Online Appendix: Parental Investments After Adverse Shock

May 16, 2022

Appendix A. Data Source and Variable Construction

A1. Pre-earthquake Hazard

Pre-earthquake hazard is taken from the 2010 version of the National Seismic Hazard Maps, prepared by the Headquarters for Earthquake Research Promotion of the Japanese Ministry (MEXT). The data contains estimated probabilities that a given 250m mesh will experience ground motion intensity exceeding a certain value within a target period. We adopt predictions based on Probabilistic Seismic Hazard Maps (PSHM). The probability is evaluated by accounting for the probability of occurrence, magnitude of all potential earthquakes in Japan and the intensity of the ground motions that could be triggered by these earthquakes.

Details can be found at (accessed at 9:52am JST, May 13, 2019):
https://www.j-shis.bosai.go.jp/download

A2. Fatality and Physical Destructions

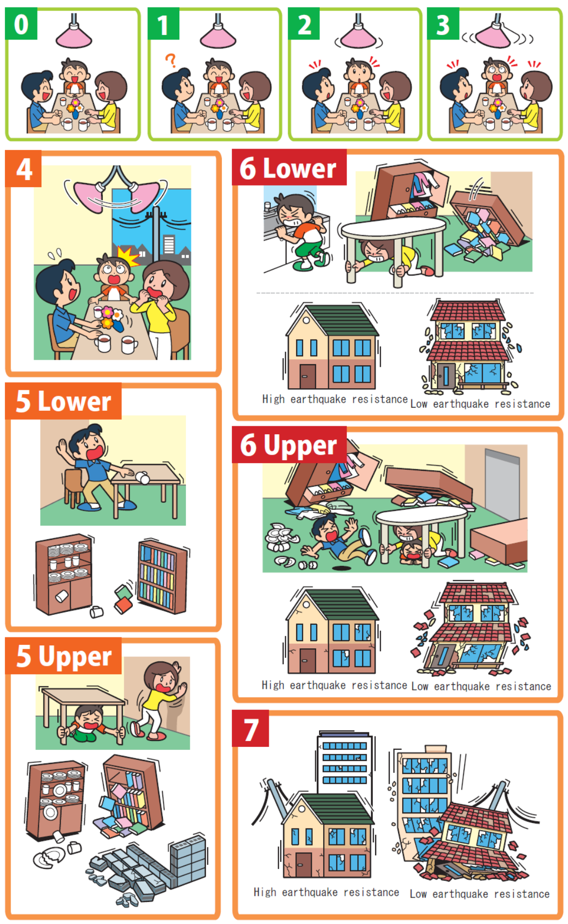
Data on fatality, the number of damaged houses/flooded household, and the number of the injured are taken from location-level administrative damage report prepared by Fire and Damage Agency and Statistical Bureau. We use the version of information updated in September 17, 2013. We take a natural logarithm of 0.01 plus the number of each damage type in the main analysis.

Details can be found at (accessed at 9:54am JST, May 17, 2019) :
http://www.stat.go.jp/info/shinsai/zuhyou/data0422.xls

A3. Seismic Intensity

Data on Seismic intensity (Z) is drawn from the National Research Institute for Earth Science and Disaster Resilience (NIED). NIED operates in a nation-wide strong-motion seismograph networks (K-NET and KiK-net), covering more than 1,700 monitoring stations distributed every 20 km in Japan. It records the seismic intensities of major earthquakes in Japan, along with a geocode of each monitoring stations. Appendix Figure 1 visualizes the scope of the damage by category of seismic intensity.

Details can be found at (accessed at 4:25pm JST, June 4, 2018):
http://www.kyoshin.bosai.go.jp/kyoshin/quake/



Appendix Figure A1: Scope of Damages for Seismic Intensity
Source: Japanese Meteorological Association.

A4. Radioactivity Concentration

Data on radiation is taken from monitoring information of environmental radioactivity level run by Nuclear Radiation Authority (NRA). NRA complies real-time radioactivity concentration (air dose rates) at more than 5200 monitoring posts distributed across all over Japan. We take averages of radioactivity concentration between March 30 to April 6, 2013, during which the data is available for a large number of monitoring posts. The radioactivity concentration is recorded as effective doses with unit of μSv/h (micro Sievert per hour) based on the conversion rate defined by Nuclear Safety Commission.

Details can be found at (accessed at 10:19am JST, October 22, 2020):
https://radioactivity.nsr.go.jp/map/ja/index.html

A5. Property Value

Data on property value is taken from Real Estate Transaction-price Information System run by Ministry of Land, Infrastructure, Transportation and Tourism. The database is based on the questionnaire survey sent to new owners of real estate. The survey covers real estate transactions in all regions in Japan after 2007 and collect property characteristics and contract summary for approximately 300,000 transactions every year. We focus on the transaction price of residential land. This is the same dataset used in **?** to estimate the impact of Fukushima radioactive fallout on the property value. To avoid our property value capturing the price changes driven by the compositional changes of property types, we first estimate a hedonic property price equation by regressing the transacted price per square meter on a set of property characteristics: dummies to indicate the time of transactions (year-quarter fixed effects), the shape of the land, the regulation on land use, and small geographical units. We then take a simple average of the residuals of the property values within each location.

Details can be found at (accessed at 8:13am JST, August 17, 2020):
https://www.land.mlit.go.jp/webland/download.html

A6. Other Region-level Controls

The main estimating model (equations 1 and 2 in section 3) includes a set of rich prefecture- or location-level control variables. All these information are taken from administrative surveys and statistics. Appendix Table 1 shows a list of data source for these variables.

Appendix Table A1: Region-level Control Variables

	level	source
Taxable income	location	*School Basic Survey*
Logarithm of population	location	*School Basic Survey*
Teacher-to-student ratio	location	*School Basic Survey*
N of primary schools /100,000 pupils	prefecture	*School Basic Survey*
N of junior high /100,000 pupils	prefecture	*School Basic Survey*
N of long-term absence at PS /1000 pupils	prefecture	*School Basic Survey*
N of long-term absence at JHS/1000 pupils	prefecture	*School Basic Survey*
Expenditure at PS /pupil	prefecture	*School Basic Survey*
Expenditure at JHS /pupil	prefecture	*School Basic Survey*
CPI (tuition and educational materials)	prefecture	*Consumer Price Index*

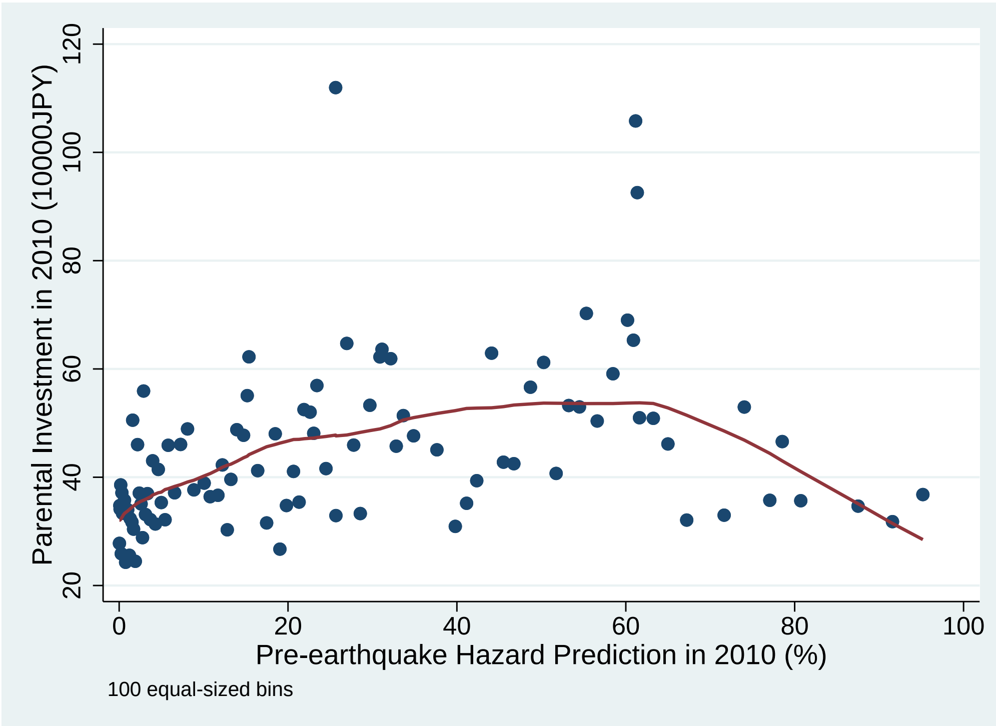
Note: PS stands for primary schools. JHS stands for junior high schools.

