \quad \frac{\partial I_{it}}{\partial C_{it}} > 0, \frac{\partial I_{it}}{\partial A_{it}} < 0, \frac{\partial I_{it}}{\partial y_{it}} < 0, \frac{\partial I_{it}}{\partial z_{it}} < 0.$$

In the empirical analyses, we investigate the responses of these coping strategies against various negative shocks caused by the earthquake. Since the adoptions of coping strategies are observed as discrete variables, we estimate the following binary dependent variable models separately for different coping strategies. Assuming an i.i.d. unobserved stochastic element, \mathbf{e} , we have the following reduced-form linear coping function for j -th risk coping strategy:

$$(4) \quad P_{ji}^* = S_i q + H_i b + \mathbf{e}_{ji}.$$

Note that S represents a matrix of household-specific shock variables generated by the earthquake and that H is a matrix of household characteristics. We do not directly observe the intensity of risk-coping strategy, P^* . Hence, our dependent variable is whether a household adopted a particular coping device against the earthquake, which can be represented by a discrete variable, p :

$$(5) \quad \begin{aligned} p_{ji} &= 1 \text{ if } P_{ji}^* > 0 \\ p_{ji} &= 0 \text{ otherwise.} \end{aligned}$$

Note that $\text{Prob}(P^* > 0) = \text{Prob}(\mathbf{e} > -Sq - Hb)$ and $\text{Prob}(P^* \leq 0) = \text{Prob}(\mathbf{e} \leq -Sq - Hb)$. We will estimate the model of equation (5) by using probit model, i.e., under an assumption of normality of the error term.

3. The Data Set and Empirical Results

The data set we employ in this paper is the survey data on consumer life after the earthquake, collected by Hyogo Prefecture (“Shinsai-go no Kurashi no Henka kara Mita Shouhi Kouzou ni tsuite no chousa Houkokusho (Research Report on Changes in Lifestyles and Consumption Behavior Following Disasters)” released on March 25th, 1997 by Hyogo-ken Seikatsu Bunka-bu Seikatsu Souzou-ka Shouhi Seikatsu Taisaku-shitsu (Hyogo Prefecture,

Department of Livelihood and Culture, Livelihood Creation Section, Office for Livelihood Policy)).

The survey was conducted in October 1996 in the six districts seriously hit by the earthquake. The survey was completed by 1,589 women who were selected, based on a stratified random sampling scheme, from all women above age of 30 in Higashinada-ku, Kita-ku and Suma-ku of Kobe city, Akashi city, and Nishinomiya city.

The definitions and summary statistics of the variables are given in Tables 1. The first key variable is a binary variable which takes one if a household reported that it faced unexpected increase in expenditure to cope with the earthquake and zero otherwise. According to the response, more than 80% of household reported that they were obliged to manage the unexpected increase in their expenditures. With respect to the rest of the variables, Table 1 reports the summary statistics for those people whose expenditures are disrupted by the earthquake.

Throughout the estimation of different risk-coping models, we employ binary dependent variables of four coping strategies, i.e., reduction in the cost of living, dissaving, borrowing, and receiving public and private transfers⁷.

We then have three sets of independent variables. The first block of variables is composed of the possible causes of the increase in expenditure. The surveys asked the respondents in detail about damages caused by the earthquake, such as damages to their house, household assets, health of the family members, and their connection to public utilities. It is notable that 42 percent and 78 percent of the respondents suffered from major damages to their house and household assets, respectively. Moreover, more than half the people experienced a disconnection of public utilities for more than one month. These figures reveal the seriousness of the economic loss caused by the earthquake.

The second block is composed of household characteristics. First, the ownership rate of housing is around 72 percent before the earthquake, where around 40 percent of those who own a house still held outstanding housing loans. The average age of the respondent is 51 years old; the majority are high school graduates or lower. There were 0.5 percent of the respondents who did not answer their education level properly. We suspect that their education level is minimal and the results reflect a stigma attached to the low level of education. Most of the respondents live with their children, and the joint-family co-residence rate is around 20 percent. On the other hand, only about 4 percent of the surveyed respondents were single. Household income was surveyed by

⁷ The question asks both the most important strategy (single choice) and other strategies (multiple choices) . The estimation below utilizes the single-choice answers. Dissaving includes those from saving for retirement, children (i.e. costs of education), houses (purchases or reforming), durables (i.e. automobiles), leisure (i.e. personal trips), unexpected events (disasters or sickness). Borrowing includes those from financial institutions or relatives or friends.

category. The median annual household income is somewhere between 6 million and 8 million yen.

Finally, to control for unobserved heterogeneity generated by the difference in the effects of the earthquake, we include the district-specific dummy variables. Since, among other things, the effects of the earthquake are determined by the proximity to the focus of it, we believe that inclusion of the district dummies are a reasonable choice.

