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June 2017

Abstract

This paper investigates the effects of the Great East Japan Earthquake on Japanese investors' risk and time preferences using surveys that collected data one month before and two months after the earthquake. Although there is some evidence to suggest that investors' risk and time preferences changed after the earthquake, the changes are not uniform across different types of financial opportunities. It is difficult to explain the post-quake stagnant stock prices in Japan in terms of these changes in investors' preferences.

Keywords: Risk preference, time preference, natural disaster, earthquake, preference stability, investor, Japan.

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1 Introduction

This paper investigates the effects of the Great East Japan Earthquake on Japanese investors' risk and time preferences. The Great East Japan Earthquake on March 11, 2011, with magnitude 9.0 inflicted enormous damage on the people in Japan by its jolt and the tsunami that cost the lives of more than 15 thousand people. In the region of 8 million homes (about 15% of all homes in Japan) suffered electric power outages and 1.8 million homes were also temporarily without water. This represents the largest earthquake in recorded history in Japan. The earthquake occurred at 14:46 JST, 14 minutes before the weekly closing at the Tokyo Stock Exchange. The Nikkei 225 dropped by about 1% in that 14 minutes. The stock price further declined by about 6% on Monday and by 10% on Tuesday; it then rebounded to some degree, stabilizing for three months at a level about 10% lower compared with the pre-quake figure. Hood et al. [2013] find that Japanese individual investors bought 6.0% less than they sold the week after the earthquake. The research question of this paper is whether this decline in stock prices was driven by investors' preferences. Kumar and Lee [2006] find that investor sentiment plays an important role in the formation of stock returns. Their paper, however, does not identify the sources of investor sentiment changes, whether they be "liquidity concerns, risk aversion, or irrational sentiment."

This paper uses publicly available survey data from the Research Institute for Socionetwork Strategies (RISS) at Kansai University to investigate the changes in investors' preferences after the earthquake. The RISS conducts surveys on an irregular basis, and surveys that pose questions about investors' risk preferences and discount rates happened to be conducted just two months before and one month after the Great East Japan Earthquake. The respondents answer hypothetical questions about lotteries and insurance in the surveys. To the best of our knowledge, these are the only set of preference surveys available that were conducted just a few months prior and subsequent to the Great East Japan Earthquake. A pooled cross-section dataset is created by combining these pre-quake and post-quake surveys to capture changes in people's preferences. Moreover, a follow-up survey was conducted in 2016 to create a panel dataset to observe and explore preference changes after the earthquake.

This paper illustrates that although there is some evidence that investors changed their risk and time preferences after the earthquake, the changes are not uniform across different types of financial opportunities. The intensity of the earthquake and the magnitude of its impacts do not seem to have had significant and consistent influences on risk aversion and discount rates measured by various financial opportunities, neither in the short run nor in the long run. If it is indeed the case that investors' preferences did not change substantively after the earthquake, it follows that the drop in Japanese stock prices after the earthquake was driven by other factors, such as tighter liquidity constraints or the prospects of lower profitability of Japanese companies.

2 Literature

Chuang and Schechter [2015] survey papers that analyze the impact of extreme events on people's preferences and conclude that the papers find "amazingly divergent results" about the impacts of natural disasters and civil wars. Thus, the papers presented below are not consistent with each other, indicating that there is no consensus in the literature as to the impact of extreme events on people's preferences.

Hanaoka et al. [2015] investigate the effect of the Great East Japan Earthquake on people's risk preferences by using the Japan Household Panel Survey on Consumer Preferences and Satisfaction, which includes hypothetical lottery questions. They conclude that men who experienced the earthquake with greater intensity became more risk tolerant. Goebel et al. [2015] study the impact of the Fukushima Daiichi nuclear accident on self-evaluation of risk aversion using household panel data and conclude that more Germans considered themselves as very risk intolerant after Fukushima than before it occurred. Cameron and Shah [2015] employ risk games using real money and find that people in Indonesia who suffered a flood or an earthquake in the past three years became more risk intolerant. Said et al. [2015] argue that although individuals hit by the 2010 floods in Pakistan became more risk intolerant, there was response variation across individuals. Individuals who experienced more severe recent flood losses, for example, became more risk tolerant. Cassar et al. [2017] conducted a series of experiments and found that the 2004 tsunami in Thailand led to increased risk intolerance.

