Very preliminary

Determinants of Charitable Giving to Unexpected Natural Disasters: Evidences from Two Big Earthquakes in Japan

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Abstract

A great amount of donation was collected after 2011 Tohoku Earthquake and 1995 Hanshin Earthquake, both of which happened in Japan. Such private donations should be enhanced in Japan since Japanese government already incurs enormous amount of debt, but little is known about what kind of people made such private donations. Using household-level monthly panel data, we explore what factors are associated with donors making donations for the victims of such earthquakes. Comparing the data just before and after these earthquakes, one can observe positive association between donations made before the earthquake and donations for the earthquake victims, which goes along with previous studies. Also, the empirical evidence shows that donation for the earthquake victims is likely to be a function of geographical distance from the epicenter with negative coefficient, which may indicate that sympathy for the earthquake victims is negatively associated with distance. In addition, income, saving and age are observed to have a positive association with donations for the earthquake victims and donations for other purposes. These factors are identified to be the significant factors both for Tohoku Earthquake and for Hanshin Earthquake. The positive association between age and donation for the earthquake victims is, however, not observed for households that donated before the earthquake.

Keywords: Tohoku Earthquake, Hanshin Earthquake, donation, Tobit, Family Income and Expenditure Survey
JEL Classification Number: D19, D64, H31, H41

1. Introduction

Two disastrous earthquakes which happened in Japan, i.e. 2011 Tohoku Earthquake and 1995 Hanshin Earthquake, are still fresh in our minds. The death toll was 13,135 and 6,402 respectively and the economic loss was $20.7 billion and $9.62 billion respectively[1]. Figure 1 is the map of Japan showing the epicenters.

However, it is a ray of light in the darkness that many charity events and volunteer activities were made, and a great amount of donation was collected after these earthquakes. As shown in Figure 2, quite a few people in Japan worked as volunteers for Tohoku Earthquake. In terms of donation, which is the focus of this study, great amount of donation was collected in Japan just after the earthquakes (Figure 3-1), and almost half of the private donation in Japan in 2011 was for the Tohoku Earthquake. Figure 3-2 shows that the increase in donation results from both the effect along the external margin (increase in the rate of donors) and the effect along the internal margin (increase in the average amount donation among donors). Then, one can come up with natural questions; who donated for the earthquake victims and what factors are associated with donors making donation? So far, few studies have been done on the donation for these earthquakes and no study, as far as the author knows, has answered these questions.

These questions are not only avocational but also of policy interest. In many countries, it is considered that private donation should be enhanced since a lot of governments already incur enormous amount of debt. Taxable deduction for certain charitable donations is an example. An extreme example is the tax credit for private donations in Hungary. Hungarian policy admits tax credit for private donations up to one percent of individual's tax liability. The reason why Hungary adopted such a policy is that Hungary needed a policy to finance charitable institutions without increasing government expenditure (Bauer, 2004). In Japan, the Cabinet Office of Japanese Government advocated the importance of private donations and proposed a policy to enhance private donations. Such a policy is named "New

[1] The death toll and economic loss are cited from a website of Cabinet Office, Government of Japan (http://www.bousai.go.jp/kaigirep/hakusho/h23/bousai2011/html/honbun/2b_sanko_siryo_06.htm , http://www5.cao.go.jp/j-j/cr/cr11/pdf/chr11_zu2-2.pdf). Exchange rate is obtained from a website of Bank of Japan.

Public”[2]. The characteristics of individuals, who made charitable donations, especially after the big earthquakes, should be investigated as a basic data for such a policy. However, such characteristics have not been investigated in detail.

Tohoku Earthquake, Mar 11, 2011　Hanshin Earthquake, Jan 17, 1995

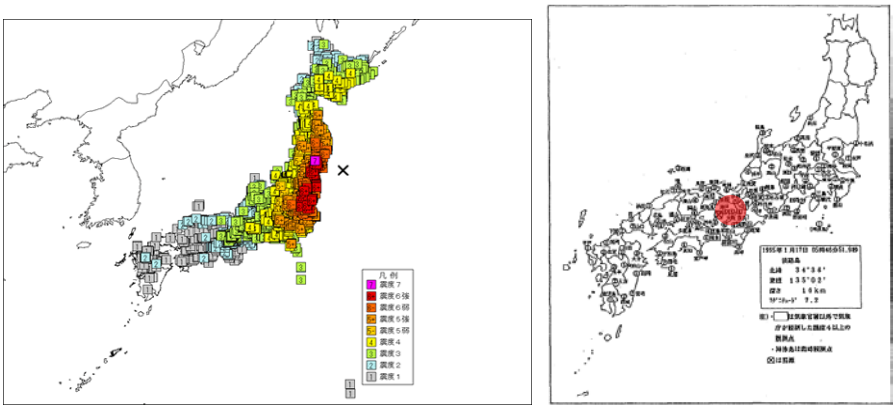


Figure 1: Maps and the epicenters of Tohoku and Hanshin earthquake[3]

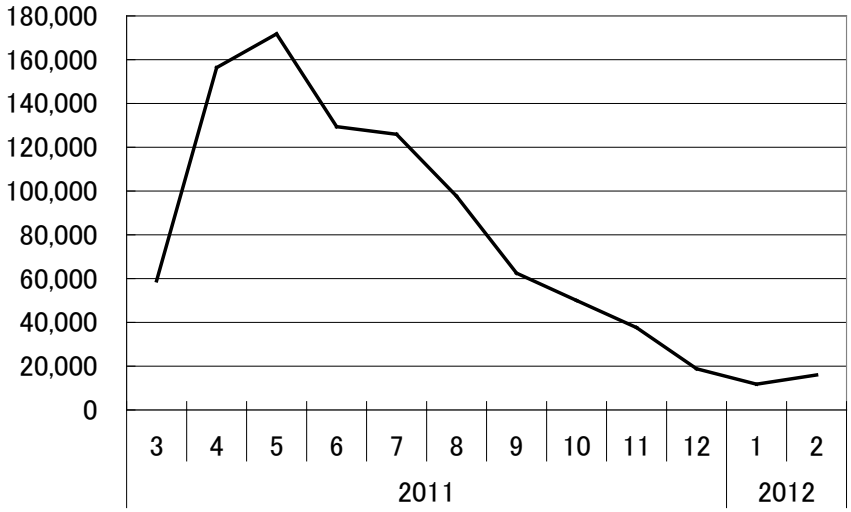


Figure 2: The monthly number of volunteers for Tohoku Earthquake; i.e. volunteers in Iwate, Miyagi and Fukushima Prefectures[4]

[2] “New Public” is explained in a website of Cabinet Office, Government of Japan (http://www5.cao.go.jp/npc/pdf/torikumi0906.pdf).

