Do Risk Preferences Change?

Evidence from Panel Data Before and After the Great East Japan Earthquake

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Introduction

- Risk preferences are fundamental determinants of individual decision-making on economic behaviors.
- Standard economic models assume that individual risk preferences are stable across time.
- Recent literature suggests that negative shocks may change risk preferences and risk-taking behaviors. However, evidence is *mixed*.
  - early life financial experiences (Malmendier and Nagel, 2011)
  - conflicts (Voors et al., 2012; Callen et al., 2014)
  - natural disasters (Eckel et al., 2009; Cameron and Shah, 2010; Cassar et al., 2011).

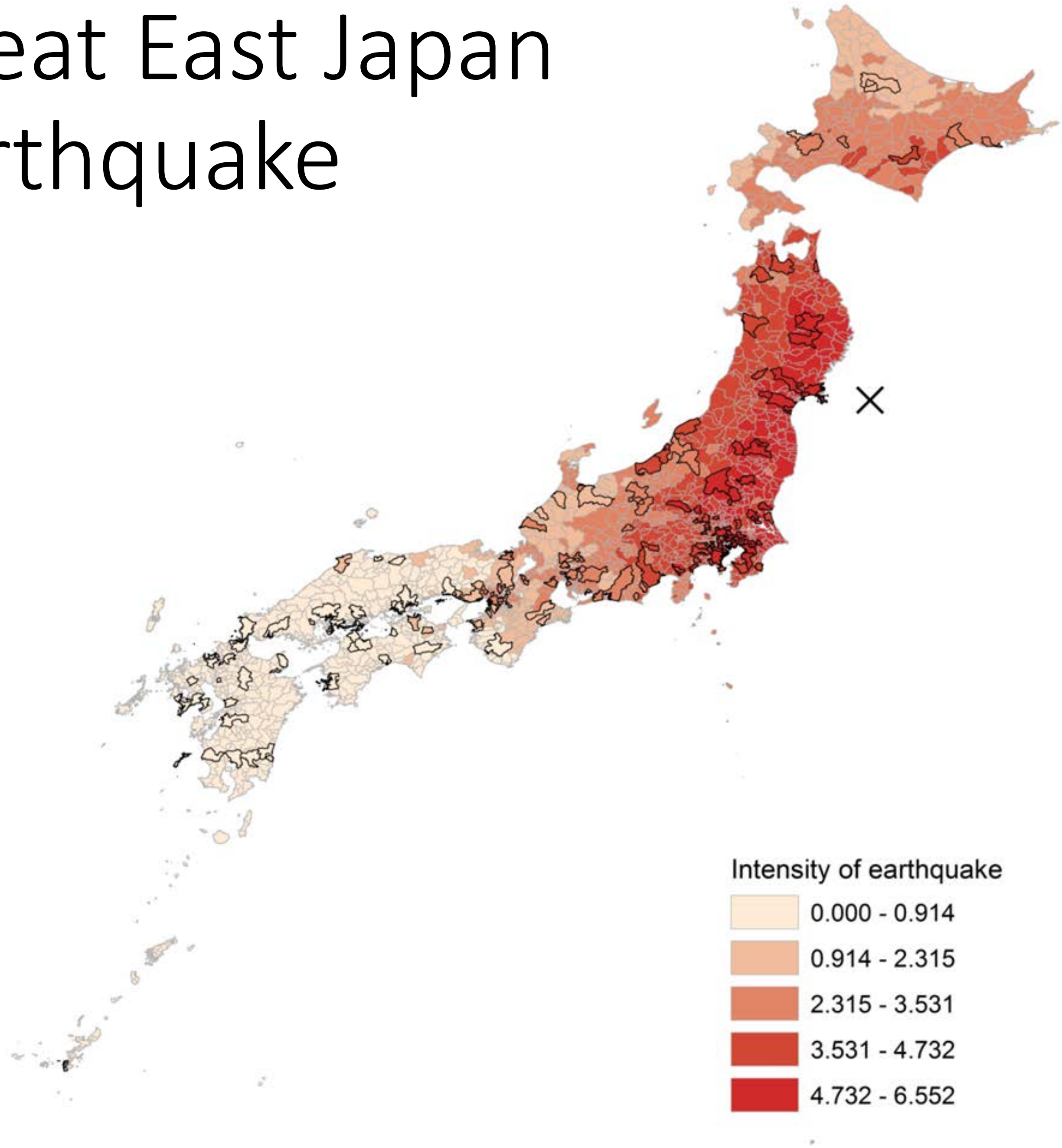
Detail

This Paper

- We study how risk preferences are affected by the Great East Japan Earthquake.
  - Occurred on March 11, 2011
  - *Largest* Earthquake in Japanese History

- We exploit the regional variation of the Earthquake's severity.