All the information is available in public at an official statistical portal (accessed between April 27, 2019 and March 27, 2020): https://www.e-stat.go.jp/

A7. Selectivity Score

We measure a child's cognitive outcome by standardized selectivity score of high school where the child was admitted at the age of 15. The standardized selectivity score reflect a child's overall test scores in five main subjects (i.e., Math, Science, Japanese, English, and Social Studies). The original selectivity score is constructed from test scores at the national-level mock exams conducted among the previous cohorts. Selectivity score is often used among junior high school students to predict the probability of being admitted to a specific high school based on their test scores at the national-level mock exams. We draw on the standardized test scores published by a dominant education institution in Japan (Torai Group, Co.). We complied standardized scores of all high school programs, took an average of the scores within each high school, and merged it with LSN21 by the name of high schools the child enrolled.[1] This is the high school version of selectivity score adopted in **?**.

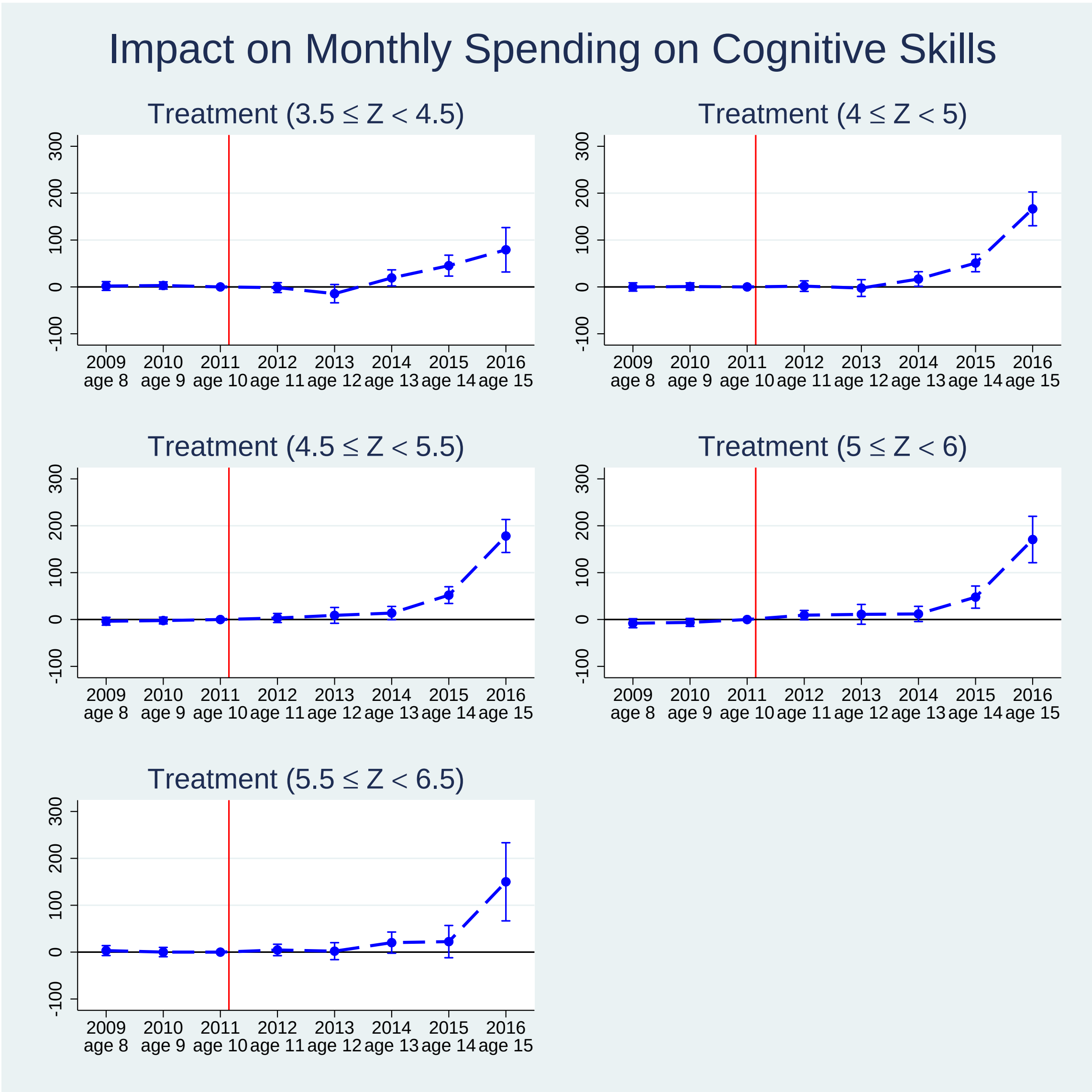
[1] We also supplement the selectivity scores for those advanced high schools where they admit students at the time of junior high school enrollment rather than at high school enrollment (i.e., six year program). Specifically, we supplement the selectivity scores for these advanced high schools by the selectivity scores of high schools which had the same (or ± 10) rank in the college admission results. Ranking information was drawn from (**?**).



Appendix Figure A2: Pre-earthquake Hazard and Parental Investment Prior to the Shock

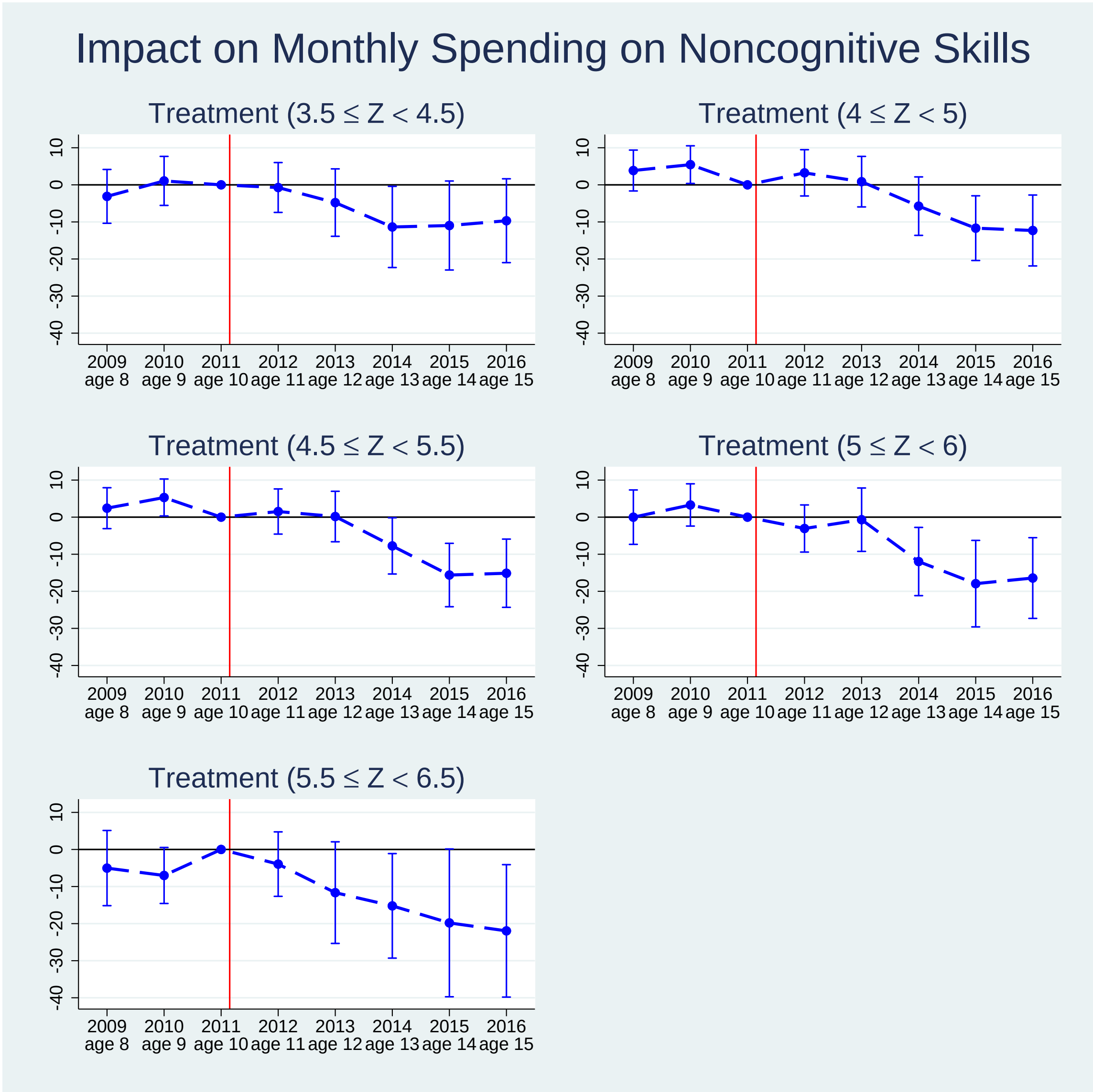
Note: Parental investment stands for an investment on cognitive skills, namely, a monthly spending on tutoring schools. Pre-earthquake hazard measures the probability of an earthquake with $Z \geq 5.5$ in the next 30 years as of 2010.