As for time preferences, Cassar et al. [2017] find that the 2004 Thailand tsunami disaster has led to increased impatience. By contrast, Callen [2015] use survey data for Sri Lankan wage workers and conclude that exposure to the Indian Ocean Earthquake tsunami increased patience.

Beyond natural events, there are studies that analyze the preferences of investors faced with financial shocks. Guiso et al. [2013] analyze survey data for clients of an Italian bank and find that their risk intolerance increased substantially after the 2008 financial crisis. Hoffmann et al. [2013] argue that investors became more risk intolerant during the worst months of the 2008 financial crisis, using survey data for clients at a Dutch discount broker.

3 Data and Methodology

3.1 Data

This paper uses publicly available survey data from the RISS of Kansai University. The institute conducts web-based surveys on an irregular basis. The survey data is collected by Macromill, a web survey company in Japan, from a pool of pre-registered Japanese respondents. We use three surveys that were conducted in Japan in January 2011, April 2011, and March 2016. The first survey was conducted only two months before the Great East Japan Earthquake, and the second survey (April 2011) was conducted around one month after the disaster (from 19 to 20 April). These two surveys constitute a pooled cross-section dataset because the same respondents were not used for the purposes of completing the second survey. As is pointed out by Chuang and Schechter [2015], one of the obstacles to analyzing extreme events like earthquakes is that "data on preferences is usually only available after the event and not before." To the best of my knowledge, no other surveys of individuals' preferences exist that were conducted just two months before and one month after the earthquake using the same preference questions. The third survey (March 2016) was conducted five years after the earthquake, aiming to create a panel dataset by combining with a past survey as explained below. [1]

The January 2011 survey (n = 1,569) and the April 2011 survey (n = 1,533) were conducted independently, and the data were collected from the pool of pre-registered respondents at those times. Although they include the same preference questions, their sample-screening process is different. The

[1] The Japan Household Panel Survey on Consumer Preferences and Satisfaction (JHPS-CPS) used by Hanaoka et al. [2015] is conducted from January to March 2011 (just before the earthquake) and January to March 2012 (about a year after the earthquake).

January 2011 survey only elicited responses from people who answered yes to the question "Do you have a bank account?" The April 2011 survey was administered with respect to people who answered yes to the question "Do you have assets other than deposits with banks?" To standardize sample selection across surveys, non-investors are eliminated from the January 2011 survey by using the same survey question used in the April 2011 screening. This reduces the sample size of the January 2011 cohort to 412. We could not eliminate people without bank accounts from the April 2011 survey, because no bank-account question was included in the survey. This does not cause a significant sample-selection difference, because it is very unlikely for people who have assets other than deposits to be without a bank account, as the bank account maintenance fee is zero in most Japanese banks.

The April 2011 survey does not include data from the five prefectures (Aomori, Iwate, Miyagi, Fukushima, Ibaragi) that were most severely hit by the earthquake. Although documentation accompanying the dataset says nothing about this omission, it is highly possible that those prefectures are excluded from the survey for fear of imposing a strain on the people in quake-stricken areas.

The March 2016 survey sample was collected from a pool of past respondents, including those who were surveyed in April 2011. This then led to the creation of a panel dataset composed of the April 2011 and March 2016 surveys (n = 588).

Our regression analyses are thus conducted using two datasets. The first dataset is a combined sample from the January and April surveys in 2011. This pooled cross-section dataset spans three months before and after the earthquake and is intended to capture the effects of the Great East Japan Earthquake on investors' preferences.

The second dataset, a two-period panel from the April 2011 and March 2016 surveys, contains information about investors' post-quake preference changes. One disadvantage of this dataset is that the difference between the two surveys that span a five-year post-quake period includes not only the post-quake recovery effect but also other noise factors. On the other hand, the advantage is that we can exploit the panel data structure to mitigate potential omitted-variable bias issues.