Estimation Results

First of all, we estimate a probit model of the determinants of the expenditure increase to investigate the sources of expenditure shocks. The estimated results are reported in Table 2. According to this table, it is clear that the major expenditure shocks are generated by damages to the house and household assets. Interestingly, the level of education is negatively related with the expenditure increase. This finding suggests that less-educated people are more vulnerable against the natural disasters.

Table 3 summarizes the estimation results of probit models of determinants of different coping strategies. These results can be summarized in the following four findings. First, the columns for expenditure reallocation and borrowing reveal that, facing major or minor damage to their housing, people primarily coped with it by borrowing, while expenditure reallocation was not effective coping means. The last column indicates that obtaining transfers acted to some extent as an effective coping device against housing damage.

Second, according to the first column for the expenditure reallocation, it seems that those who owned a house without outstanding housing loans before the earthquake could borrow money sufficiently and, therefore, they did not need to reallocate their expenditures. The borrowing column indicates that borrowing was possible especially for those who had their own house before the earthquake. This suggests the importance of collateral to getting a loan after the earthquake. Moreover, educated respondents could effectively adopt borrowing as a coping strategy, which is consistent with the previous findings of Horioka and Kohara (1999) and Sawada, Ii, and Nawata (2003) that educated people are less likely to face credit constraints.

The third finding is from the second column for dissaving. According to this column, major or minor shocks to households' assets are coped with by means of dissaving. Interestingly, age has a positive impact on the probability of adopting dissaving. This might be a reflection of the life-cycle effects. Under a finite horizon, the optimal amount of precautionary saving is a negative function of the length of the remaining life [Caballero (1990)]. The positive coefficient we observe on the age variable might capture this effect—older people are more willing to dissave to cope

with the shock than younger people, who still have long lives ahead of them.

Finally, as mentioned already, receiving a transfer is an effective coping means against major housing damage. Moreover, those who had outstanding housing loans before the earthquake have higher probabilities to receive transfers from outside. Yet, co-residence decreased the probability of coping via transfer significantly, suggesting the importance of ex ante intra-family arrangements as a self-insurance device through, for example, migration to mitigate risk spatially.

4. Concluding Remarks

In this paper, we examined how people cope with unexpected resource losses caused by a sudden earthquake occurred in Kobe in 1995 by employing a unique household-level data shortly after the earthquake. We found that the coping means are specific to the nature of shocks caused by the earthquake. For example, borrowing was extensively used to recover the damages to housing, while dissavings were utilized to compensate for the loss to household assets.

Our analysis in this paper contains important policy implications in the preparation of well-designed social safety nets against future natural disasters. The economic losses caused by a huge earthquake such as the Great Hanshin-Awaji earthquake are too large for the government to support effectively. Hence, the government's ex-post support should be one that facilitates the self-insurance of the victims of the disaster. Our empirical results suggest that provisions of the subsidized loan programs to the victims can be a good example. Such interventions are not likely to create the moral hazard problems that Horwich (2000) pointed out, since they are not direct resource transfers to the victims.

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Table 1
Descriptive Statistics of the Variables Used

Variable Description	Variable Name	Mean (Standard Deviation)
<u>Expenditure shock</u>		
Dummy=1 if the household faces an increase in its expenditure because of earthquake	exp_inc	0.803
<u>Coping Variables</u>		
Dummy=1 if expenditure reallocations were the most important coping means	copebyexp	0.250
Dummy=1 if dissaving was the most important coping means	copebysav	0.537
Dummy=1 if borrowing was the most important coping means	copebybor	0.096
Dummy=1 if receiving transfers was the most important coping means	copebytra	0.116
<u>Shock Variables</u>		
Dummy=1 if there was major damage to the house	lhshock	0.426
Dummy=1 if there was minor damage to the house	shshock	0.431
Dummy=1 if there was major damage to household assets	lashock	0.094
Dummy=1 if there was minor damage to household assets	sashock	0.773
Dummy=1 if there were healing-related shocks to the family	hlshock	0.213
Dummy=1 if there was utility disconnection for more than one month.	utshock	0.536
<u>Household Characteristics</u>		
Dummy=1 if had own house before the earthquake	ownh_b	0.718
Dummy=1 if had outstanding housing loans before the earthquake	hloan_b	0.319
Age of the respondent	age	51.190 (10.842)
Dummy=1 if the respondent did not report education level	(default category)	0.005
Dummy=1 if the highest education of the respondent is high school or lower	midhigh	0.615
Dummy=1 if the highest education of the respondent is higher than high school	higher	0.380
Dummy=1 if the respondent is single	single	0.042
Dummy=1 if the respondent lives with children	child	0.623
Dummy=1 if the respondent lives with parents or grand-children	cores	0.198
Dummy=1 if the household's annual income is lower than 2 million yen (default).	(default category)	0.061
Dummy=1 if the household's annual income is between 2 million and 4 million yen.	_income_2	0.211
Dummy=1 if the household's annual income is between 4 million and 6 million yen.	_income_3	0.219
Dummy=1 if the household's annual income is between 6 million and 8 million yen.	_income_4	0.185
Dummy=1 if the household's annual income is between 8 million and 10 million yen.	_income_5	0.150
Dummy=1 if the household's annual income is between 10 million and 12 million yen.	_income_6	0.083