Appendix B. Alternative Treatment Definitions



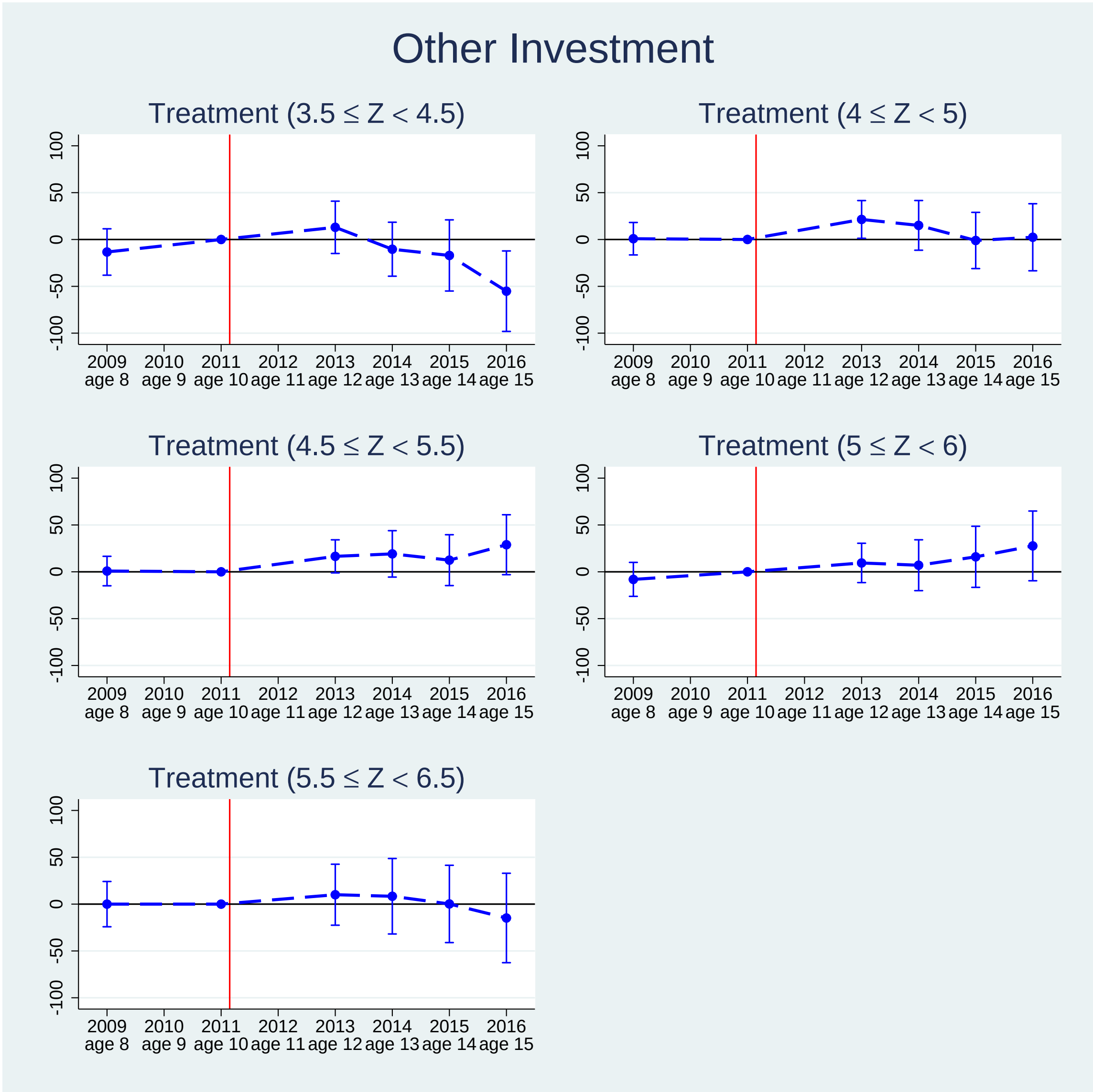
Appendix Figure B1: Impact by Alternative Treatment Definition (Spending on Cognitive Skills)

Note: Dependent variable = monthly spending on tutoring schools (100 JPY $\approx$ 1 USD as of January 2021). Each graph shows the estimated impacts of different definitions of treatment effect from a separate individual-level fixed effect model. Control group consists of children exposed to $Z < 2$ in all estimations. N = 21536 when treatment group is defined by $3.5 \leq Z < 4.5$. N = 29656 when treatment group is defined by $4 \leq Z < 5$. N = 32848 when treatment group is defined by $4.5 \leq Z < 5.5$. N = 23344 when treatment group is defined by $5 \leq Z < 6$. N = 17632 when treatment group is defined by $5.5 \leq Z < 6.5$. The model controls for year effects specific to the region groups defined by the decile of the proportion of private junior high schools in the region, in addition to hazard group-specific year effects. Spikes indicate 95% confidence interval.



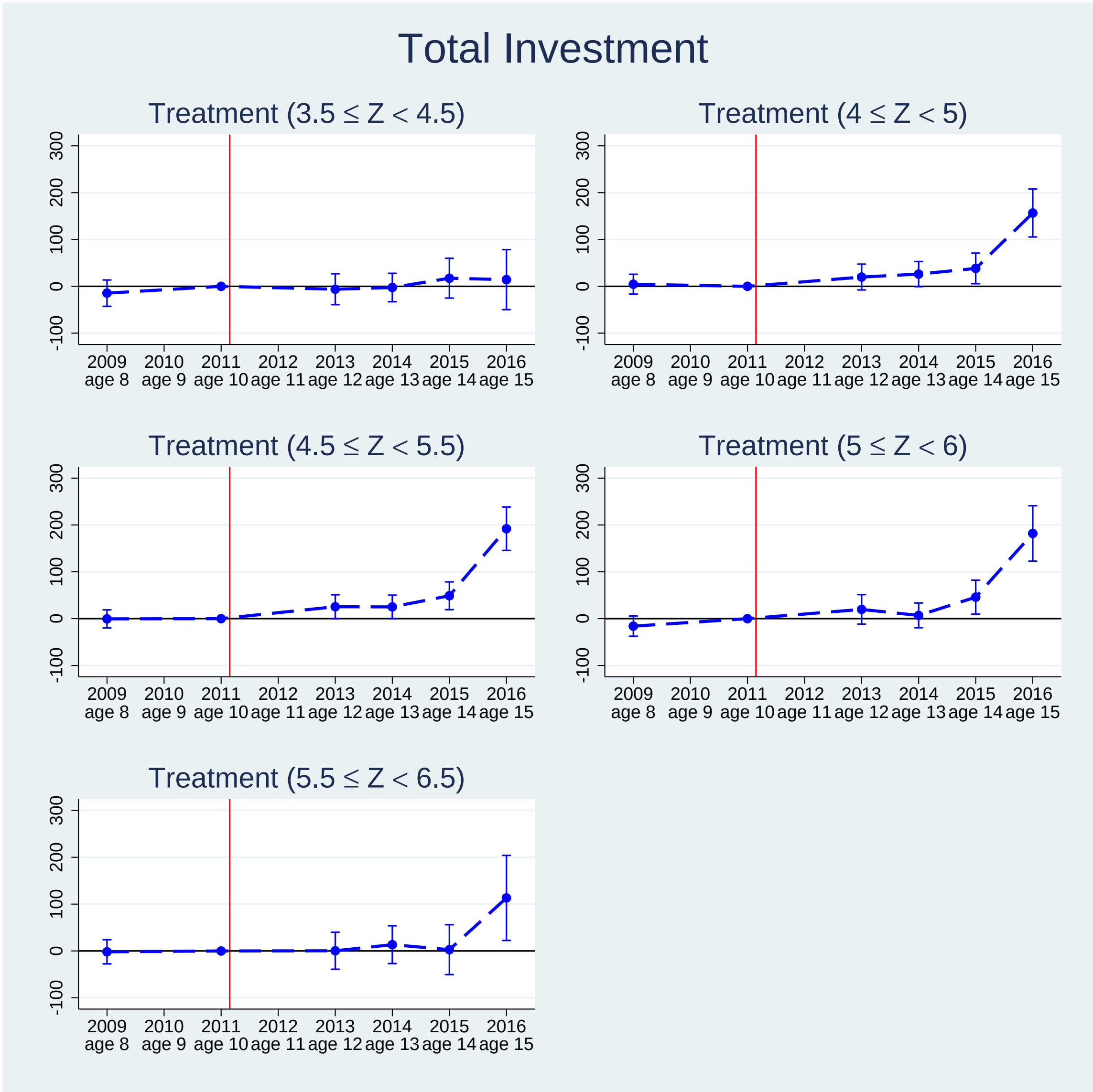
Appendix Figure B2: Impact by Alternative Treatment Definition (Spending on Noncognitive Skills)

Note: Dependent variable = monthly spending on after school clubs (music, sports etc., measured in 100 JPY ≈ 1 USD as of January 2021). Each graph shows the estimated impacts of different definitions of treatment effect from a separate individual-level fixed effect model. Control group consists of children exposed to $Z < 2$ in all estimations. N = 21536 when treatment group is defined by $3.5 \leq Z < 4.5$. N = 29656 when treatment group is defined by $4 \leq Z < 5$. N = 32848 when treatment group is defined by $4.5 \leq Z < 5.5$. N = 23344 when treatment group is defined by $5 \leq Z < 6$. N = 17632 when treatment group is defined by $5.5 \leq Z < 6.5$. The model controls for year effects specific to the region groups defined by the decile of the proportion of private junior high schools in the region, in addition to hazard group-specific year effects. Spikes indicate 95% confidence interval.