[3] Cited from a website of Ministry of Education, Culture, Sports, Science and Technology, Government of Japan (http://www.mext.go.jp/b_menu/hakusho/html/hpaa201101/detail/1311096.htm) and a website of Cabinet Office, Government of Japan (http://www.bousai.go.jp/kyoiku/kyokun/pdf/101.pdf).The author adds the epicenter of the Hanshin Earthquake on the map.

[4] Data: National Institute of Educational Policy Research (2011)

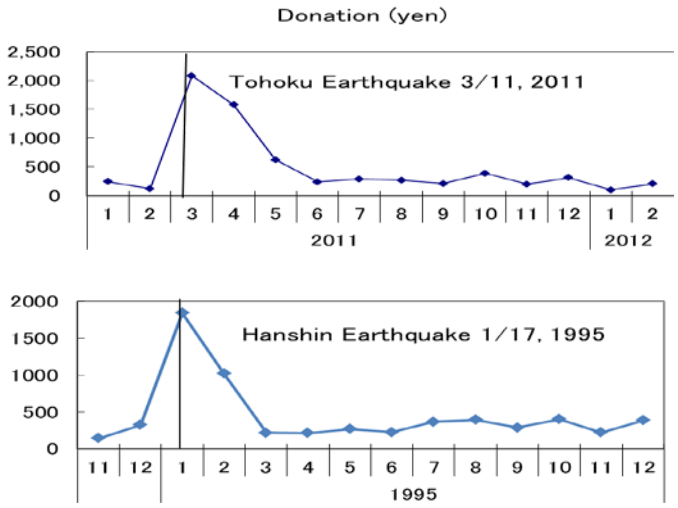
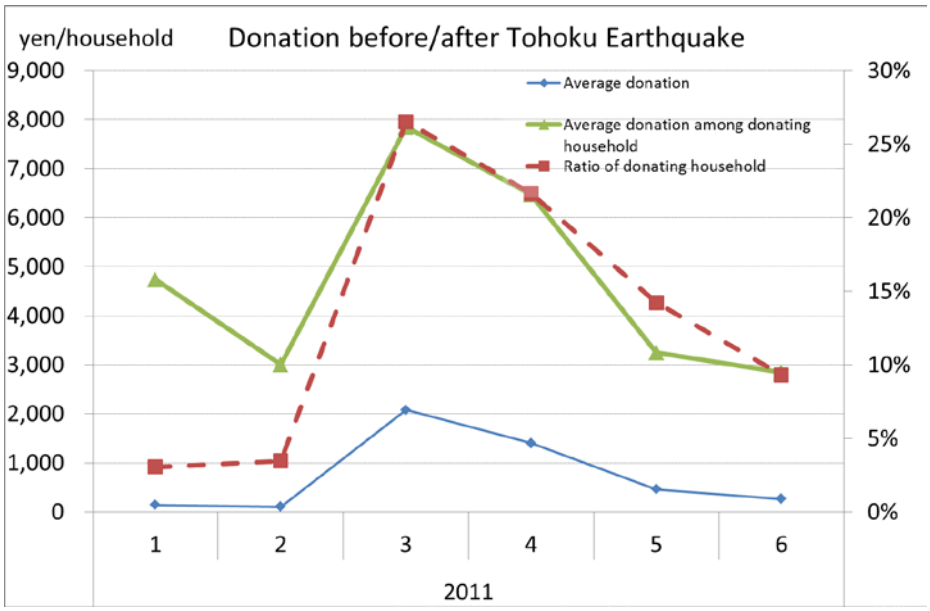


Figure 3-1: Monthly private donation per household before and after Tohoku and Hanshin earthquakes[5]



[5] Data: Family Income and Expenditure Survey

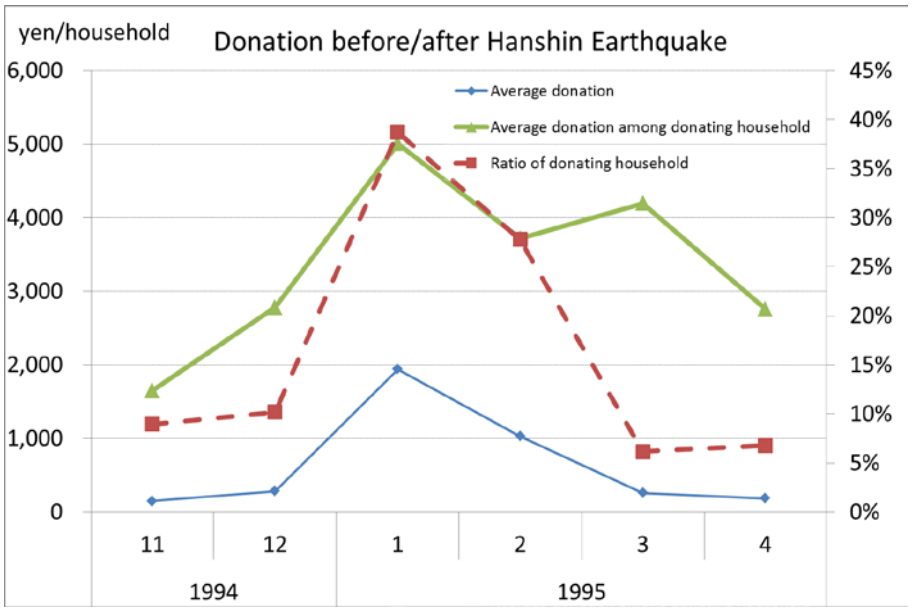


Figure 3-2: Donation before/after Earthquakes

In order to answer the question "who donated for the earthquake victims and what factors are associated with donors making donation?", we analyze micro-level household data set provided from Statistics Bureau, Ministry of Internal Affair and Communications, "Family Income and Expenditure Survey" (FIES hereafter). FIES contains monthly panel consumption data of households, including data of private donation, as well as demographic feature of households such as number of household member, age of the head of household and saving. About 9,000 households are requested to record their income and expenditure in the Family Account Book every month. This statistics started in 1946 and such a large, detailed and high frequent data is peculiar to Japan[6].