3.2 Preference Questions

The RISS surveys include financial questions about risk and time preferences. The risk preference questions ask respondents, willingness to pay (WTP) for two types of hypothetical lotteries and two types of hypothetical insurance. Specifically, a 50% chance of winning JPY 2,000 (about USD 18), a 1% chance of winning JPY 100,000 (about USD 900), a 10% chance of losing JPY 20,000 (about USD 180), and a 1% chance of losing JPY 100,000 (about USD 900). Respondents state their WTP numerically, expressing reservation prices thereof. The exact format of the survey questions is shown in Appendix A.1 and A.2.

The four time-preference questions ask respondents to make savings decisions for each of the four hypothetical savings plans, with an amount of money (JPY 10,000 [about USD 900] or JPY 1,000,000 [about USD 90,000]) and a maturity (one week or one year). Each question presents five binary choices that correspond to the interest rates of 0%, 2%, 6%, 10%, and 20%, in this ascending order. For each binary choice, respondents are asked to choose one of two options: receive the money today (option A) or save the money for the specified period (option B). In each question, respondents choose all A, all B, or choose A at first and switch to B at some point. The choices provide information about the range of reservation interest rates of respondents. Respondents are not allowed to provide irrational answers. If they switch more than once, a warning sign appears to choose differently and they cannot proceed to the next question. The exact format of the survey questions is shown in Appendix A.3.

3.3 Measures of Risk Preference

The risk-aversion measure used in this paper is the Arrow–Pratt measure of absolute risk aversion (ARA)$\rho = -U''/U'$. On the basis of Cramer et al. [2002], reservation prices (p) obtained from a lottery question can be transformed into ARA (Equation 1).

$$ARA_l = \frac{\alpha Z - p}{(1/2)(\alpha Z^2 - 2\alpha Z p + p^2)}, \tag{1}$$

where Z is the prize of a lottery ticket and α is the probability of winning the lottery. As for a insurance, ARA is calculated by

$$ARA_i = -\frac{\alpha Z - p}{(1/2)(\alpha Z^2 - 2\alpha Z p + p^2)}, \tag{2}$$

where Z is redefined as the benefit of the insurance andα is the probability of suffering the loss.

Another possible measure of risk aversion is the transformed price for lotteries and insurances.

$$TP_l = 1 - \frac{p}{\alpha Z}, \tag{3}$$

$$TP_i = \frac{p}{\alpha Z} - 1. \tag{4}$$

TP_l and $TP_i$are equal to zero when the individual is risk neutral, positive when risk intolerant, and negative when risk tolerant. Although risk-preference regressions are run on both ARA and TP, results from the latter are excluded because they are similar to those of ARA and thus their inclusion would not confer additional meaning.

The hypothetical lottery (insurance) question on the RISS survey asks respondents to input their reservation price numerically. Since any non-negative integer is accepted, some respondents input numbers that violate the monotonicity of the utility function. The price of a lottery ticket with a 1% chance of winning 100,000 yen (about 1,000 dollars), for example, cannot be equal to or above 100,000 yen if the utility is monotone. We drop those individuals whose reservation prices do not satisfy the monotonicity of utility for at least one out of the four lottery/insurance questions in the risk-preference regressions. About 7% of the observations are dropped by application of this criterion.

Note that ARA_l (ARA_i) is decreasing (increasing) in p only when $p < \alpha Z + \sqrt{\alpha Z^2 - \alpha^2 Z^2}$. In the case of the lottery with 1% chance of winning 100,000 yen, ARA_l is decreasing in p if $p < 10,949.87$. Reservation prices of seven individuals fall into the interval of 10,949.87<p<100,000. In the risk-preference regressions using ARA, we drop those individuals whose lottery (insurance) reservation prices are larger than $\alpha Z + \sqrt{\alpha Z^2 - \alpha^2 Z^2}$ in the risk-preference regressions. About 1% of the observations are dropped by application of this criterion.

3.4 Variables Overview

Table (1) shows correlations among preference variables. ARA is used for lotteries and insurance. Discount rates are ordinal variables that take larger values as the respondent becomes impatient. Although the correlations between the two types of lotteries and the two types of insurance are moderate (.398 and .606, respectively), the lottery–insurance correlations are negative. This strongly implies that people behave very differently in terms of risk aversion between lotteries and insurance: a risk tolerant person in the context of lotteries tends to be risk intolerant about insurance.