Appendix Figure B3: Impact by Alternative Treatment Definition (Other spending)

Note: Dependent variable = other monthly expenditures for the child including foods, clothes, tuition, and expenses on medical treatment (100 JPY $\approx$ 1 USD as of January 2021). Information on other investment is not available in 2010 and 2012 due to changes in the questionnaire. Each graph shows the estimated impacts of different definitions of treatment effect from a separate individual-level fixed effect model. Control group consists of children exposed to $Z < 2$ in all estimations. N = 16152 when treatment group is defined by $3.5 \leq Z < 4.5$. N = 22242 when treatment group is defined by $4 \leq Z < 5$. N = 24636 when treatment group is defined by $4.5 \leq Z < 5.5$. N = 17508 when treatment group is defined by $5 \leq Z < 6$. N = 13224 when treatment group is defined by $5.5 \leq Z < 6.5$. The model controls for year effects specific to the region groups defined by the proportion of private junior high schools, in addition to hazard group-specific year effects. Spikes indicate 95% confidence interval.



Appendix Figure B4: Impact by Alternative Treatment Definition (Total)

Note: Dependent variable = total monthly spending (100 JPY $\approx$ 1 USD as of January 2021). Information on other investment, therefore total investment, is not available in 2010 and 2012 due to changes in the questionnaire. Each graph shows the estimated impacts of different definitions of treatment effect from a separate individual-level fixed effect model. Control group consists of children exposed to $Z < 2$ in all estimations. N = 22242 when treatment group is defined by $4 \leq Z < 5$. N = 24636 when treatment group is defined by $4.5 \leq Z < 5.5$. N = 17508 when treatment group is defined by $5 \leq Z < 6$. N = 13224 when treatment group is defined by $5.5 \leq Z < 6.5$. The model controls for year effects specific to the region groups defined by the proportion of private junior high schools, in addition to hazard group-specific year effects. Spikes indicate 95% confidence interval.

Appendix Table B1: Estimated Treatment Effects Used to Construct Figure 3

	(1)	(2)	(3)	(4)
	Cognitive skills	Noncognitive skills	Other	Total
Treatment effect ($Z \geq 4.5$)				
2009	-2.53	1.07	0.65	-0.81
	(3.91)	(2.68)	(7.40)	(8.92)
2010	-1.27	3.07		
	(3.43)	(2.34)		
2012	4.20	0.65		
	(4.56)	(2.84)		
2013	7.76	-0.86	14.37	21.27
	(7.76)	(3.31)	(8.50)	(11.85)
2014	14.75	-8.55	17.50	23.70
	(6.52)	(3.68)	(11.66)	(11.67)
2015	48.39	-15.44	11.21	44.16
	(8.60)	(4.39)	(12.83)	(14.18)
2016	177.21	-15.45	23.63	185.39
	(17.98)	(4.52)	(15.02)	(23.01)
N of observations	35,208	35,208	26,406	26,406
N of children	4,401	4,401	4,401	4,401

Note: Each column presents estimation results from a separate individual-level fixed effect model. Base year = 2011. Control group consists of children exposed to $Z < 2$. Dependent variable in column 1 = monthly spending on tutoring schools in 100JPY. Dependent variable in column 2 = monthly spending on after school clubs (music, sports etc.) in 100JPY. Dependent variable in column 3 = other monthly expenditures for the child including foods, clothes, tuition, and expenses on medical treatment in 100JPY. Information on other investment in column 3 is not available in 2010 and 2012 due to changes in the questionnaire. 100 JPY $\approx$ 1 USD as of January 2021. The model controls for year effects specific to the region groups defined by the proportion of private junior high schools, in addition to hazard group-specific year effects. Robust standard errors clustered at prefecture level in parentheses.

C. Sensitivity Against Controlling for Additional Variables

Appendix Table C1 : Sensitivity Against Including Covariates
Y = monthly spending on cognitive skills in 100 JPY

	(1) baseline	(2) + price of foods	(3) + region traits	(4) + absence ratio	(5) all included
Treatment effect ($Z \geq 4.5$)					
2009	-2.53	1.48	-2.53	0.55	5.03
	(3.91)	(4.35)	(3.96)	(4.38)	(5.65)
2010	-1.27	-1.73	-1.41	1.86	-4.24
	(3.43)	(3.50)	(3.45)	(3.82)	(4.76)
2012	4.20	3.42	4.17	5.63	0.53
	(4.56)	(4.73)	(4.56)	(4.99)	(5.28)
2013	7.76	2.49	7.78	8.77	4.88
	(7.76)	(8.13)	(7.77)	(7.89)	(8.24)
2014	14.75	11.73	14.79	18.97	15.76
	(6.52)	(6.85)	(6.50)	(6.65)	(7.47)
2015	48.39	42.86	48.49	47.70	41.30
	(8.60)	(9.05)	(8.60)	(8.92)	(9.82)
2016	177.21	171.02	177.40	184.54	174.50
	(17.98)	(18.47)	(17.99)	(18.42)	(18.26)
Hazard and private FE	Yes	Yes	Yes	Yes	Yes
Other control variables	No	No	No	No	Yes

Note: Each column presents estimation results from a separate individual-level fixed effect model. Base year = 2011. Control group consists of children exposed to $Z < 2$. 100 JPY ≈ 1 USD as of January 2021. Column 1 replicates in the baseline model presented in Panel 1 in Figure 3. All models control for year effects specific to the region groups defined by the decile of the proportion of private junior high schools in the region, in addition to hazard group-specific year effects. "Prices of foods" indicates CPI growth rate of foods at each prefecture and its polynomials."Region traits" includes a logarithm of population and taxable income at each location. "Absence ratio" indicates numbers of long-term absence at primary schools and junior high schools per 1000 students at each prefecture. Robust standard errors clustered at location level in parentheses.

Appendix Table C2: Sensitivity Against Including Covariates
Y = monthly spending on noncognitive skills in 100 JPY

	(1) baseline	(2) + price of education	(3) + teacher-student ratio	(4) + school expense	(5) + number of schools	(6) + property prices	(7) + family traits	(8) all included
Treatment effect ($Z \geq 4.5$)								
2009	1.07	1.09	0.90	0.98	0.40	1.16	1.04	-1.41
	(2.68)	(2.76)	(2.67)	(2.68)	(2.85)	(2.68)	(2.99)	(3.27)
2010	3.07	2.39	3.03	3.18	2.95	2.88	3.40	1.47
	(2.34)	(2.44)	(2.34)	(2.40)	(2.35)	(2.34)	(2.76)	(2.96)
2012	0.65	0.66	0.72	0.70	0.50	0.64	-0.80	-1.10
	(2.84)	(2.88)	(2.84)	(2.84)	(2.86)	(2.84)	(2.98)	(3.02)
2013	-0.86	-1.07	-0.73	-0.69	-1.17	-0.79	-0.50	0.53
	(3.31)	(3.39)	(3.32)	(3.31)	(3.34)	(3.31)	(3.54)	(3.75)
2014	-8.55	-7.77	-8.31	-8.64	-8.89	-8.36	-7.81	-6.22
	(3.68)	(3.90)	(3.71)	(3.69)	(3.76)	(3.67)	(3.89)	(4.29)
2015	-15.44	-14.79	-15.15	-15.53	-16.18	-15.26	-14.17	-13.89
	(4.39)	(4.51)	(4.41)	(4.40)	(4.45)	(4.38)	(4.41)	(4.59)
2016	-15.45	-15.70	-15.07	-15.57	-16.21	-15.19	-15.00	-15.25
	(4.52)	(4.63)	(4.55)	(4.53)	(4.64)	(4.50)	(4.63)	(4.90)
Hazard and private FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	No	No	No	No	No	No	No	Yes

Note: Each column presents estimation results from a separate individual-level fixed effect model. Base year = 2011. Control group consists of children exposed to $Z < 2$. 100 JPY $\approx$ 1 USD as of January 2021. Column 1 replicates in the baseline model presented in Panel 2 in Figure 3."Prices of education" indicates CPI growth rate for tuition and educational materials at each prefecture and its polynomials."Teacher-student ratio" indicates teacher-to-student ratio and its second and third polynomials at each location. "School expense" indicates school expenditures per 1000 pupils at primary schools and junior high schools at each prefecture. "property prices" indicates average residualized prices of residential land at each location. "family traits" include employment status of parents, the number of siblings, and a dummy to indicate that grandparent(s) lives with the child, and BMI of the child. Robust standard errors clustered at location level in parentheses.