Historically, the economics of charitable donation has attracted the interest of many economists. Especially in USA, enormous size of donation has been made, but it is difficult to explain the behavior of donation theoretically; the theoretical framework of economy explains the behavior of human with self-interest, while the behavior of donation seems to be completely unselfish.

[6] Statistics Bureau, Ministry of Internal Affairs and Communications, Government of Japan compares FIES made in G7 countries in its website (http://www.stat.go.jp/data/kakei/pdf/mikata7.pdf) and concludes that the Japanese FIES is the most frequent (monthly) and that only four of G7 countries, including Japan, require households to keep their Family Account Books. Among such four countries, it concludes that Japan surveys the largest number of households (approximately 9,000 households).

To take an example in USA, the amount of donation is $316.23 billion in 2012[7], 2% of the GDP. Among these previous studies, most studies especially focus on private donations[8]. This paper hereafter focuses on private donations, too.

There are some strands of previous studies focusing on private donations. Since our study is about the determinants for charitable donations, it is natural to introduce previous studies about the determinants for charitable donations first. Hood et al. (1977), Kitchen (1992), Tiehen (2001), Auten et al. (2002) and Bakija and Heim (2008) point out the relationship between income and donation. Wealth is found to have positive association with donation by Kitchen (1992). Although income and wealth monotonically associate with donation, age's association is not that simple. Glenday et al. (1986) and Kitchen (1992) show that age has monotonically positive association with donation where Gittell and Tebaldi (2006) explain the association is U-shaped; i.e. middle aged people between the age of 35 to 54 donate the least. Tiehen (2001), Gittell and Tabaldi (2006) and Schokkaert (2006) show that education has positive association with donation. Religious affiliation also has positive association (Jackson et al., 1995; Gittell and Tabaldi, 2006). Since tax incentive, which definitely enhances charitable donation, has been studied especially intensively, we introduce these literatures in a separate paragraph. The effect of government grant, which has also been studied strenuously, is introduced in the following paragraph.

As explained in the previous paragraph, tax incentive to enhance charitable donation is studied a lot. One reason why it has been studied is that this is one of the most important measures for government. Feldstein and Clotfelter (1976) estimate that the price elasticity with respect to private donation. Randolph (1995) estimates both permanent and transitory elasticity. Auten et al. (2002) estimate such elasticity based on permanent income hypothesis. Although, there are relatively fewer studies about Japan, Yamauchi (1997) estimated the price elasticity with respect to private donation in Japan. Feldstein (1980) shows theoretically that tax deductibility is more efficient than government direct expenditure for public goods.

Government grants are other important measures for government. Therefore, the effect of government grants to charitable donations has been studied

[7] Giving USA 2012

[8] In USA, 72% of the donation is contributed by individuals.

thoroughly. For example, Warr (1982) and Roberts (1984) show theoretically that government direct expenditure to a public good financed by lump-sum taxes completely cancels out private donations. Bergstrom et al. (1986) extend their model by introducing non-donors, and Bernheim (1986) extends their model by introducing multiple public goods, and Andreoni (1988) extends their model to a natural limit. Payne (1998) finds incomplete crowding-out effect by using non-profit firm data. Gruber and Hungerman (2007) explain how government spending under the New Deal crowded-out church spending. Andreoni and Payne (2011) find out that the main reason of the crowding-out is the reduced fundraising effort.

Since the commencement of experimental economics in 1948 (Chamberlin, 1948), experiments have been used to explain people's non-rational decision making. Since donation is *prima facie* non-rational behavior, experiment has been adopted to know human's behavior. Among these experimental studies, Eckel et al. (2007) share some research interest with us because they conduct laboratory experiment after Hurricane Katrina to observe how private donation for Katrina victims is affected by the initial endowment, matching subsidy rate and place. These factors are not identical but somewhat related to wealth, price and distance. There are other experimental studies. For example, List and Lucking-Reiley (2002) use solicitation by direct mail to see how such effort enhances charitable donations. Eckel and Grossman (2003) make rebate subsidy for some donors and matching subsidy for other donors, and test the equivalency between them. Karlan and List (2007) and Meier (2007) investigate how matching subsidy enhances charitable donations. Eckel and Grossman (2008) investigate the difference between men and women in Public Goods, Ultimatum, and Dictator Experiments.

Finally, Andreoni (2006) provides a great survey on these studies.

These previous literatures focus on time-homogeneous charitable donations and most of them disregard sudden increase in donations following an unexpected event such as a natural disaster. One example of research on such increase in donations is Brown et al. (2012), who study the determinants of charitable donations in USA for 2004 Indian Ocean tsunami disaster. They study the determinants of increase in charitable donations to unexpected natural disasters and find that a household that had donated for other purposes tended to donate more for tsunami victims than a household that had not donated. Also, age is not found to be a significant explanatory

variable for tsunami donations where it has a positive association with all other charitable donations. In addition, they find that some determinants are associated with both tsunami donations and all other donations, such as households with a female head, education and religion.

In the study of Brown et al. (2012), they use biennial panel data and their study is on donation from US citizen to a natural disaster which happened far away from US. In our study, we observe donations just before and after the natural disaster using monthly data, we study data of two natural disasters, and we study the charitable donation for a natural disaster which happened within the country. For this purpose, FIES data is best suited for the analysis of charitable donation for natural disaster.