The correlations among discount-rate variables are also moderate (.413-.651). Discount rates and risk aversion calculated from lotteries are not correlated; however, in the context of insurance, they are weak/negatively correlated. This implies that an impatient person does not tend to buy insurance.

The focus of this study is to measure the effects of the earthquake on investors' preferences. Although the magnitude of the earthquake was enormous, the impact of the earthquake was heterogeneous across Japan, not least because the epicenter was located off the coast of eastern Japan. The impact of the earthquake is measured by the "Japan Meteorological Agency seismic intensity scale" for each respondent on the basis of their prefecture of residence. This intensity scale is designed to measure the intensity of ground motion at the point of observation and is commonly used in Japan. We use the maximum intensity scale in each prefecture obtained from the April 2011 Monthly Report on Earthquakes and Volcanoes in Japan. The scale data ranges from 0 (Miyazaki and Okinawa) to 6.6 (Miyagi).

We use two types of seismic-scale variables. The first seismic-scale variable takes the seismic-scale values with respect to the near-term post-quake survey in April 2011 and zeros with respect to the January 2011 and March 2016 surveys. This variable is named "quake-shock" and is intended to capture the short-run effects of the earthquake. The second seismic-scale variable takes the values thereof with respect to the long-term post-quake survey in March 2016 (and zeros with respect to the January 2011 and April 2011 surveys). This variable is named "quake-recovery" variable and intended to capture the long-run effects of the earthquake.

To capture effects of the earthquake across Japan that are not correlated with the intensity of the earthquake such as the experience of watching programs on television about the devastation caused by the earthquake, a post-quake dummy variable is introduced. The variable takes 1 if survey responses correspond to the April 2011 variant, else 0.

Control variables include age, gender, marital status, years of education, and log yearly household income. Household income is obtained by converting income classes into income amounts by using central values of intervals[2]. As for age, age class dummies are used in the regression analyses to capture possible nonlinear effects of age on preferences. Table (2) summarizes descriptive statistics of our sample.

3.5 Estimation Methods

Risk-preference regressions are run on the two datasets, "Before and After Pooled Cross Sections" and "Before and Five-Years-After Panel". OLS is used for the pooled cross-sections dataset and a fixed-effects model is used for the panel dataset. Discount-rate regressions are also run on the same two datasets. Interval regression is used to estimate the discount-rate equations because the discount-rate answers are

[2] 0-500k yen, 500k-1kk yen, 1kk-2kk yen, 2kk-3kk yen, 3kk-5kk yen, 5kk-7kk yen, 7kk-10kk yen, 10kk-15kk yen, and 15kk-30kk yen.

given in intervals. To estimate the discount-rate equations using the panel dataset, fixed-effects interval regression is applied.

4 Empirical Results

4.1 Risk Preference Regressions

Table 3 shows risk-preference regression results for lotteries and insurance using the "two months before and one month after" pooled cross-sections dataset. Positive coefficients imply that investors became more risk intolerant. The effect of the earthquake is captured by the post-quake dummy and the quake-shock variable. The post-quake dummy is insignificant in all regressions. The quake-shock variable is insignificant except for the case of insurance for a 10% chance of losing 20,000 yen (about 200 dollars), which implies that investors became uninterested in this type of insurance after the earthquake. Overall, however, the effect of the earthquake on risk preferences of investors was not significant.

Age and gender play an important role in determining investors' risk preferences. Note, however, that the effect of age is different between lotteries and insurance. Columns (1) and (2) pertain to lotteries. Investors tend to be more risk intolerant with advancing age until they reach their 60s. Males are more risk tolerant than females. Columns (3) and (4) pertain to insurance. Although age is still significant, the effect is the opposite of that for lotteries, i.e., investors tend to be more risk tolerant with advancing age until they reach their 60s. In other words, senior investors tend not to buy both lottery tickets and insurance. This partly explains the negative correlation between risk aversion for lotteries and insurance presented in Table (2). The effect of gender is not significant in the context of insurance.

Education does not have a significant influence on risk aversion[3]. There is weak evidence that higher incomes make people more risk tolerant for lotteries and more risk intolerant for insurance.