Appendix Table C3: Sensitivity Against Including Covariates
Y = monthly spending on noncognitive skills in 100 JPY

	(1) baseline	(2) + price of foods	(3) + region traits	(4) + absence ratio	(5) all included
Treatment effect ($Z \geq 4.5$)					
2009	1.07	0.68	0.95	-0.50	-1.41
	(2.68)	(2.71)	(2.67)	(2.80)	(3.27)
2010	3.07	3.21	3.02	1.82	1.47
	(2.34)	(2.37)	(2.34)	(2.43)	(2.96)
2012	0.65	0.71	0.66	-0.74	-1.10
	(2.84)	(2.84)	(2.84)	(2.88)	(3.02)
2013	-0.86	-0.38	-0.85	-0.54	0.53
	(3.31)	(3.43)	(3.31)	(3.32)	(3.75)
2014	-8.55	-7.25	-8.50	-8.27	-6.22
	(3.68)	(3.92)	(3.68)	(3.63)	(4.29)
2015	-15.44	-14.71	-15.37	-15.41	-13.89
	(4.39)	(4.44)	(4.39)	(4.39)	(4.59)
2016	-15.45	-14.98	-15.39	-16.42	-15.25
	(4.52)	(4.56)	(4.52)	(4.69)	(4.90)
Hazard and private FE	Yes	Yes	Yes	Yes	Yes
Other control variables	No	No	No	No	Yes

Note: Each column presents estimation results from a separate individual-level fixed effect model. Base year = 2011. Control group consists of children exposed to $Z < 2$. 100 JPY ≈ 1 USD as of January 2021. Column 1 replicates in the baseline model presented in Panel 2 in Figure 3. All models control for year effects specific to the region groups defined by the decile of the proportion of private junior high schools in the region, in addition to hazard group-specific year effects. "Prices of foods" indicates CPI growth rate of foods at each prefecture and its polynomials."Region traits" includes a logarithm of population and taxable income at each location. "Absence ratio" indicates numbers of long-term absence at primary schools and junior high schools per 1000 students at each prefecture. Robust standard errors clustered at location level in parentheses.

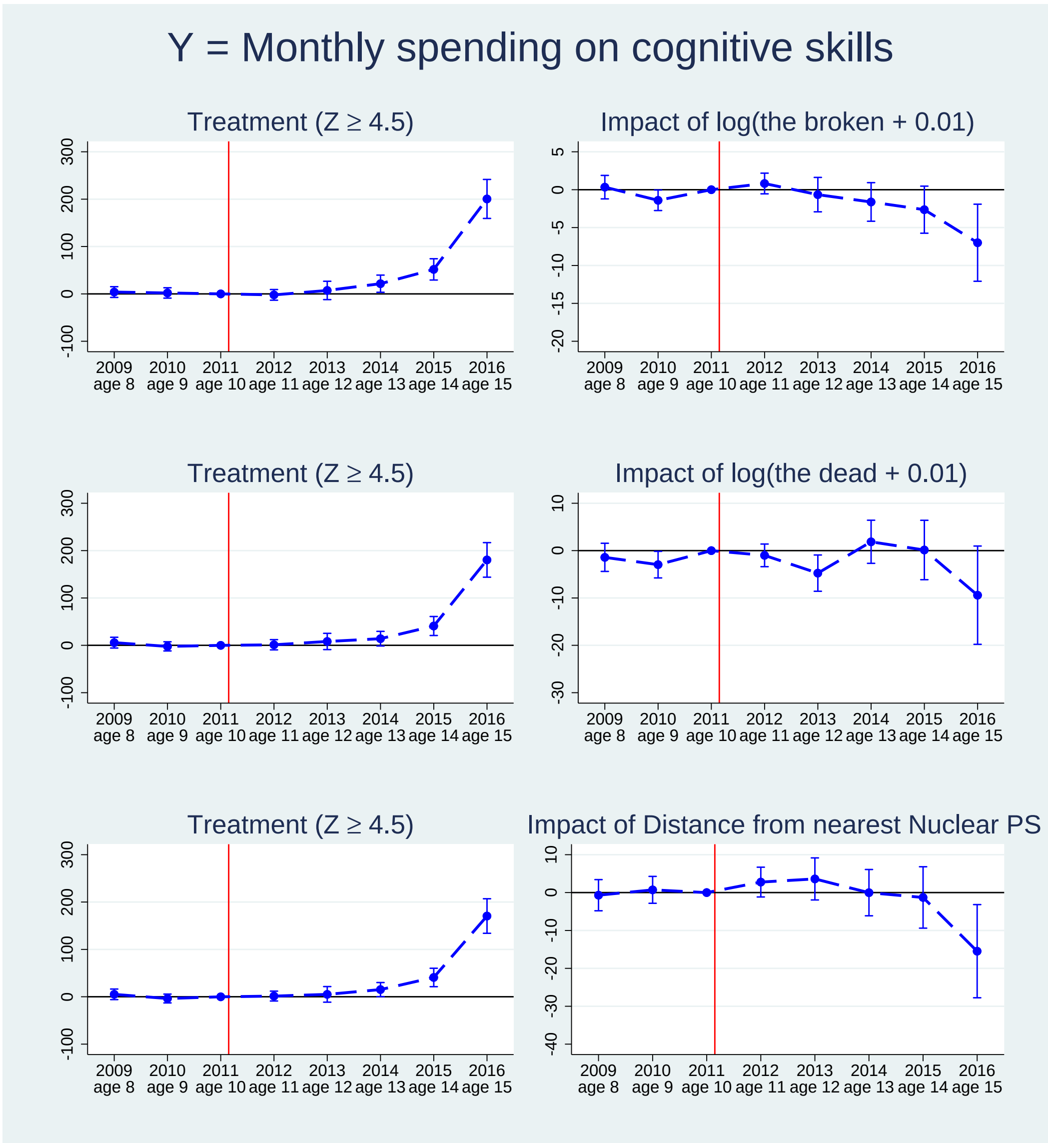
D. Attrition and Migration

Appendix Table D1: Long-term Selective Attrition and Migration

	Attrition dummy				Migration dummy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$I(Z \geq 4.5)$	-0.023	-0.020	-0.011	-0.002	0.004	0.004	-0.008	-0.005
	(0.021)	(0.023)	(0.025)	(0.028)	(0.006)	(0.007)	(0.011)	(0.012)
$I(Z \geq 4.5) \times LowIncome^{11}$			-0.008	-0.016			0.017	0.018
			(0.026)	(0.026)			(0.015)	(0.015)
$LowIncome^{11}$			0.067	0.065			-0.030	-0.029
			(0.019)	(0.019)			(0.012)	(0.012)
Hazard & private FE	No	Yes	No	Yes	No	Yes	No	Yes
N of Observations	6,918	6,918	5,815	5,815	4,401	4,401	3,810	3,810

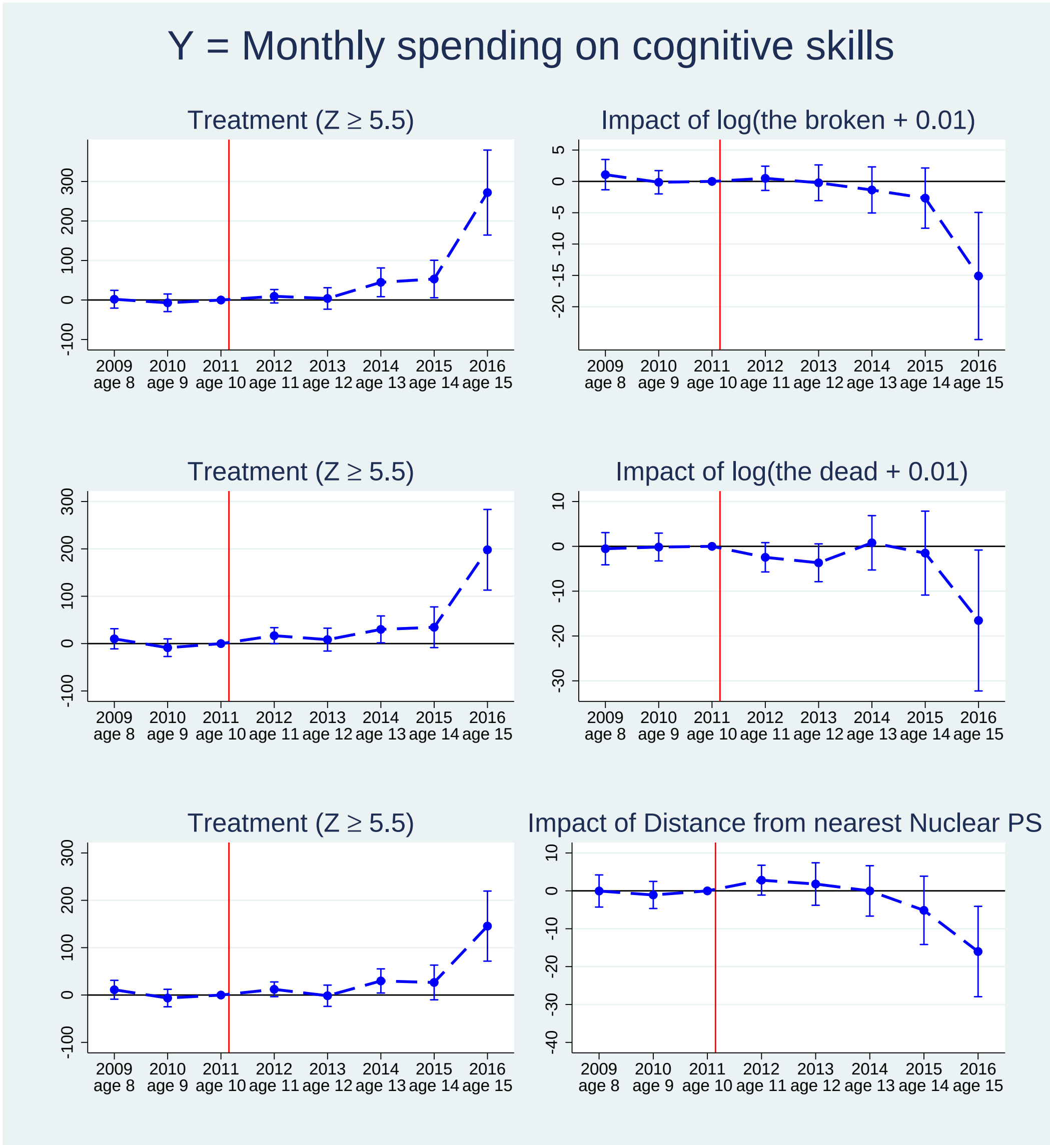
Note: Each column present estimation results from a linear probability model. Control group consists of children exposed to $Z < 2$. An attrition dummy takes one if the individual is not observed at least once after the Great East Japan Earthquake, and zero otherwise. Similarly, a migration dummy takes one if the individual lives in different locations at least once after the earthquake. Robust standard errors clustered at location level in parentheses. $LowIncome^{11}$ takes a dummy variable which takes one if household income falls below the median value right before the earthquake, zero otherwise. The income information is available only to a subset of the original sample.