There is a reason for us to analyze a natural disaster which happened within the country. We can investigate whether "distance" from the epicenter affected private donation, which may be hardly observed if the natural disaster would have happened outside the country. There is also a reason why we consider "distance" as an important factor. Kimball et al. (2006) find geographical distance affected the unhappiness after the Hurricane Katrina. Ishino et al. (2011) point out the relationship between donation and happiness after Tohoku Earthquake. Therefore, it is natural to consider "distance" as a determinant in the analysis; the distance between the residence of donors and the epicenter. If distance matters, it is the evidence that geographical distance affects not only happiness but also behavioral response of the donors. One of our novelties is that we investigate whether distance has association with donation after natural disasters and reinforce the result by analyzing two donations after two earthquakes.

Actually, there is a study which has an interest in the association of distance in the context of donation after natural disaster. The laboratory experiment by Eckel et al. (2007) investigates what kind of factors, such as initial endowment, matching subsidy rate and location, affect private donations after Hurricane Katrina. One location is Texas, which was more affected by the Hurricane Katrina than another location: Minnesota. We recognize that their study also reveals the determinants of charitable donations for victims of natural disasters, including distance. However, since their study uses laboratory experiment where our study uses actual data of donation, there are substantial differences between their study and our study.

This paper proceeds in five parts. The next section explains FIES data in

detail. The following two sections analyze Tohoku Earthquake and Hanshin Earthquake respectively. Then, the following section summarizes the result and the last section concludes.

2. Data Description

The scope of the survey of FIES is the all households in Japan, excluding some households such as single-person student households. Using the three-stage stratified sampling method, 8,076 two-or-more-people households as well as 745 single-person households are requested to report their consumption every month. Two-or-more-people households are surveyed in consecutive six months where single-person households are surveyed in consecutive three months. One sixth of the two-or-more-people households are replaced every month where one third of the single-person households are replaced every month.

Each household is requested to report Household Schedule, Family Account Book, Yearly Income Schedule and Savings Schedule. Household Schedule includes non-monetary statistics, such as number of household members or gender of the head of household. Yearly Income Schedule and Savings Schedule include annual income, saving and loan, which are available from 2002. Family Account Book includes monthly consumption data divided into approximately 600 types of consumptions including donation. Household Schedule, Yearly Income Schedule and Savings Schedule are reported only once per household and Family Account Book is reported every month. Demographic feature of each household is extracted from Household Schedule, Yearly Income Schedule and Savings Schedule.

The micro-level household data of FIES can be accessed at a single location in Tokyo, Japan after an application process. In order to make panel data from the micro-level household data, we follow the method written in Unayama (2011)[9].

We use monthly donation amount as a dependent variable, and we use demographic features of households (age of a head of household, income, gender of a head of household, number of household member, workrate[10],

[9] The author thanks Takashi Unayama for providing the author with Stata code to create panel data from FIES micro-level data.

[10] Workrate is defined as the number of workers in household divided by the number of household member.

geographical distance from the epicenter[11], saving and loan) as independent variables. A dummy variable "pre-donation"[12] is added to identify households that donated before the month of the earthquake.

The following variables are not included in FIES, and thus not included in our analysis: their religion, ethnicity[13] or year of education[14]. Also, a variable of "price" (= '1- marginal tax rate' if itemized and 1 otherwise) is not included in our analysis. If one donates a unit amount to a certain charity, Her disposable income falls by '1- marginal tax rate' if she itemizes because her tax liability falls by 'marginal tax rate'. Thus, many of previous studies include "price" as one of the independent variables. However, we consider "price" is less important in our study. The main reason why "price" is less important in Japan is that fewer people itemize deduction. Actually, only 10-20% of donation enjoys tax deduction in Japan where more than 32%[15] in USA (Cordes et al., 2000; Friedman and Greenstein, 2002; Kato, 2010). Also, FIES does not have data of marginal tax rate. FIES includes household income statistics. However, since Japanese progressive income tax is imposed on personal income, not on household income, we have no idea about the marginal tax rate that each household faces. In addition, FIES does not have information whether a household itemizes its donation or not.

We use six months panel data from two months before the month of the earthquake to three months after the month of the earthquake where the earthquake happened in Mar 2011 In Tohoku or Jan 1995 in Hanshin. The summary statistics of the FIES data is as follows (Table 1-1 and Table 1-2).

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[11] "Geographical distance" is calculated as the distance from the affected area to the donor's location. Affected area is Iwate Prefecture, Miyagi Prefecture and Fukushima Prefecture in Tohoku Earthquake and Osaka Prefecture and Hyogo Prefecture in Hanshin Earthquake. When calculating geographical distance from the affected area to the donor's location, we calculate the distance from the prefectural capital of the prefecture that the donor lives to the prefectural capital of each prefecture that consists of the affected area, and take the minimum value of them. Finally, we drop observations whose value of geographical distance equals zero.

[12] pre-donation=1 if a household donated before the month of the earthquake and pre-donation=0 otherwise.

[13] Taking into account the fact that Japan is relatively homogeneous in terms of religion or ethnicity, we consider that such data is not crucial in our study.

[14] In FIES, education data is not available except for people who are currently studying in educational institutions.

[15] 32% of taxpayers used itemized deduction in USA. Since higher income taxpayers tend to itemize deduction more and higher income people tend to donate more, it is probable that much more than 32% of donation enjoys tax deduction. With this background, price elasticity has attracted a lot of attention in the studies in USA and some studies (e.g. Brown et al., 2012) use "price" as an explanatory variable.

We can observe great increase in donation on the month the earthquakes happened and on the next month. Also, we can easily see that households that had donated before the month of the earthquake donated for earthquake victims with higher probability.