Table 4 shows risk-preference regression results for lotteries and insurance using the "one month after and five years after" panel data. The control variables are insignificant, suggesting insufficient systematic variation in the five-year period. The quake-recovery variable captures post-quake preference changes in proportion to the intensity of the earthquake.

The regression results provide weak evidence of changing risk preferences following the earthquake. The coefficients for lotteries are significantly positive and those for insurance are significantly negative. This implies that investors who experienced a strong jolt became less interested in buying both lotteries and insurance after the earthquake. This is not to be conflated with the effects of aging, because those effects are captured by the age variables and constant term.

4.2 Time Preference Regressions

Table 5 shows discount-rate regression results for various amounts and periods using the "two months before and one month after" pooled cross-sections dataset. Positive coefficients imply that investors became more impatient. The effect of the earthquake is captured by the post-quake dummy and the quake-shock variable. The post-quake dummy and the quake-shock variable are not significant except for column (1), a 10 thousand yen (about 100 dollars) saving opportunity for one week.

[3] Outreville [2015] surveys empirical studies into the relationship between risk aversion and education, and concludes that risk aversion is negatively correlated with higher education.

Age variables are generally significant except for column (4), a saving opportunity of 1 million yen (about 10 thousand dollars) for one year. Investors become more impatient with advancing age. Men are more impatient than women. Higher education and lower income makes investors more patient.

Table 6 shows regression results using the "one month after and five years after" panel data. The control variables are insignificant, suggesting insufficient variation in the five-year period. Coefficients on the quake-recovery variable imply that investors who experienced a strong jolt became more patient after the earthquake. This result is inconclusive, because the significance of coefficients is not uniform across different types of saving opportunities.

5 Discussions and Conclusions

This paper shows that although there is some evidence to suggest that investors' risk and time preferences changed following the earthquake, the changes are not uniform across different types of financial opportunities, neither in the short run nor in the long run. As is pointed out by Chuang and Schechter [2015], existing empirical research into the impacts of extreme events on people's preferences shows divergent results. The results herein do not contradict existing studies, and neither do they add new evidence about the significance and magnitude of the effects of the huge earthquake on people's preferences. It is difficult to explain the post-quake stagnant stock prices in Japan in terms of preference changes vis-à-vis investors faced with extreme natural disaster.

One possible reason for this insignificant result is that the sample utilized herein is limited to investors. They are more educated and affluent than the average person and can be less affected by natural disasters. Another possible reason is the existence of inaccurate, misremembered, or dishonest answers in the survey data elicited from respondents, which could serve to bias estimation results. The risk-aversion question asks respondents to provide numerical reservation prices for hypothetical lotteries and insurance. Although this may not be very taxing for most investors, some investors might have stated responses that do not accord with their actual preferences for one reason or another. As we pointed out in Section 3.3, about 8% of the sample was eliminated owing to extreme numerical answers.

Turning to the non-uniform regression results, the negative relationship between lotteries and insurance in regard to risk preference in Table 2 implies that risk aversion has a very different meaning in different financial contexts. The estimated coefficients between lotteries and insurance in Table 3 also support this view. Moreover, different parameters in the financial opportunities could have led to different estimation results. Table 5 also shows different time-preference regression results across different saving opportunities.

This paper used survey data collected just one month before and two months after the earthquake and aimed at contributing toward understandings vis-à-vis the inconsistent results found across existing studies. Despite the huge advantage offered by the survey timings, the regression results do not produce consistent and significant results regarding the effects of the earthquake on investors' preferences. This implies that survey timing is not the only obstacle to regression analyses of preference changes induced by extreme events. Toward understanding of the diverse regression results, presented in this paper and in other existing studies, it may be necessary to add new dimensions to the determinants of preferences. Liquidity constraints or irrational behaviors could be a source of inconsistent behaviors across different financial opportunities.

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A Survey Questions

A.1 Lottery Question

There are two lottery questions, different in probability and prize. The parameters of the two lotteries are (X, Y) = (half,2,000) and (1 percent/100,000), respectively.

> Suppose there is a lottery with an X chance of winning. If you win, you get Y yen. If you lose, you get nothing. Do you buy the lottery ticket for 200 yen? Choose one that applies. Also, state the maximum price you would pay to buy the lottery ticket.
>
> 1. [Yes, I buy the lottery ticket] Up to what price do you buy the lottery ticket? State the maximum price.
> 2. [No, I don't buy the lottery ticket] Would you buy the lottery ticket if it was cheaper? If so, state the maximum price you would be willing to pay.