E. More on Mechanisms: Other Types of Destruction



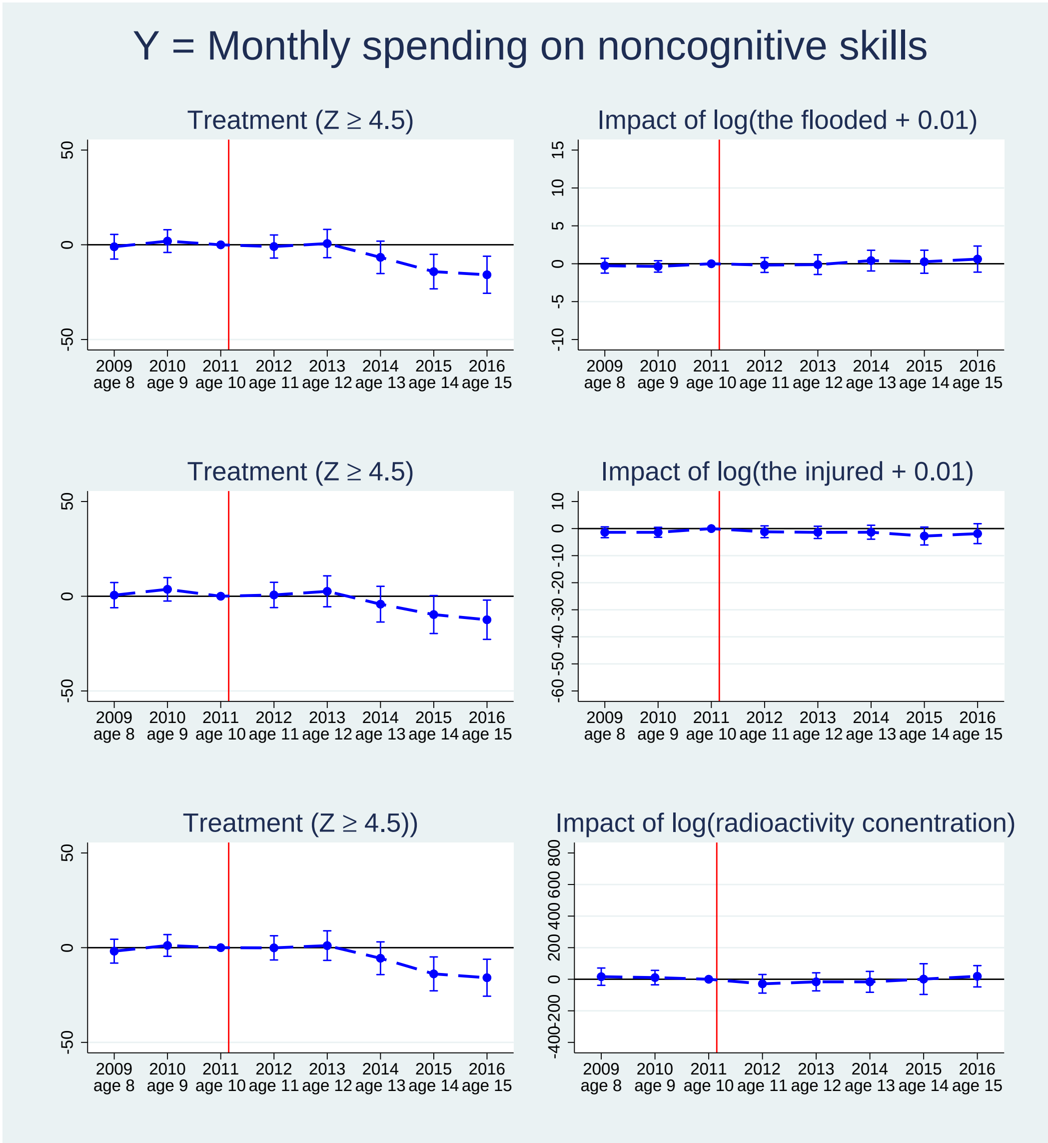
Appendix Figure E1: Does Physical Damage Explain the Main Result? (Treatment = $Z \geq 4.5$, Y = Monthly Spending on Cognitive Skills)

Note: Dependent variable = monthly spending on tutoring schools in 100 JPY. 100 JPY $\approx$ 1 USD as of January 2021. The two graphs in each row present the estimated treatment effects from the same individual-level fixed effect model. Righthand side graphs show the estimates for the damage variables interacted with year effects (base year = 2011). The numbers of the broken house and the death toll are modified by adding 0.01 before taking the logarithm. All models also control for the same sets of control variables included in column 8 in Table 6. Control group consists of children exposed to $Z < 2$. Spikes indicate 95% confidence interval.



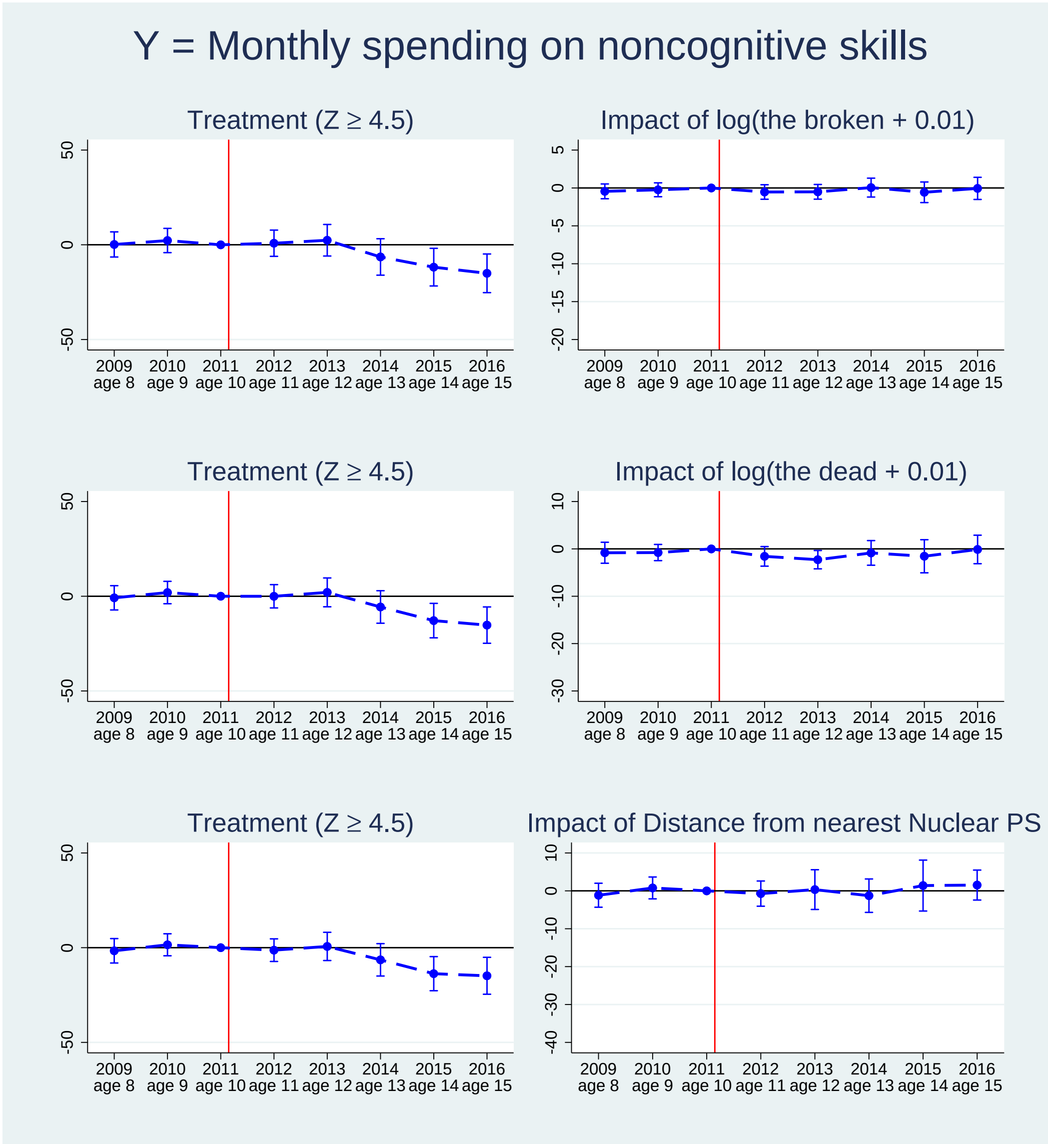
Appendix Figure E2: Does Physical Damage Explain the Main Result? (Treatment = $Z_i \geq 5.5$, Y = Monthly Spending on Cognitive Skills)