Table 1-1: Summary statistics for Jan-Jun 2011 and Nov 1994-Apr 1995

Tohoku Earthquake					Hanshin Earthquake				
obs. 1156	mean	std. dev.	min	max	obs. 1165	mean	std. dev.	min	max
donation Jan 2011	203	3,211	0	100,000	donation Nov 1994	118	764	0	20,000
donation Feb 2011	189	3,115	0	100,000	donation Dec 1994	262	2,210	0	50,000
donation Mar 2011	1,993	8,275	0	100,000	donation Jan 1995	1,941	6,753	0	116,600
donation Apr 2011	1,589	16,264	0	400,000	donation Feb 1995	782	3,506	0	66,000
donation May 2011	258	1,249	0	20,500	donation Mar 1995	250	2,203	0	50,000
donation Jun 2011	214	1,258	0	21,000	donation Apr 1995	208	1,383	0	20,020
age	57.0	15.1	22	95	age	50.0	13.6	22	90
income	595	368	96	3,696	income	731	466	60	8,270
gender (male:1 female:2)	1.09	0.29	1	2	gender (male:1 female:2)	1.05	0.21	1	2
# of household member	3.00	1.09	2	8	# of household member	3.34	1.16	2	7
workrate	0.42	0.32	0	1	workrate	0.46	0.29	0	1
distance [km]	546	380	45	1,756	distance [km]	404	271	29	1,184
saving	1,247	1,877	0	23,683					
loan	395	1,002	0	14,350					

note: We excluded the data around the epicenter; i.e. data of distance=0. Thus, the minimum of the distance is larger than zero.

unit: [yen] for donation and [10 thousand yen] for income, saving and loan

Table 1-2: Summary statistics about donation in every month

Tohoku Earthquake						
	All household			Households that donated before the month of the earthquake (6.7% of all households)		
	Average donation [yen] (A)	Ration of donating household (B)	A/B[yen]	Average donation [yen] (C)	Ration of donating household (D)	C/D[yen]
donation Jan 2011	203	3.7%	5,544			
donation Feb 2011	189	4.3%	4,388			
donation Mar 2011	1,993	26.7%	7,465	7,206	56.2%	12,831
donation Apr 2011	1,589	22.2%	7,159	8,750	56.2%	15,579
donation May 2011	258	15.2%	1,697	1,060	47.9%	2,211
donation Jun 2011	214	9.8%	2,177	828	32.9%	2,517

Hanshin Earthquake						
	All household			Households that donated before the month of the earthquake (21.6% of all households)		
	Average donation [yen] (A)	Ration of donating household (B)	A/B[yen]	Average donation [yen] (C)	Ration of donating household (D)	C/D[yen]
donation Nov 1994	118	12.0%	985			
donation Dec 1994	262	11.5%	2,288			
donation Jan 1995	1,941	38.2%	5,076	3,433	59.8%	5,738
donation Feb 1995	782	26.1%	2,992	1,231	39.3%	3,129
donation Mar 1995	250	5.4%	4,629	682	11.3%	6,040
donation Apr 1995	208	7.1%	2,917	354	12.6%	2,823

We define the following terms just for convenience (Table 2).

Table 2: Definition of terms

Term	Definition
Pre-earthquake period	months before the month of the earthquake
Post-earthquake period	The month of the earthquake and after
Pre-earthquake donation[16]	donation in pre-earthquake period
Earthquake donation[17]	donation in post-earthquake period

[16] The purpose of this donation is irrelevant to earthquake.
[17] It must be a mixture of donation for earthquake victims and other purpose donations. However, we look upon this donation as an earthquake-related donation.

Natural logarithm[18] is taken hereafter to donation, income, saving, loan and distance data[19]. Figure 4 represents the distribution of the natural logarithm of donation on March 2011, the month the Tohoku Earthquake occurred. 73.3% people took zero in the histogram. The average donation is 1,993 yen where it is 7,465 yen among donors. The right histogram of Figure 4 explains one of the reasons why we take natural logarithm for donation statistics. The histogram of donation statistics would be positively skewed if natural logarithm were not taken.

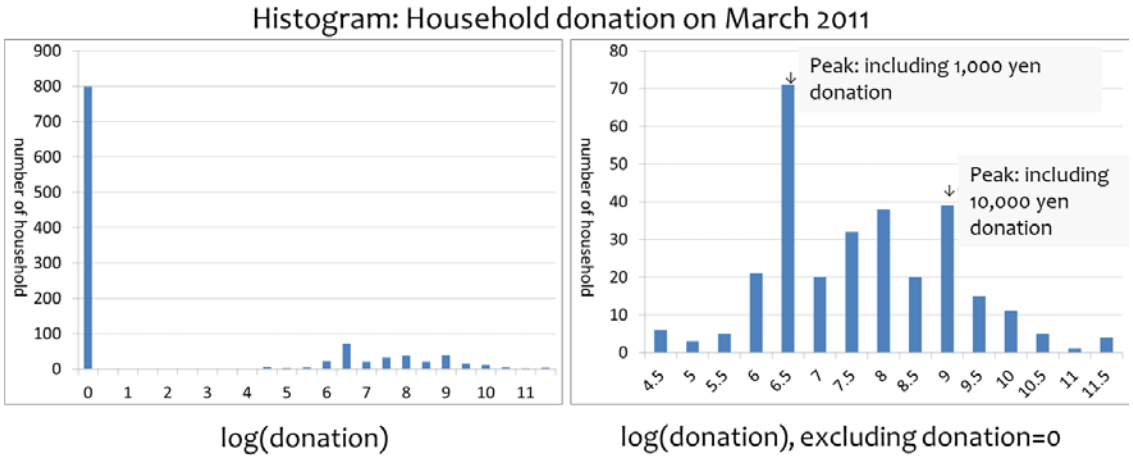

Figure 4: The distribution of earthquake donation on March 2011

Then, we analyze what factors are associated with pre-earthquake donations and earthquake donations. Since the dependent variable, donation, takes a lot of zeros and the dependent variable has to be non-negative, Ordinary Least Squares (OLS) regression does not performs accurately. Instead of OLS regression, we use Tobit regression to fix this issue. We explain Tobit regression as follows.