Great East Japan Earthquake



Novelty of This Paper

- We use *panel* data on risk preference collected before and after the Earthquake.
- Existing studies rely on cross-section data collected *after the occurrence of negative shocks.*
    - Cross section and fixed effect specifications generate different results in our study.
    - This finding suggests that the presence of unobserved heterogeneity may *bias* cross section studies.

Summary of Results

1. Individuals become more risk tolerant if exposed to larger intensity above “frightening” level.

2. All the results are driven by men.
   - Women show opposite patterns, but not very robust.

3. Those men become more engaged in gambling and drinking.

4. Cross-section specification generates very different estimates from panel specification.

Seismic Intensity

- Seismic intensity (*Shindo*) is a metric of strength of earthquake *at a specific location*
  - More than 1,700 observation stations across Japan
- *Shindo* is a logarithm of acceleration, and increase of seismic intensity by two means 10-fold of acceleration.
- *Shindo* can take values between 0 (no shaking) to 7, and most people feel scared above 4. (Description)

Data on Risk Preference

- Our measure of risk preferences are directly elicited using a hypothetical lottery question in the Japan Household Panel Survey on Consumer Preferences and Satisfactions (JHPS-CPS).
  - A nationally representative annual *panel* survey
  - Two waves: 2011 (*before* the Earthquake) and 2012 (*after* the Earthquake).

- We follow Cramer et al. (2002, JEBO) to construct a measure of risk aversion.

Measuring Risk Preference

- Respondents choose "buy" or "do not buy" a lottery with 50% chance of wining JPY100,000 (expected value of JPY50,000) at *each* of the following 8 prices.

JPY 10	(USD 0.1)	Buy ☐	Not Buy ☐	↑ *More risk averse*
JPY 2,000	(USD 20)	Buy ☐	Not Buy ☐	
JPY 4,000	(USD 40)	Buy ☐	Not Buy ☐	
JPY 8,000	(USD 80)	Buy ☐	Not Buy ☐	
JPY 15,000	(USD 150)	Buy ☐	Not Buy ☐	
JPY 25,000	(USD 250)	Buy ☐	Not Buy ☐	
JPY 35,000	(USD 350)	Buy ☐	Not Buy ☐	
JPY 50,000	(USD 500)	Buy ☐	Not Buy ☐	↓ *Less risk averse*

- The reservation price λ is the midpoint of the prices at which a respondent switches from "Buy" to "Not Buy".
- Risk aversion measure = $1 - \lambda/50{,}000$ (Raw data) (Validity)
  - Value of 0 if risk-neutral, and 1 for perfect risk-aversion.
  - As the vaue is in [0,1], we logit-transform it in our regression.

Summary Statistics

- Sample size of 3,221 respondents located across 226 municipalities.

Variables	N	Mean	SD	Min	Max
A. Individual-Level Variables					
Risk Aversion Measure	3,221	0.81	0.21	0	0.9998
Age (in years)	3,221	52.1	12.6	22	78
Male	3,221	0.47	0.50	0	1
High School graduation or less	3,204	0.55	0.50	0	1
Married	3,171	0.82	0.38	0	1
B. Municipality-Level Variables					
X (seismic intensity)	226	2.83	1.94	0	6.06
Radiation (μSv/h)	226	0.10	0.24	0	2.40
Fatality rate (per 1,000 population)	226	0.25	2.43	0	26.9

Identification Strategy

- A basic model would be:

$$Y_{ijt} = \alpha_t + \beta X_{jt} + \gamma Z_{ijt} + \pi \underline{W_i} + \varepsilon_{ijt}$$

for individual *i*, location *j*, and time *t.*

Y_{ijt} is a measure of risk preference

α_t is an year effect

X_{jt} is intensity of the Earthquake (=0 before the Earthquake)