Note: Dependent variable = monthly spending on tutoring schools in 100 JPY. 100 JPY $\approx$ 1 USD as of January 2021. The two graphs in each row present the estimated treatment effects from the same individual-level fixed effect model. Righthand side graphs show the estimates for the damage variables interacted with year effects (base year = 2011). The numbers of the broken house and the death toll are modified by adding 0.01 before taking the logarithm. All models also control for the same sets of control variables included in column 8 in Table 6. Control group consists of children exposed to $Z_j < 2$. Spikes indicate 95% confidence interval.



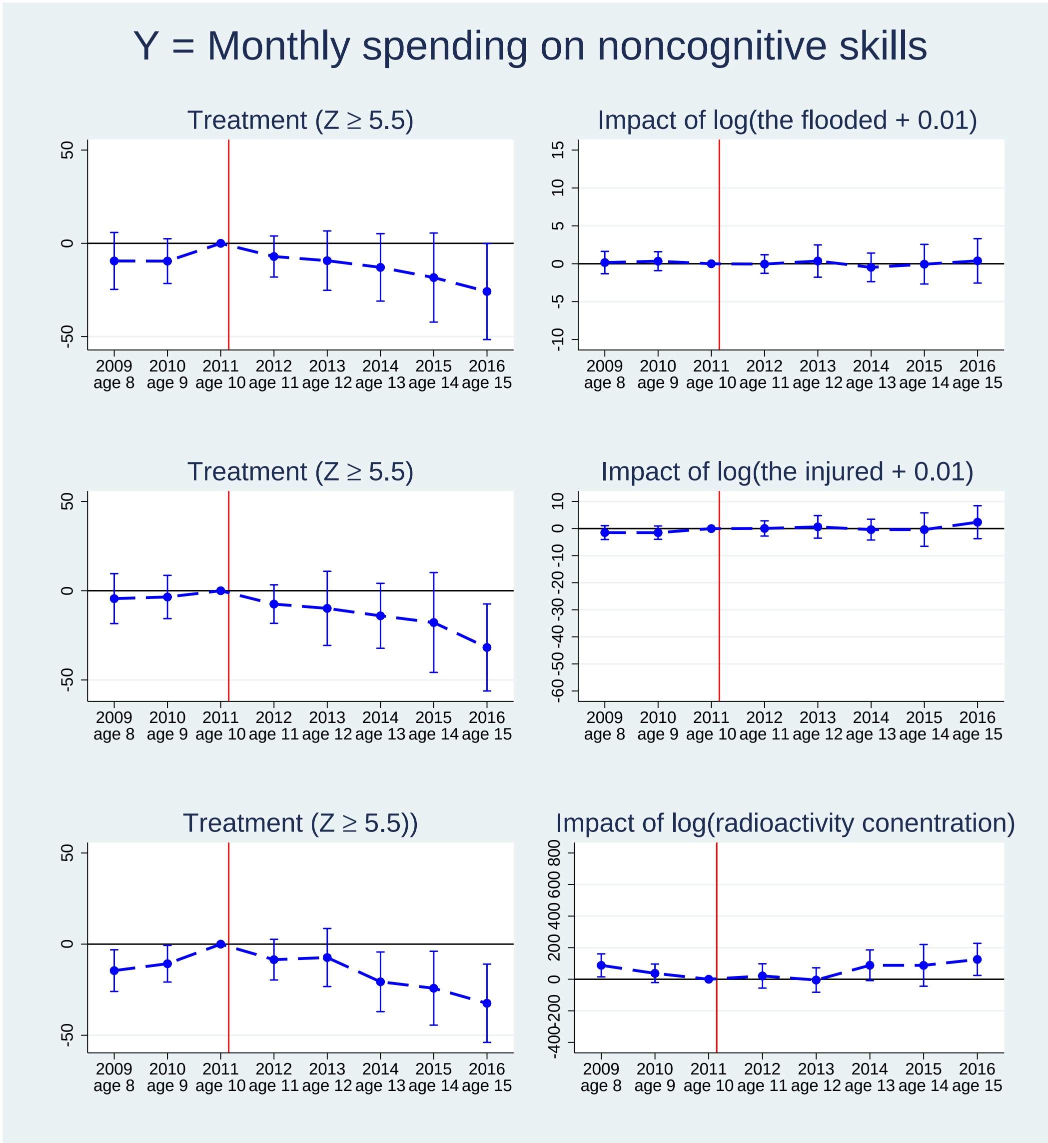
Appendix Figure E3: Does Physical Damage Explain the Main Result? (Treatment = $Z \geq 4.5$, Y = Monthly Spending on Noncognitive Skills)

Note: Dependent variable = monthly spending on after school clubs in 100 JPY. 100 JPY $\approx$ 1 USD as of January 2021. The two graphs in each row present the estimated treatment effects from the same individual-level fixed effect model. Righthand side graphs show the estimates for the damage variables interacted with year effects (base year = 2011). The numbers of the broken house and the death toll are modified by adding 0.01 before taking the logarithm. All models also control for the same sets of control variables included in column 8 in Table 6. Control group consists of children exposed to $Z < 2$. Spikes indicate 95% confidence interval.



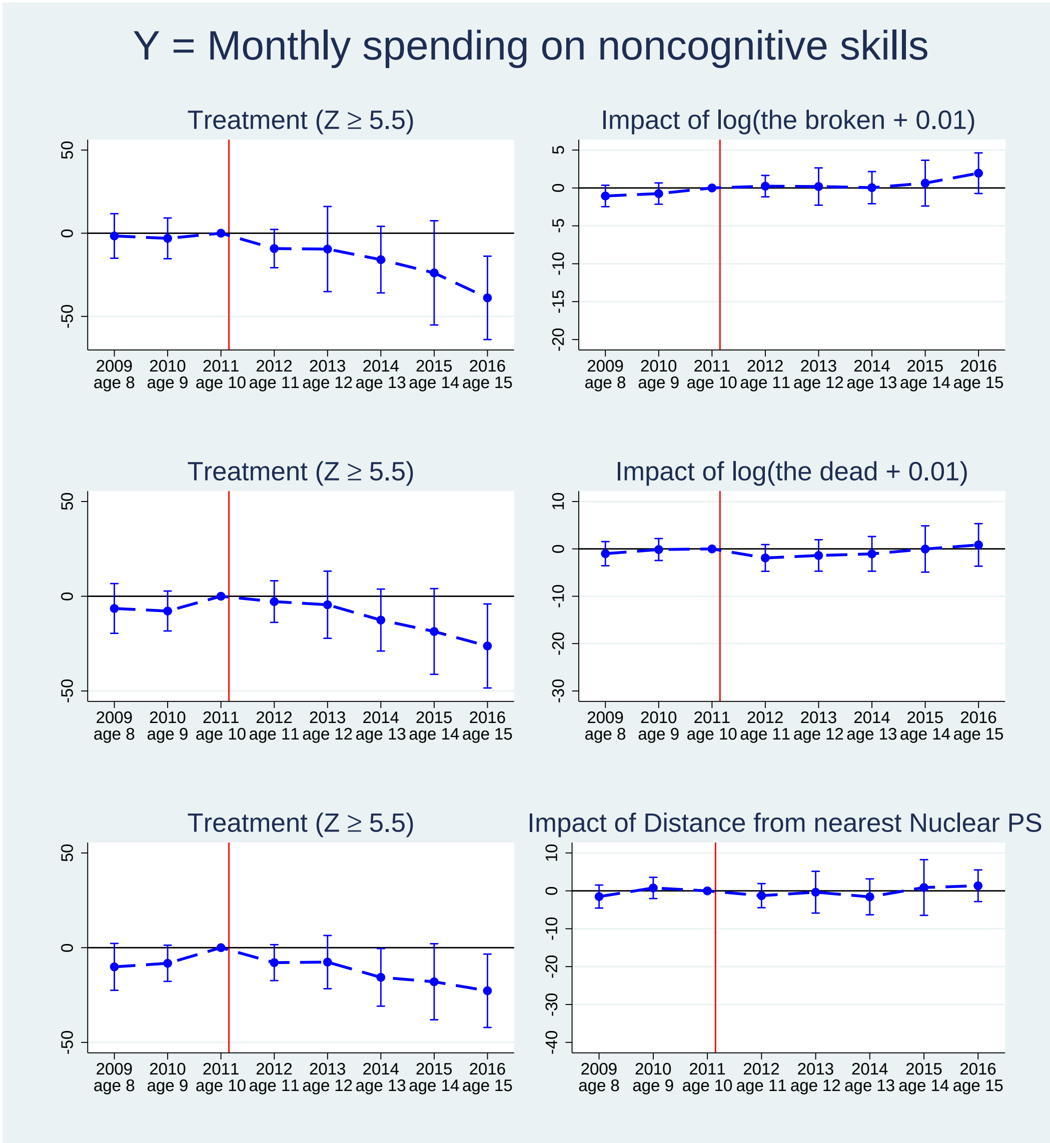
Appendix Figure E4: Does Physical Damage Explain the Main Result? (Treatment = $Z \geq 4.5$, Y = Monthly Spending on Noncognitive Skills)