Dummy=1 if the household's annual income is between 12 million and 14 million yen.	_income_7	0.039
Dummy=1 if the household's annual income is higher than 14 million yen.	_income_8	0.052
<u>Regional Characteristics</u>		
Dummy=1 if Higashinada-ku (default)	(default category)	0.163
Dummy=1 if Kita-ku	_Iarea_2	0.136
Dummy=1 if Suma-ku	_Iarea_3	0.136
Dummy=1 if Akashi city	_Iarea_4	0.370
Dummy=1 if Nishinomiya city	_Iarea_5	0.181
Dummy=1 if other area	_Iarea_6	0.014

Note) Numbers in parentheses are standard deviation.

Table 2
The Sources of Expenditure Shocks
Dependent variable: Dummy=1 if the household faces an increase in expenditure because of the earthquake

Explanatory Variables	Variable Name	dF/dx	(Standard Error)
Dummy=1 if there was major damage to the house	lhshock	0.238	(0.020)****
Dummy=1 if there was minor damage to the house	shshock	0.168	(0.021)***
Dummy=1 if there was major damage to household assets	lashock	0.098	(0.027)**
Dummy=1 if there was minor damage to household assets	sashock	0.136	(0.029)***
Dummy=1 if there were healing-related shocks to the family	hlshock	0.030	(0.027)
Dummy=1 if there was utility disconnection for more than one month.	utshock	0.007	(0.020)
Dummy=1 if had own house before the earthquake	ownh_b	0.034	(0.029)
Dummy=1 if had outstanding housing loans before the earthquake	hloan_b	0.032	(0.024)
Age of the respondent	age	-0.001	(0.001)
Dummy=1 if the highest education of the respondent is high school or lower	midhigh	-0.786	(0.048)***
Dummy=1 if the highest education of the respondent is higher than high school	higher	-0.985	(0.010)***
Dummy=1 if the respondent is single	single	-0.012	(0.051)
Dummy=1 if the respondent lives with children	child	0.012	(0.023)
Dummy=1 if the respondent lives with parents or grand-children	cores	-0.019	(0.026)
Dummy=1 if the household's annual income is between 2 million and 4 million yen.	_inco~2	0.002	(0.043)
Dummy=1 if the household's annual income is between 4 million and 6 million yen.	_inco~3	0.020	(0.040)
Dummy=1 if the household's annual income is between 6 million and 8 million yen.	_inco~4	-0.003	(0.047)
Dummy=1 if the household's annual income is between 8 million and 10 million yen.	_inco~5	0.031	(0.041)
Dummy=1 if the household's annual income is between 10 million and 12 million yen.	_inco~6	0.013	(0.048)
Dummy=1 if the household's annual income is between 12 million and 14 million yen.	_inco~7	0.034	(0.053)
Dummy=1 if the household's annual income is higher than 14 million yen.	_inco~8	0.095	(0.027)**

Dummy=1 if Kita-ku	_Iarea_2	-0.072	(0.048)
Dummy=1 if Suma-ku	_Iarea_3	-0.057	(0.049)
Dummy=1 if Akashi city	_Iarea_4	0.038	(0.034)
Dummy=1 if Nishinomiya city	_Iarea_5	-0.042	(0.043)
Dummy=1 if other area	_Iarea_6	-0.122	(0.141)
Sample size		1279	

Note 1) In this table, “dF/dx” reports the change in the probability for a marginal change in continuous independent variable and for a discrete change of dummy independent variable from 0 to 1, evaluated at the mean independent variables.