A.2 Insurance Question

There are two insurance questions, different in probability and damage. The parameters of the two insurance questions are (X, Y) = (one in ten, 20,000) and (one in one hundred, 100,000), respectively.

> Suppose you face a X chance of suffering theft of Y yen. If you pay an insurance premium of 2,000 yen in advance, the theft damage will be recovered if you suffer a theft. Do you buy this insurance? Choose one that applies. Also, state the maximum price you would pay to buy the insurance.
>
> 1. 1. [Yes, I buy the insurance] How much would you pay for the insurance premium? State the maximum price.
> 2. [No, I don't buy the insurance] Would you buy the insurance premium if it was cheaper? If so, state the maximum price you would be willing to pay.

A.3 Discount Rate Question

There are four discount-rate questions, different in maturity and in the amount of money. The parameters of the four discount-rate questions are (X, Y) = (one week, 10,000), (one year, 10,000), (one week, 1,000,000), and (one year, 1,000,000), respectively. When (X, Y) = (one week, 10,000), the survey question is as follows:

> Which ones do you prefer? Compare between (A) receiving 10,000 yen today and (B) receiving another amount in one week. Choose either (A) or (B) for each of the following pairs.

(A)			(B)
Receive 10,000 yen today	□	□	Receive 10,000 yen in one week
Receive 10,000 yen today	□	□	Receive 10,004 yen in one week
Receive 10,000 yen today	□	□	Receive 10,012 yen in one week
Receive 10,000 yen today	□	□	Receive 10,019 yen in one week
Receive 10,000 yen today	□	□	Receive 10,038 yen in one week

2. The numbers in the rightmost column correspond to interest rates of 0%, 2%, 6%, 10%, and 20%, respectively. The same interest rates are applied in other discount-rate questions, and the wording and the numbers in the survey question above are modified accordingly.

	Lottery 2k p=.5	Lottery 100k p=.01	Insurance 20k p=.1	Insurance 100k p=.01	Dis. 10k 1 week	Dis. 10k 1 year	Dis. kk 1 week	Dis. kk 1 year
Lott. 2k p=.5 ARA	1							
Lott. 100k p=.01 ARA	0.398***	1						
Insur. 20k p=.1 ARA	-0.165***	-0.156***	1					
Insur. 100k p=.01 ARA	-0.0984***	-0.164***	0.606***	1				
Dis. 10k 1w Rank	-0.00292	0.00984	-0.0447*	-0.00430	1			
Dis. 10k 1y Rank	0.00544	-0.0290	-0.0435*	-0.0215	0.632***	1		
Dis. kk 1w Rank	-0.0216	-0.0298	-0.0368	0.00926	0.589***	0.634***	1	
Dis. kk 1y Rank	-0.00868	-0.0201	-0.0453*	-0.0524*	0.413***	0.651***	0.649***	1
Observations	2533							

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1: Correlations Among Preference Variables: Absolute Risk Aversion and Discount Rate

	count	mean	sd	min	max
Lott. 2k p=.5 Price	2333	435.49	344.04	0	1900
Lott. 100k p=.01 Price	2333	489.91	1026.96	0	10000
Insur. 20k p=.1 Price	2333	1233.63	1172.49	0	8000
Insur. 100k p=.01 Price	2333	1297.69	1567.96	0	10000
Dis. 10k 1w Rank	2533	4.47	1.84	1	6
Dis. 10k 1y Rank	2533	3.58	1.46	1	6
Dis. kk 1w Rank	2533	3.77	1.72	1	6
Dis. kk 1y Rank	2533	2.81	1.27	1	6
JMA seismic intensity scale	2533	4.01	1.47	0	6.6
Age	2533	48.02	12.61	21	89
Male	2533	0.69	0.46	0	1
Marriage	2533	0.60	0.49	0	1
Education year	2520	14.83	1.99	9	18
Yearly household income (thousand yen)	2381	7521.42	4823.29	250	22500
Observations	2533				