Let $y^*_{pre,it}$ be the latent propensity to donate in month t of household i in pre-earthquake period. We assume that the latent propensity, whose domain is $(-\infty, \infty)$, depends linearly on independent variables:

[18] Following e.g. Brown et al. (2012)

[19] Natural logarithm of zero is recorded to zero. Since there is no value between zero and one among these nor are there any negative values, any natural logarithm takes zero or positive value.

$$y^{*}_{pre,it} = \vec{\alpha}_{pre} \cdot \vec{x}_i + \beta_{pre,t} dummy_t + u_{pre,it} \quad (1)$$

where $\vec{x}_i$ is a vector of demographic features of household i, $dummy_t$ is a dummy variable for month t, $u_{pre,it}$ is a normally distributed random variable, and $\vec{\alpha}_{pre}$ and $\beta_{pre,t}$ are coefficients. We further assume that if the latent propensity to donate is positive, observed donation is equal to latent propensity to donate ($y_{pre,it} = y^{*}_{pre,it}$), and otherwise observed donation is zero ($y_{pre,it} = 0$).

In post-earthquake period, our hypothesis is that there is positive association between pre-earthquake donation and post-earthquake donation. This viewpoint is related to the study by Brown et al. (2012), which show the positive association between planned philanthropy and unplanned giving for Indian Ocean tsunami disaster. Thus, the latent propensity to donate is expressed as:

$$y^{*}_{post,it} = \vec{\alpha}_{post} \cdot \vec{x}_i + \beta_{post,t} dummy_t + \gamma \cdot predonate_i + u_{pre,it} \quad (2)$$

where the dummy variable $predonate_i$ takes unity ($predonate_i = 1$) if household i donated in pre-earthquake period and takes zero ($predonate_i = 0$) otherwise. These above regressions are Tobit regressions [20] (Tobin, 1958). This regression performs well if the dependent variable is restricted to non-negative and it frequently takes zero.

In order to investigate the differences in post-earthquake period between households that donated in pre-earthquake period and households that did not, we conduct Tobit regression in post-earthquake period, restricted to households that donated in pre-earthquake period on one hand and restricted to households that did not on the other hand. On these regressions, we express the latent propensity to donate as follows:

$$y^{*}_{predonate,it} = \vec{\alpha}_{predonate} \cdot \vec{x}_i + \beta_{predonate,t} dummy_t + u_{predonate,it} \quad (3)$$

for households that donated in pre-earthquake period, and

[20] Following e.g. Brown et al. (2012)

$$y^{*}_{nonpredonate,it} = \vec{\alpha}_{nonpredonate} \cdot \vec{x}_i + \beta_{nonpredonate,t} dummy_t + u_{nonpredonate,it} \quad (4)$$

for households that did not donate in pre-earthquake period.

Our hypothesis of the signal condition on Tobit regressions in pre-earthquake donation and in earthquake donation are as follows (Table 3). Our hypothesis on gender, age, income and saving follows the previous studies. Our hypothesis on age's association for earthquake donation follows Brown et al. (2012), which show that age has no association with tsunami donation. Our hypothesis on distance follows our intuition that sympathy, which may decrease with distance, is positively correlated with earthquake donation.

Table 3: Hypothesis of the signal condition

Sign Condition	pre-earthquake donation	earthquake donation
gender	+	+
age	+	insignificant
income	+ or insignificant	+ or insignificant
saving	+ or insignificant	+ or insignificant
loan	?	?
# of household member	?	?
workrate	?	?
distance	insignificant	−
pre-donation		+

3. An Analysis of Tohoku Earthquake in 2011

We conduct Tobit analysis in pre-earthquake period and post-earthquake period. The result is as follows (Table 4).

Table 4: Tobit analysis in pre-earthquake period and post-earthquake period for Tohoku Earthquake

Pre-earthquake donation			
Tobit regression	coef.	std. err.	t stat.
gender	-1.51	2.91	(-0.52)
age<20	(omitted)		
20≦age<30	-4.43	5.98	(-0.74)
30≦age<40	-2.39	2.67	(-0.89)
40≦age<50	-6.59	2.83	(-2.33)
50≦age<60	-0.93	2.08	(-0.45)
log(income)	8.56	1.88	(4.56)
log(saving)	0.57	0.27	(2.09)
log(loan)	0.09	0.26	(0.36)
# of household member	-2.12	0.88	(-2.40)
workrate	-4.88	2.73	(-1.79)
log(distance)	2.99	1.09	(2.76)
dummy (Feb 2011)	1.01	1.45	(0.70)
const.	-90.42	15.76	(-5.74)

Dependent variable: log(donation) in Jan-Feb 2011

Obs.: 2180, P-value: 0.0000, Pseudo R^2: 0.0434

Post-earthquake donation			
Tobit regression	coef.	std. err.	t stat.
gender	1.16	0.78	(1.48)
age<20	(omitted)		
20≦age<30	-4.00	1.65	(-2.42)
30≦age<40	-3.98	0.87	(-4.60)
40≦age<50	-1.69	0.74	(-2.28)
50≦age<60	-1.70	0.67	(-2.54)
log(income)	2.77	0.51	(5.41)
log(saving)	0.41	0.08	(4.92)
log(loan)	-0.02	0.08	(-0.31)
# of household member	-0.99	0.25	(-3.91)
workrate	-1.70	0.80	(-2.12)
log(distance)	-0.65	0.30	(-2.19)
dummy (pre-donation)	8.05	0.75	(10.79)
dummy (Mar 2011)	7.42	0.68	(10.90)
dummy (Apr 2011)	6.04	1.19	5.09
dummy (May 2011)	2.68	0.70	(3.81)
_cons	-25.83	3.81	(-6.78)

Dependent variable: log(donation) in Mar-Jun 2011

Obs.: 4360, P-value: 0.0000, Pseudo R^2: 0.0493

There are three findings which fit in previous studies. The most significant finding is that the dummy variable "pre-donation" has a positive association with earthquake donations. This fact shows that household that donated before the earthquake tends to donate more for the earthquake victims. This finding meets the result of Brown et al. (2012), which show that household

that had donated before the tsunami disaster tended to donate more for tsunami victims. Another finding is that there is a clear evidence of sudden increase in the amount of donation and it sharply declines in course of time. The other finding is that income, saving and age are positively associated with both earthquake donations and pre-earthquake donations, which is intuitively plausible. These three findings are consistent with previous studies.