Note 2) Huber-White consistent robust standard errors are employed. The symbols *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Table 3
Comparisons of Different Coping Strategies

Explanatory Variables	Variable Name	Expenditure Reallocation	Dissaving	Borrowing	Receiving Transfers
		dF/dx (Std. Err.)	dF/dx (Std. Err.)	dF/dx (Std. Err.)	dF/dx (Std. Err.)
Dummy=1 if there was major damage to the house	lhshock	-0.237 (0.054)***	0.007 (0.077)	0.214 (0.068)***	0.092 (0.047)**
Dummy=1 if there was minor damage to the house	shshock	-0.068 (0.051)	0.014 (0.071)	0.154 (0.061)***	-0.013 (0.040)
Dummy=1 if there was major damage to household assets	Lashock	-0.036 (0.089)	0.177 (0.096)*	-0.037 (0.027)	-0.048 (0.029)
Dummy=1 if there was minor damage to household assets	sashock	-0.025 (0.060)	0.124 (0.072)*	-0.040 (0.038)	-0.046 (0.049)
Dummy=1 if there were healing-related shocks to the family	hlshock	-0.012 (0.048)	0.017 (0.058)	-0.014 (0.023)	0.015 (0.031)
Dummy=1 if there was utility disconnection for more than one month.	utshock	0.017 (0.040)	0.104 (0.048)**	-0.062 (0.023)***	-0.024 (0.022)
Dummy=1 if had own house before the earthquake	ownh_b	-0.098 (0.057)*	0.064 (0.064)	0.050 (0.021)**	-0.040 (0.039)
Dummy=1 if had outstanding housing loans before the earthquake	hloan_b	0.086 (0.052)*	-0.103 (0.059)**	-0.020 (0.023)	0.052 (0.034)*
Age of the respondent	Age	-0.007 (0.002)***	0.009 (0.003)***	-0.001 (0.001)	-0.001 (0.001)
Dummy=1 if the highest education of the respondent is high school or lower	midhigh	-0.145 (0.321)	0.268 (0.344)	0.636 (0.112)***	-0.195 (0.134)*
Dummy=1 if the highest education of the respondent is higher than high school	higher	-0.158 (0.268)	0.244 (0.335)	0.923 (0.062)***	-0.123 (0.077)
Dummy=1 if the respondent is single	single	-0.049 (0.104)	0.070 (0.133)	-0.006 (0.062)	-0.016 (0.054)
Dummy=1 if the respondent lives with children	child	0.039 (0.044)	-0.117 (0.054)**	0.043 (0.022)*	0.006 (0.026)
Dummy=1 if the respondent lives with parents or grand-children	cores	-0.020 (0.051)	0.017 (0.060)	0.051 (0.033)*	-0.051 (0.023)*
Dummy=1 if the household's annual income is between 2 million and 4 million yen.	_linc0~2	-0.114 (0.079)	0.193 (0.106)	-0.046 (0.030)	0.003 (0.058)

Dummy=1 if the household's annual income is between 4 million and 6 million yen.	_linc~3	-0.105 (0.081)	0.202 (0.108)*	-0.056 (0.028)	-0.009 (0.056)
Dummy=1 if the household's annual income is between 6 million and 8 million yen.	_linc~4	-0.081 (0.087)	0.074 (0.124)*	-0.052 (0.028)	0.081 (0.090)
Dummy=1 if the household's annual income is between 8 million and 10 million yen.	_linc~5	-0.115 (0.078)	0.192 (0.112)	-0.039 (0.031)	-0.006 (0.061)
Dummy=1 if the household's annual income is between 10 million and 12 million yen.	_linc~6	-0.162 (0.059)*	0.223 (0.115)*	-0.037 (0.032)	0.045 (0.091)
Dummy=1 if the household's annual income is between 12 million and 14 million yen.	_linc~7	-0.139 (0.073)	0.298 (0.100)**	-0.061 (0.016)*	-0.017 (0.067)
Dummy=1 if the household's annual income is higher than 14 million yen.	_linc~8	-0.173 (0.052)**	0.197 (0.128)	-0.037 (0.033)	0.125 (0.137)
Dummy=1 if Kita-ku	_larea_2	0.191 (0.091)**	-0.054 (0.091)	-0.008 (0.037)	-0.073 (0.022)**
Dummy=1 if Suma-ku	_larea_3	0.036 (0.081)	0.063 (0.086)	-0.015 (0.033)	-0.043 (0.029)
Dummy=1 if Akashi city	_larea_4	0.015 (0.059)	0.044 (0.070)	-0.009 (0.027)	-0.022 (0.028)
Dummy=1 if Nishinomiya city	_larea_5	-0.007 (0.070)	0.107 (0.081)	0.012 (0.039)	-0.063 (0.023)**
Dummy=1 if other area	_larea_6	-0.024 (0.201)	0.134 (0.183)	-0.020 (0.057)	-0.037 (0.050)
Sample size		513	513	513	513

Note 1) In this table, “dF/dx” reports the change in the probability for a marginal change in continuous independent variable and for a discrete change of dummy independent variable from 0 to 1, evaluated at the mean independent variables.

Note 2) Huber-White consistent robust standard errors are employed. The symbols *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.