Table 2: Summary Statistics

	(1) Lottery 2k p=.5	(2) Lottery 100k p=.01	(3) Insurance 20k p=.1	(4) Insurance 100k p=.01
After quake dummy	-15.015	0.139	6.500	1.502
	(36.629)	(1.200)	(5.757)	(2.389)
Quake shock	-0.594	-0.018	-2.863**	-0.610
	(7.196)	(0.221)	(1.144)	(0.481)
30s	-7.658	2.066	-13.435**	0.110
	(38.138)	(2.008)	(6.455)	(2.738)
40s	38.276	2.950	-19.430***	-5.497**
	(37.695)	(2.025)	(6.364)	(2.617)
50s	88.066**	3.511*	-28.836***	-7.345***
	(38.481)	(2.031)	(6.595)	(2.716)
60s	98.992**	4.687**	-38.938***	-9.176***
	(43.489)	(2.200)	(6.881)	(2.888)
70s	70.120	2.585	-24.481***	-3.221
	(64.178)	(2.744)	(9.405)	(4.395)
80s	83.548	7.934***	-27.904	-5.783
	(197.590)	(2.294)	(19.923)	(8.271)
Male	-144.654***	-3.698***	2.291	0.946
	(18.608)	(0.727)	(3.032)	(1.266)
Marriage	-65.726***	-0.662	-3.900	-3.701**
	(22.578)	(0.958)	(3.584)	(1.591)
Education year	-2.614	0.025	0.513	-0.180
	(4.931)	(0.180)	(0.730)	(0.315)
Income	-7.085	-0.751*	5.047**	1.988**
	(13.954)	(0.431)	(2.177)	(0.959)
Constant	913.426***	16.694***	-60.593***	-2.576
	(134.763)	(4.683)	(20.011)	(9.243)
Observations	1685	1685	1685	1685
R^2	0.041	0.020	0.045	0.031

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

20s dummy is used as a base for the age dummy variables

Table 3: Risk Aversion: Two Months Before and One Month After the Earthquake: Pooled OLS

	(1) Lottery 2k p=.5	(2) Lottery 100k p=.01	(3) Insurance 20k p=.1	(4) Insurance 100k p=.01	(5) Lottery 2k p=.5	(6) Lottery 100k p=.01	(7) Insurance 20k p=.1	(8) Insurance 100k p=.01
Quake recovery	11.342*	0.760***	-3.354***	-0.565	10.786**	0.543***	-3.457***	-0.279
	(6.586)	(0.273)	(0.926)	(0.400)	(4.947)	(0.196)	(0.750)	(0.318)
30s	-64.334	-1.792	17.722	-8.282				
	(118.431)	(1.839)	(20.481)	(10.194)				
40s	-106.353	-0.209	25.114	-12.952				
	(139.739)	(3.800)	(25.215)	(11.963)				
50s	-106.421	-1.521	4.116	-9.407				
	(162.034)	(4.670)	(27.494)	(12.944)				
60s	-148.365	-1.343	13.917	-6.590				
	(181.293)	(5.557)	(31.008)	(13.884)				
70s	-186.259	-10.051	18.194	-1.171				
	(219.386)	(8.071)	(35.028)	(15.119)				
80s	-319.316	-21.894**	49.579	16.972				
	(240.000)	(9.689)	(57.924)	(17.607)				
Marriage	-25.643	0.365	-1.615	-1.211				
	(21.823)	(0.935)	(3.949)	(1.669)				
Education year	-4.505	-1.151	-5.166	-0.588				
	(19.153)	(0.871)	(3.945)	(1.825)				
Income	0.685	-1.113	4.181	-0.329				
	(37.886)	(0.966)	(6.317)	(2.096)				
Constant	884.859**	38.684***	-14.363	24.627	697.700***	10.551***	-40.553***	3.237***
	(403.723)	(13.826)	(74.892)	(32.265)	(9.895)	(0.393)	(1.500)	(0.636)
Observations	902	902	902	902	902	902	902	902
R^2	0.016	0.036	0.064	0.016	0.011	0.016	0.042	0.002

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

20s dummy is used as a base for the age dummy variables

Table 4: Risk Aversion: One Month After and Five Years After the Earthquake: Fixed-Effects Model