Age's association with donation in post-earthquake period is different from our hypothesis. This age's association is further studied in the next Table.

It is worthy to discuss how distance associates with donation. Positive and significant relationship between distance and donation in *pre*-earthquake period is observed. The reason is unknown. There might be some correlation between private donation and geographical condition. However, in post-earthquake period, earthquake donation beats out the inherent positive relationship and produces the opposite, negative and significant, relationship. This can be an evidence that earthquake donation is likely to be a function of geographical distance with negative coefficient. This might be evidence that the sympathy, which positively associates with donation, is negatively correlated with geographical distance[21].

We also conduct Tobit analysis by restricting to households that donated in pre-earthquake period and by restricting to households that did not donate in pre-earthquake period respectively. The result is as follows (Table 5).

There are two findings which are worth mentioning. FIES data shows that the amount of the donation peaked at Mar 2011, and it declined sharply during post-earthquake period. For the donation from those who donated in pre-earthquake period, however, a significant downward trend with the amount of donation was not observed. For sympathetic guys (who donated in pre-earthquake period), sympathy for the earthquake victims might last long. In addition, positive association between age and earthquake donation was observed for households that did not donate in pre-earthquake period, whereas it was not observed for households that did donate in pre-earthquake period. Previous studies already show that age has smaller

[21] People might think that people in Osaka and Hyogo prefectures donated more for Tohoku Earthquake victims because they had suffered from Hanshin Earthquake. However, we could not find such evidence.

association with disaster-related donations, and our contribution is the further analysis on two kinds of households: households that donated in pre-earthquake period and households that did not.

Table 5: Tobit analysis in post-earthquake period for Tohoku Earthquake pre-donation=0 and pre-donation=1 respectively

Post-earthquake donation restricting pre-donation=0			
Tobit regression	coef.	std. err.	t stat.
gender	0.88	0.88	(1.00)
age<20	(omitted)		
20≤age<30	-4.32	1.83	(-2.37)
30≤age<40	-4.29	0.98	(-4.38)
40≤age<50	-2.16	0.84	(-2.58)
50≤age<60	-1.86	0.77	(-2.43)
log(income)	2.64	0.58	(4.57)
log(saving)	0.50	0.10	(5.20)
log(loan)	-0.05	0.09	(-0.56)
# of household member	-0.98	0.28	(-3.49)
workrate	-1.78	0.90	(-1.98)
log(distance)	-0.76	0.34	(-2.28)
dummy (Mar 2011)	8.01	0.78	(10.24)
dummy (Apr 2011)	6.01	0.78	(7.66)
dummy (May 2011)	2.73	0.81	(3.38)
_cons	-25.41	4.26	(-5.97)

Dependent variable: log(donation) in Mar-Jun 2011

Obs.: 4068, P-value: 0.0000, Pseudo R^2: 0.0366

Post-earthquake donation restricting pre-donation=1			
Tobit regression	coef.	std. err.	t stat.
gender	2.77	1.98	(1.40)
age<20	(omitted)		
20≤age<30	-2.94	4.50	(-0.65)
30≤age<40	-2.13	1.90	(-1.13)
40≤age<50	3.51	2.03	(1.73)
50≤age<60	-0.02	1.42	(-0.01)
log(income)	3.35	1.21	(2.78)
log(saving)	-0.05	0.16	(-0.33)
log(loan)	-0.03	0.17	(0.16)
# of household member	-1.33	0.65	(-2.03)
workrate	-1.40	1.95	(-0.72)
log(distance)	0.61	0.74	(0.82)
dummy (Mar 2011)	4.81	1.30	(3.71)
dummy (Apr 2011)	4.39	1.30	(3.38)
dummy (May 2011)	2.70	1.31	(2.07)
_cons	-25.95	10.00	(-2.60)

Dependent variable: log(donation) in Mar-Jun 2011

Obs.: 292, P-value: 0.0002, Pseudo R^2: 0.0343

4. An Analysis of Hanshin Earthquake in 1995

We studied the analysis on Tohoku Earthquake. Our sheer chance is that we can conduct similar analysis on Hanshin Earthquake. We conduct Tobit analysis in pre-earthquake period and post-earthquake period for Hanshin Earthquake. The result is as follows (Table 6).

Table 6: Tobit analysis in pre-earthquake period and post-earthquake period for Hanshin Earthquake

Pre-earthquake donation			
Tobit regression	coef.	std. err.	t stat.
gender	-0.57	1.88	(-0.30)
age<20	(omitted)		
20≦age<30	-2.57	1.99	(-1.29)
30≦age<40	-3.18	1.20	(-2.65)
40≦age<50	-1.56	1.14	(-1.37)
50≦age<60	-2.37	1.19	(-1.99)
log(income)	2.67	0.84	(3.17)
# of household member	-0.19	0.39	(-0.49)
workrate	-4.18	1.53	(-2.72)
log(distance)	0.22	0.45	(0.49)
dummy (Dec 1994)	-0.27	0.73	(-0.37)
const.	-26.24	6.44	(-4.07)

Dependent variable: log(donation) in Nov-Dec 1994

Obs.: 2218, P-value: 0.0038, Pseudo R^2: 0.0086

Post-earthquake donation			
Tobit regression	coef.	std. err.	t stat.
gender	0.76	1.03	(0.74)
age<20	(omitted)		
20≦age<30	-2.78	1.19	(-2.34)
30≦age<40	-0.66	0.67	(-0.98)
40≦age<50	-0.36	0.66	(-0.55)
50≦age<60	-0.62	0.67	(-0.92)
log(income)	1.75	0.44	(3.94)
# of household member	-0.49	0.22	(-2.21)
workrate	-2.93	0.86	(-3.42)
log(distance)	-1.13	0.25	(-4.49)
dummy (pre-donation)	4.55	0.48	(9.49)
dummy (Jan 1995)	11.20	0.67	(16.65)
dummy (Feb 1995)	8	0.65	12.3
dummy (Mar 1995)	-1.42	0.78	(-1.83)
_cons	-16.83	3.43	(-4.90)

Dependent variable: log(donation) in Jan-Apr 1995

Obs.: 4436, P-value: 0.0000, Pseudo R^2: 0.0811

Several findings in Hanshin Earthquake obtained from Table 6 are similar to those in Tohoku Earthquake. The dummy variable "pre-donation" has a positive association with earthquake donations. As we saw in the Tohoku Earthquake case, this fact also shows that household that donated before the earthquake tends to donate more for the earthquake victims. Moreover, there is a clear evidence of sudden increase in donations and it sharply declines in course of time. In addition, income, saving and age are positively associated with earthquake donations and pre-earthquake donations.