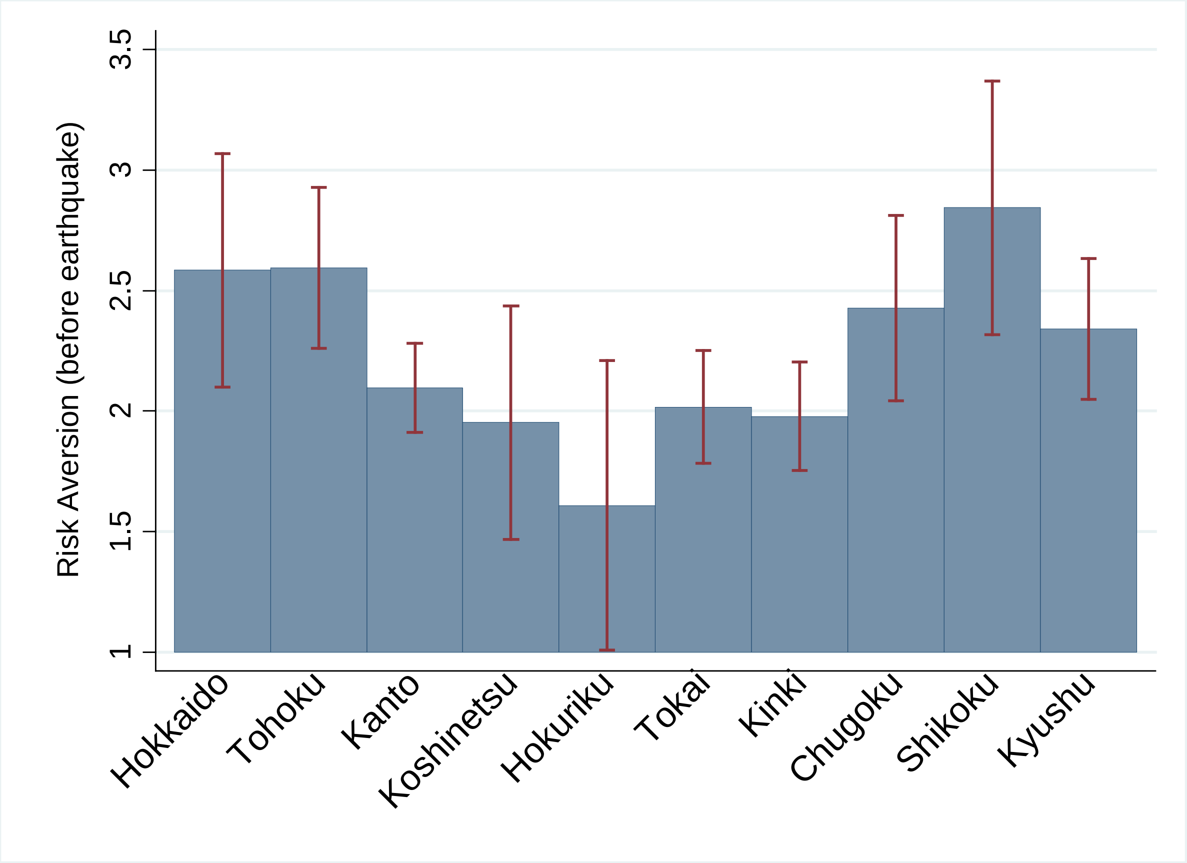
Z_{ijt} is time-varying individual characteristics

W_i is unobserved time-invariant individual characteristics
- susceptibility to local social norm
- physical and mental stress tolerance

ε_{ijt} is a random shock.

Unobserved Heterogeneity

- The risk preference *before* the Earthquake differed among regions (through formation of risk preferences at regions or residential sorting).



Fixed Effects Specification

- To overcome the issue of unobserved heterogeneity, we adopt fixed effects specification.