	(1)	(2)	(3)	(4)
	Dis.	Dis.	Dis.	Dis.
	10k	10k	kk	kk
	1 week	1 year	1 week	1 year
After quake dummy	5.251***	0.114	-0.048	-1.184**
	(1.861)	(0.732)	(1.131)	(0.527)
Quake shock	-0.881**	0.131	-0.093	0.110
	(0.369)	(0.146)	(0.221)	(0.104)
30s	0.638	-0.137	1.158	0.162
	(1.737)	(0.811)	(1.133)	(0.591)
40s	4.559**	1.282	3.722***	0.708
	(1.787)	(0.825)	(1.155)	(0.610)
50s	8.478***	1.525*	4.973***	0.943
	(1.918)	(0.854)	(1.236)	(0.627)
60s	10.568***	2.253**	6.139***	1.093
	(2.134)	(0.945)	(1.354)	(0.689)
70s	11.448***	1.229	6.495***	0.644
	(3.325)	(1.320)	(2.012)	(0.990)
80s	126.245***	3.483	1.209	1.943
	(3.639)	(3.966)	(5.457)	(4.504)
Male	6.004***	2.485***	5.770***	2.168***
	(0.987)	(0.419)	(0.605)	(0.300)
Marriage	-0.096	-0.576	-0.917	-0.622*
	(1.146)	(0.500)	(0.730)	(0.361)
Education year	-0.455*	-0.286***	-0.221	-0.132
	(0.255)	(0.107)	(0.160)	(0.081)
Income	1.034	0.574*	0.936**	0.421**
	(0.703)	(0.297)	(0.439)	(0.193)
Constant	7.639	4.544	-0.015	1.453
	(6.721)	(2.857)	(4.123)	(1.968)
Observations	1825	1825	1825	1825
$Cox - Snell - pseudo - R^2$	0.068	0.036	0.076	0.039

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

20s dummy is used as a base for the age dummy variables

Table 5: Discount Rate: Two Months Before and One Month After the Earthquake: Pooled OLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dis.	Dis.	Dis.	Dis.	Dis.	Dis.	Dis.	Dis.
	10k	10k	kk	kk	10k	10k	kk	kk
	1 week	1 year	1 week	1 year	1 week	1 year	1 week	1 year
Quake recovery	-0.734	-0.588*	-0.906	-0.203	-0.429	-0.513*	-0.959*	-0.148
	(1.316)	(0.311)	(0.565)	(0.217)	(1.236)	(0.282)	(0.529)	(0.196)
30s	-10.435	-1.957	-6.344	-0.359				
	(9.178)	(2.067)	(5.524)	(1.757)				
40s	-13.891	-2.937	-6.191	-1.303				
	(11.443)	(2.746)	(6.600)	(2.180)				
50s	-11.201	-1.784	-6.649	-1.808				
	(13.362)	(3.242)	(7.334)	(2.497)				
60s	-12.920	-4.697	-11.907	-3.091				
	(15.707)	(3.784)	(8.171)	(2.896)				
70s	-26.771	-5.335	-15.150	-1.788				
	(19.147)	(4.480)	(9.553)	(3.391)				
80s	-27.593	-6.418	-16.978	-2.647				
	(28.824)	(5.592)	(10.454)	(3.679)				
Marriage	0.759	0.051	-1.609*	0.066				
	(2.136)	(0.494)	(0.907)	(0.387)				
Education year	-1.460	-0.478	-0.533	0.212				
	(2.929)	(0.745)	(1.525)	(0.436)				
Income	-0.996	-0.121	1.422	-0.514				
	(3.483)	(0.757)	(1.488)	(0.585)				
Constant	7.700	2.208	4.690**	1.810*	5.603	1.426	4.618**	1.287
	(5.996)	(1.360)	(2.385)	(0.952)	(5.369)	(1.190)	(2.182)	(0.827)
Observations	616	982	886	1026	688	1094	990	1146
$Cox-Snell-pseudo-R^2$	0.018	0.023	0.028	0.010	0.000	0.007	0.007	0.001

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

20s dummy is used as a base for the age dummy variables

Table 6: Discount Rate: One Month After and Five Years After the Earthquake: Fixed-Effects Interval Regression