Note: Dependent variable = monthly spending on after school clubs in 100 JPY. 100 JPY $\approx$ 1 USD as of January 2021. The two graphs in each row present the estimated treatment effects from the same individual-level fixed effect model. Righthand side graphs show the estimates for the damage variables interacted with year effects (base year = 2011). The numbers of the broken house and the death toll are modified by adding 0.01 before taking the logarithm. All models also control for the same sets of control variables included in column 8 in Table 6. Control group consists of children exposed to $Z < 2$. Spikes indicate 95% confidence interval.



Appendix Figure E5: Does Physical Damage Explain the Main Result? (Treatment = $Z \geq 5.5$, Y = Monthly Spending on Noncognitive Skills)

Note: Dependent variable = monthly spending on after school clubs in 100 JPY. 100 JPY $\approx$ 1 USD as of January 2021. The two graphs in each row present the estimated treatment effects from the same individual-level fixed effect model. Righthand side graphs show the estimates for the damage variables interacted with year effects (base year = 2011). The numbers of the broken house and the death toll are modified by adding 0.01 before taking the logarithm. All models also control for the same sets of control variables included in column 8 in Table 6. Control group consists of children exposed to $Z < 2$. Spikes indicate 95% confidence interval.



Appendix Figure E6: Does Physical Damage Explain the Main Result? (Treatment = $Z \geq 5.5$, Y = Monthly Spending on Noncognitive Skills)

Note: Dependent variable = monthly spending on after school clubs in 100 JPY. 100 JPY $\approx$ 1 USD as of January 2021. The two graphs in each row present the estimated treatment effects from the same individual-level fixed effect model. Righthand side graphs show the estimates for the damage variables interacted with year effects (base year = 2011). The numbers of the broken house and the death toll are modified by adding 0.01 before taking the logarithm. All models also control for the same sets of control variables included in column 8 in Table 6. Control group consists of children exposed to $Z < 2$. N = 12712. Spikes indicate 95% confidence interval.

F. Household Income

Appendix Table F1: Sensitivity Against Controlling for Household and Miscellaneous Income (base year = 2011)

	Spending on cognitive skills			Spending on noncognitive skills		
	(1)	(2)	(3)	(4)	(5)	(6)
	Base	+ Household income	+ Other income	Base	+ Household income	+ Other income
Treatment effect ($Z \geq 4.5$)						
2013	-5.915	-6.314	-5.988	3.752	3.441	3.689
	(10.988)	(11.005)	(10.993)	(5.210)	(5.197)	(5.215)
2014	18.743	17.981	18.088	-3.096	-3.391	-3.401
	(12.540)	(12.557)	(12.567)	(6.137)	(6.149)	(6.106)
2015	33.456	33.298	33.490	-6.434	-7.178	-6.461
	(15.234)	(15.210)	(15.226)	(6.754)	(6.736)	(6.731)
2016	156.482	156.984	156.320	-10.421	-10.668	-10.509
	(23.617)	(23.574)	(23.618)	(6.847)	(6.842)	(6.833)
Sample size	12,270	12,270	12,270	12,270	12,270	12,270
N of children	2,454	2,454	2,454	2,454	2,454	2,454

Note: Each column presents estimation results from a separate individual-level fixed effect model. Income information is available in 2011 and 2013-2018. Base year = 2011. Control group consists of children exposed to $Z < 2$. All models control for the same sets of control variables included in the baseline model presented in column 8 in Table 6. In addition, columns 2 and 5 control for household income and its polynomials; columns 3 and 6 control for miscellaneous income and its polynomials. Robust standard errors clustered at location level in parentheses.

G. Local Supply of Tutoring Schools and After School Clubs

The earthquake can have also affected the number of tutoring schools in the region. To examine this possibility, we are interested in estimating the impact of the seismic intensity in region s on the number of tutoring schools in the same region at year t:

$$ln(Y_{st}) = \alpha + After_t * \gamma_1 I(Treated_s) + \theta_s + \mu_{st}, \ \ t = \{2009, 2014\} \tag{1}$$

where Y_{st} is the number (plus 0.001) of tutoring schools or the number of workers employed by tutoring schools in region s at year t ; $Treated_s$ is a treatment dummy defined by the seismic intensity at location s; $After_t$ is a dummy which takes one after the earthquake in 2011. By taking the first difference, we obtain the estimating model:

$$\Delta ln(Y_{st}) = \gamma_1 I(Treated_s) + \Delta\mu_{st} \tag{2}$$

where Δ is an operator to take a difference between $t = 2014$ and $t = 2009$.

Appendix Table G1: Impact on $\Delta log(N + 0.01)$

	(1) N of tutoring schools	(2) N of workers
Treatment effect ($Z \geq 4.5$)	-0.0319	0.183
	(0.0853)	(0.133)
N of locations	1,132	1,132
Treatment effect ($Z \geq 5.5$)	-0.301	-0.0333
	(0.268)	(0.320)
N of locations	873	873

Note: Each cell presents estimation results from a separate location-level first differenced model. Data is taken from Economics Census in 2009 and 2014. Control group consists of locations exposed to $Z < 2$. All models control for region group effects defined by the decile of the proportion of private junior high schools in the region, in addition to hazard-specific group dummies. Robust standard errors clustered at location level in parentheses.

H. Increased Regional Demands

The impact on the number of *plants* in other industries (Keizai Census)

We estimate the same model from the previous page but with dependent variable replaced by the number (plus 0.001) of plants in one-digit industry.

Appendix Table H1: Impact on $\Delta log(Number of Plants + 0.01)$

	(1)	(2)
	Treatment group	
	$Z \geq 4.5$	$Z \geq 5.5$
Agriculture and Forestry	-0.139	-0.416
	(0.0722)	(0.174)
Fisheries	-0.190	-0.324
	(0.0878)	(0.187)
Construction	-0.128	-0.317
	(0.0548)	(0.159)
Manufacturing	-0.166	-0.361
	(0.0559)	(0.165)
Electricity, Gas, Heat Supply and Water	-0.250	-0.0415
	(0.109)	(0.239)
Information and Communications	-0.242	-0.630
	(0.0957)	(0.228)
Transport and Postal Activities	-0.0663	-0.333
	(0.0540)	(0.159)
Wholesale and Retail Trade	-0.176	-0.474
	(0.0655)	(0.203)
Finance and Insurance	-0.155	-0.411
	(0.0554)	(0.156)
Real Estate, Goods Rental and Leasing	-0.0815	-0.307
	(0.0650)	(0.159)
Scientific Research and Technical Services	-0.167	-0.498
	(0.0604)	(0.190)
Accommodations and Restaurants	-0.179	-0.484
	(0.0673)	(0.223)
Medical, Health Care and Welfare	-0.0815	-0.416
	(0.0650)	(0.215)
General Services	-0.158	-0.416
	(0.0528)	(0.168)
N of locations	1132	873

Note: Each cell presents estimation results from a separate location-level first differenced model. Data is taken from Economics Census in 2009 and 2014. Control group consists of locations exposed to $Z < 2$. All models control for region group effects defined by the decile of the proportion of private junior high schools in the region, in addition to hazard group dummies. Robust standard errors clustered at location level in parentheses.