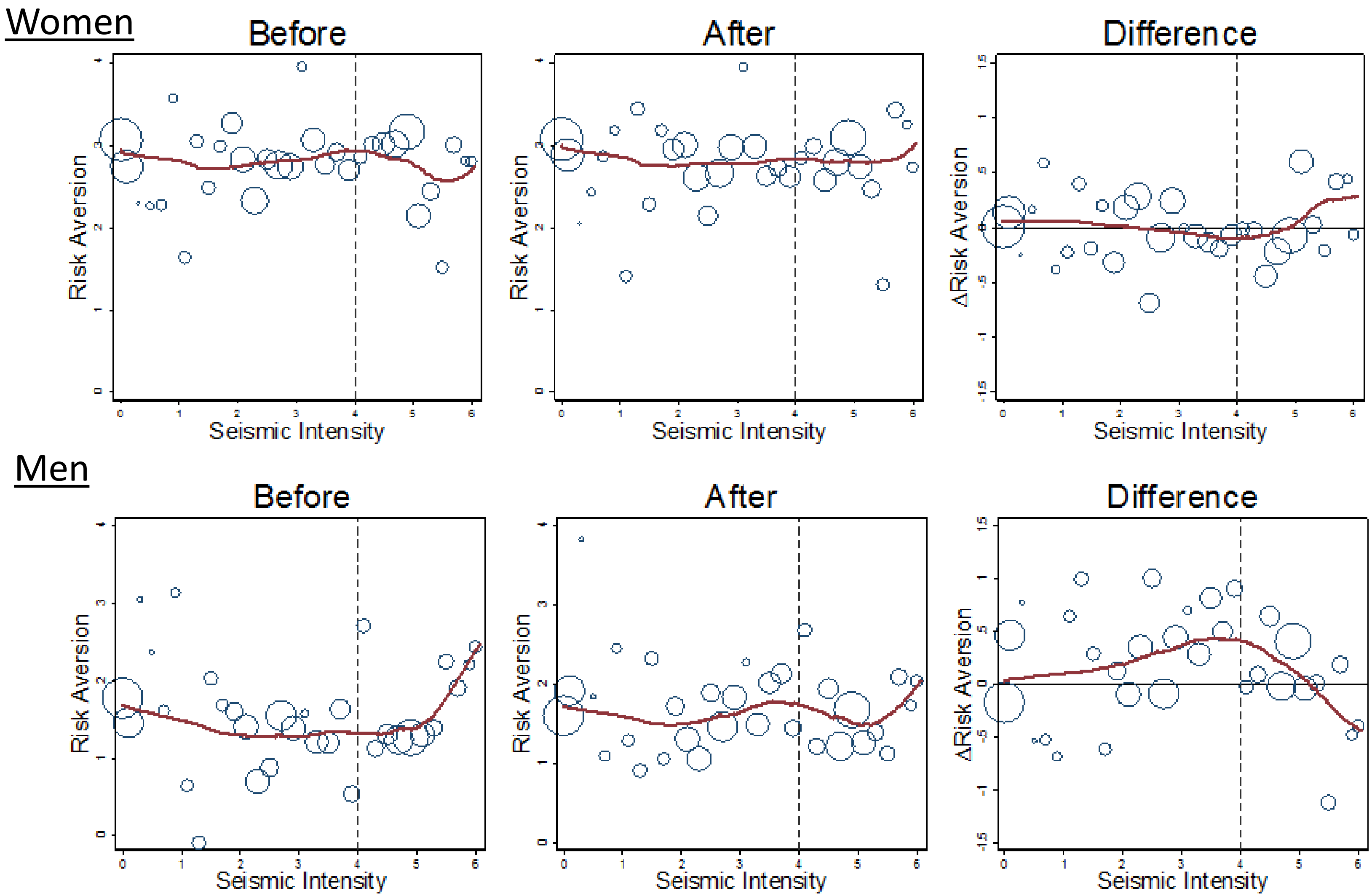
- As the effect seems to have kink at around intensity of 4 (description), our main specification is:

$$\Delta \mathrm{Y}_{ijt} = \Delta\alpha + \beta X_j + \rho I\left[X_j \geq 4\right](X_j - 4) + \gamma \Delta Z_{ijt} + \Delta\varepsilon_{ijt}$$

ρ captures the ***additional*** effect of being exposed to higher intensity

- If unobserved heterogeneity W_i are not correlated with X_j, then fixed-effects specification and cross-section specification must produce similar results.
  - But we find significant differences (discussed later)

Risk Preference Before and After the Earthquake



Main Result

	Full Sample			Men			Women		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
X	0.030	0.017	0.012	0.127**	0.092*	0.053	-0.060	-0.055	-0.028
	(0.034)	(0.031)	(0.026)	(0.057)	(0.049)	(0.042)	(0.038)	(0.034)	(0.029)
(X – 4) * 1[X ≥ 4]	-0.135			-0.551***			0.255*		
	(0.123)			(0.195)			(0.134)		
(X – 4.5) * 1[X ≥ 4.5]		-0.136			-0.709***			0.427**	
		(0.176)			(0.249)			(0.190)	
(X – 5) * 1[X ≥ 5]			-0.253			-0.995***			0.518*
			(0.263)			(0.336)			(0.301)
Constant	0.048	0.064	0.069	-0.003	0.037	0.087	0.094	0.091	0.058
	(0.082)	(0.080)	(0.077)	(0.137)	(0.133)	(0.129)	(0.096)	(0.093)	(0.090)
Value of X when ΔY=0	*5.60*	*5.68*	*5.54*	*5.19*	*5.23*	*5.37*	*4.78*	*4.92*	*5.16*
Individual FE	×	×	×	×	×	×	×	×	×
Mean of Δrisk aversion	0.089	0.089	0.089	0.184	0.184	0.184	0.005	0.005	0.005
Mean of risk aversion (before)	2.168	2.168	2.168	1.429	1.429	1.429	2.823	2.823	2.823
N of individuals	3,221	3,221	3,221	1,514	1,514	1,514	1,707	1,707	1,707
R-squared	0.000	0.000	0.000	0.004	0.004	0.003	0.002	0.003	0.001