It is also worthy to discuss how distance associates with donation. Distance

is not a significant explanatory variable in pre-earthquake period[22]. However, distance becomes a significant variable in post-earthquake period with negative coefficient. Therefore, earthquake donation is likely to be a function of geographical distance with negative coefficient. This finding coincides with that on our finding in the Tohoku Earthquake case.

We also conduct Tobit analysis by restricting to households that donated in pre-earthquake period on one hand and by restricting to households that did not donate in pre-earthquake period on the other hand. The result is as follows (Table 7).

Table 7: Tobit analysis in post-earthquake period for Hanshin Earthquake pre-donation=0 and pre-donation=1 respectively

Post-earthquake donation restricting pre-donation=0			
Tobit regression	coef.	std. err.	t stat.
gender	0.85	1.26	(0.68)
age<20	(omitted)		
20≦age<30	-3.30	1.48	(-2.22)
30≦age<40	-0.89	0.85	(-1.05)
40≦age<50	-0.39	0.85	(-0.45)
50≦age<60	-0.72	0.86	(-0.84)
log(income)	1.90	0.57	(3.35)
# of household member	-0.79	0.28	(-2.87)
workrate	-2.42	1.06	(-2.27)
log(distance)	-1.17	0.31	(-3.73)
dummy (Jan 1995)	11.64	0.88	(13.18)
dummy (Feb 1995)	8.63	0.87	(9.88)
dummy (Mar 1995)	-1.98	1.05	(-1.89)
_cons	-18.11	4.35	(-4.16)

Dependent variable: log(donation) in Jan-Apr 1995

Obs.: 3480, P-value: 0.0000, Pseudo R^2: 0.0715

Post-earthquake donation restricting pre-donation=1			
Tobit regression	coef.	std. err.	t stat.
gender	-0.06	1.95	(-0.03)
age<20	(omitted)		
20≦age<30	-2.52	2.09	(-1.20)
30≦age<40	-0.77	1.15	(-0.67)
40≦age<50	-1.03	1.10	(-0.94)
50≦age<60	-0.61	1.10	(-0.55)
log(income)	1.70	0.72	(2.37)
# of household member	0.40	0.41	(0.97)
workrate	-4.87	1.49	(-3.27)
log(distance)	-0.98	0.43	(-2.25)
dummy (Jan 1995)	10.51	0.99	(10.62)
dummy (Feb 1995)	6.72	0.98	(6.84)
dummy (Mar 1995)	-0.45	1.08	(-0.41)
_cons	-12.12	5.66	(-2.14)

Dependent variable: log(donation) in Jan-Apr 1995

Obs.:956, P-value: 0.0000, Pseudo R^2: 0.0802

[22] It is consistent with our hypothesis. Note that the epicenter is different between Hanshin earthquake and Tohoku Earthquake.

Two findings follow from Table 7. The most important finding is that positive association between age and earthquake donation was observed for households that did not donate in pre-earthquake period, whereas it was not observed for other households. This finding corresponding to age is identical to that on Tohoku Earthquake case. Also, we obtained a different result from Tohoku Earthquake case: when it comes to households that donated in pre-earthquake period, a significant downward trend with the amount of donation *was* observed after the earthquake.

5. Result

We find several determinants for sudden upsurge of donations, following an unexpected event such as natural disaster. Some determinants are consistent with previous studies, such as Brown et al. (2012). We find three determinants that do not deviate from previous studies. Firstly, there is a strong and positive association between donation before the earthquake and earthquake donations. Secondly, income and saving are positively associated with earthquake donations and non-earthquake purpose donations. Thirdly, age is positively associated with donation for non-earthquake purpose. These three findings do not deflect from previous research. However, age has also positive association with earthquake donation. This finding is somewhat different from previous studies.

There are several new findings. Earthquake donation is likely to be a function of geographical distance from the epicenter with negative coefficient. As far as the author knows, such dependence of the distance from the disaster is first pointed out in our context[23]. This fact may indicate that sympathy for earthquake victims is negatively associated with distance. The other finding is that we can observe positive association between age and earthquake donations for households that did not donate in pre-earthquake period, whereas we cannot for households that did. Such detailed analysis about the association between age and donation has not been known before.

6. Conclusion

[23] As we have seen already, happiness studies (e.g. Kimball et al., 2006) and experiments (e.g. Eckel et al., 2007) are interested in the effect of distance. However, these studies are substantially different from our study in the context.

We conduct an event study on donation, before and after the disastrous earthquakes. We find the significant determinants of private donation for victims of such natural disasters. Among the determinants, these three facts are to be noted:

(1) Past experience of donation positively and significantly associated with earthquake donations,

(2) Income, saving and age has a positive association with earthquake donations as well as donations for other purposes, and

(3) Earthquake donations are likely to be a function of geographical distance with negative coefficient.

However, the abovementioned relationship between age and donation disappears when it comes to households that had donated before the earthquake.

For policy perspective, it is worthy to understand the trend of behaviors related to earthquake donation. In a nutshell, (1) *sympathetic* (who once donated for other purposes), (2) *rich* (high income and saving) and (3) *close* (from the epicenter, in the case of earthquake) people tend to donate for the victims of such natural disasters.

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