Note: X is seismic intensity (*Shindo*)

Robustness Check

Our results are robust to control for

- income and assets (Table)
- radiation and fatalities (Table)

Also robust to

- alternative measure of intensity measure (Table)
- alternative measure of risk preferences(Table)

Panel vs. Cross-Section Specifications

- Our cross-section estimates significantly differs from panel estimates suggesting that unobserved heterogeneity may *bias* cross section studies.

	Men		
Specification	Panel	Cross Section	
Data	BEFORE and AFTER earthquake	AFTER earthquake only	
	(1)	(2)	(3)
X	0.127**	-0.001	0.017
	(0.057)	(0.055)	(0.054)
(X – 4) * 1[X ≥ 4]	-0.551***	-0.048	-0.047
	(0.195)	(0.195)	(0.187)
Constant	-0.003	1.633***	1.469
	(0.137)	(0.140)	(1.166)
Individual FE	×	–	–
Covariates	–		×
N of individuals	1,514	1,514	1,514
R-squared	0.004	0.000	0.047

Results on “Risk-Taking” Behaviors

- Gambling and drinking at high-intensity locations increases as the intensity increase. (Fig) (Definition)

Outcomes	Men		
	Gambling	Drinking	Smoking
	(1)	(2)	(3)
X	-0.013**	-0.003	-0.001
	(0.007)	(0.002)	(0.003)
$(X - 4) * 1[X \geq 4]$	0.047**	0.018*	0.000
	(0.019)	(0.011)	(0.010)
Constant	0.042**	0.007	0.012
	(0.018)	(0.005)	(0.009)
Individual FE	×	×	×
Income	×	×	×
Mean of Δoutcome	0.018	0.003	0.011
Mean of outcome (before)	0.145	0.024	0.024
N of individuals	1,514	1,514	1,514
R-squared	0.004	0.002	0.000

A Possible Mechanism: Emotional Response

- Previous literature suggests emotional response to a negative shock may affect risk preference.
- We investigate this channel using the following three questions in the survey.
  - Depression: Do you feel depressed lately?
  - Stress: Do you feel stressed lately?
  - Sleep problem: Have you been sleeping well lately?
- We find that men exposed to higher intensity have more emotional/mental issues.
  - The result do not hold for women.

A Possible Mechanism: Emotional Response

Note: *Lower* the score, *more* the mental issues

Dep. Emotional Response Score	Men	Women
	(1)	(2)
X	0.011	0.015
	(0.015)	(0.015)
$(X - 4) * 1[X \geq 4]$	-0.124**	-0.071
	(0.051)	(0.052)
Constant	-0.005	-0.022
	(0.040)	(0.032)
Individual FE	×	×
Income	×	×
N of individuals	1,493	1,690
R-squared	0.005	0.001

Attrition, Multiple Switch, and Migration

- Attrition: 263 respondents (7.5%) did not complete the survey in 2012.
- Multiple Switch: 198 respondents (5.8%) have multiple switches in answering hypothetical lottery question.
- Migration: 147 respondents (4.4%) moved municipalities between 2011 and 2012.
- Attrition, multiple switch, and migration do *not* seem to be systematically related to the intensity of the Earthquake.

Conclusion -1

- We test whether experiencing a negative shock—the Great East japan Earthquake—alters risk preference.
- We use unique panel data collected before and after the Earthquake to overcome the bias resulting from unobserved heterogeneity.
- We find people exposed to larger intensity become more risk tolerant, and the result is driven by men.
- Also, these men become more engaged in gambling and drinking.

Conclusion -2

- Questions for the future research
  - Is the effect persistent?
  - Effect on other behavior such as saving and investment
  - What exactly is the mechanism on how experiencing high intensity alters risk preference.