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## Post-disaster trust in Japan: the social impact of the experiences and perceived risks of natural hazards

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### ABSTRACT

The purpose of this study is to examine the social impact of natural hazards in Japanese society. Using the Japanese General Social Survey, this study examines how citizens' previous experiences and perceived risks of disasters are associated with their levels of four different forms of trust: in-group, out-group, generalised, and political trust. Furthermore, as the survey was conducted a year after the devastating Triple Disaster in 2011, the study examines the residents of the Tohoku region, who were the primary victims of the Triple Disaster. The results of this study suggest that the disaster experience is positively associated with trust: Japanese citizens with disaster experience had higher levels of in-group and out-group trust than those without disaster experience, and Tohoku residents showed higher levels of out-group, generalised, and political trust than the residents of other regions. Contrarily, citizens' perceived risks of disaster showed negative relationships with trust: the Japanese citizens who perceived higher risks of disasters had lower levels of out-group, generalised, and political trust. However, the negative effects of the perceived risks of disasters significantly reduced among Tohoku residents.

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Natural hazards; Triple Disaster; social trust; political trust; Japan

## Introduction

In 2011, Japan experienced a chain of calamities – the Tohoku earthquake, the following tsunami, and the Fukushima Daiichi Nuclear Power Plant accident – that devastated coastal cities and villages in the Tohoku region, leaving physical and psychological scars on the residents (see Hikichi, Aida, Tsuboya, Kondo, & Kawachi, 2016; Mori, Takahashi, Yasuda, & Yanagisawa, 2011). The Triple Disaster, as it is commonly called, also triggered fear and trauma among people who were not directly affected, particularly the residents living close to coastlines or nuclear power plants (see Ben-Ezra, Palgi, Soffer, & Shrira, 2012; Butler, Parkhill, & Pidgeon, 2011). Because the disasters affected not only the people exposed to the events but also the people who were not, such as the residents of other regions or general citizens, it is important to examine the effects of both the actual experience and perceived risks of such disasters among the entire Japanese populace, which is a goal of this study.

Disaster studies have reported two opposing images of the aftermath of disasters. One is of the destructive impact on a community, wherein a disaster creates a state of

normlessness and lack of trust, placing the entire community in need of policing to maintain order (e.g. Miller, 2006; Papanikolaou, Adamis, Mellon, Prodromitis, & Kyriopoulos, 2012). The other is of community members trusting and assisting one another and collectively overcoming difficulties in response to a disaster (e.g. Albrecht, 2018; Chang, 2010). Regarding these two opposing images, some studies have emphasised the existence (or absence) of social capital as the main factor defining the aftermath experience (Aldrich, 2012; Nakagawa & Shaw, 2004). Others have emphasised that the two images are not mutually exclusive, considering the victims' change of circumstances and the amount of social support over time (Kaniasty & Norris, 1993, 2004). This study has been motivated by the fact that further related empirical studies will help us define the social impact on the aftermath of disasters.

To understand the social impact of natural hazards, this study particularly focuses on trust, which has been considered as an integral part of the society (e.g. Inglehart, 1997; Uslaner, 2002). Sociologists have shown that trust takes different forms: some people are more trusting of those close to them while others have a broader range of people they trust, extending beyond family and friends to include community groups (see Crepaz, Jazayeri, & Polk, 2017; Delhey & Newton, 2003). Moreover, trust not only extends horizontally but also spreads vertically toward people in governing organisations and leadership positions (Newton & Zmerli, 2011). Unfortunately, these findings have not been thoroughly applied or tested in the context of disaster. Therefore, this study builds a bridge by investigating how individuals' exposure to disasters, whether direct or indirect, affects these different forms of trust. This study also contributes to the literature of social capital as social trust is its key indicator (Delhey, Newton, & Welzel, 2011; Fukuyama, 1995; Putnam, 2000). Furthermore, this study uses the trust measurements widely employed in national and international social surveys; therefore, the study results are applicable to areas outside Japan, enabling a comparison or generalisation of the results in the future. Overall, the findings of this study can deepen our understanding of people's attitudinal or psychological responses to natural hazards.

## The social impact of disasters

Studies on the aftermath of disasters have portrayed conflicting images. One image shows that those affected by a disaster become more individualistic and focus on the protection of their own property, which leads to a decrease in the degree of social integration. The other image shows an increase in altruism, social support, and reciprocity after disasters. For example, Miller (2006) studied the city of New Orleans, where the circumstances caused by Hurricane Katrina in 2005 decreased trust among residents, pitting survivors against outsiders and neighbours against neighbours. Papanikolaou et al. (2012) also described the victims of the 2007 wildfires in Greece, who were less likely to support one another than those who were not affected by the fires. Other studies argued that the so-called corrosive communities characterised by the disruption of social organisations, people disputing about environmental damage, and the prevalence of uncertainties emerged after disasters (Picou, Marshall, & Gill, 2004; Ritchie & Gill, 2007).

Contrarily, numerous studies showed that the rise of antisocial behaviour after disasters is not common (e.g. Brunnsma, Overfelt, & Picou, 2007; Fischer, 1998; Quarantelli & Dynes, 1977). These studies found that altruism and reciprocal behaviours arise when family,

friends, and neighbours are at risk. For example, Toya and Skidmore (2014) studied the countries of the Organization for Economic Cooperation and Development and found a robust, positive relationship between disaster events and trust. Yamamura's (2016) research on the Kobe earthquake in Japan also revealed increased social capital among the affected residents. Focusing on the 2010 Chile earthquake, Dussailant and Guzmán (2014) found that a disaster can be an opportunity to strengthen interpersonal trust, which in turn increases social capital. According to these studies, natural calamities have created 'a paradise built in hell' (see Kotani & Yokomatsu, 2016; Solnit, 2010).

In an attempt to understand the conflicting images of the aftermath of disasters, some studies have argued that the resilience of individuals or communities after a disaster depends on the pre-disaster community structure (see Wickes, Zahnow, Taylor, & Piquero, 2015). Social capital, as manifested by community members' level of trust, participation in voluntary associations, width and breadth of social networks, etc., is particularly important in post-disaster recovery trajectories (see Adger, Hughes, Folke, Carpenter, & Rockström, 2005; Aldrich, 2012; Aldrich & Meyer, 2015; Nakagawa & Shaw, 2004). Although these studies are prominent, they pay insufficient attention to the measurement of post-disaster social capital, that is, the social capital that remained as a result of direct or indirect exposure to disasters. Other studies have claimed that the two opposing images are not mutually exclusive if the victims' change of circumstances over time is considered. For example, Kaniasty and Norris (2004) suggested a comprehensive model that simultaneously explains both the altruistic communities and deterioration of social support. The model suggests that pre-existing socio-psychological conditions and resources affect the extent of exposure to the disaster, and the disaster triggers a heroic and altruistic struggle to fulfill immediate needs; however, the distribution of resources and aid is not equitable, and therefore, the victims of the disaster eventually face the sad reality of declining social support (Norris & Kniasty, 2004). Although this model is comprehensive and convincing, further research is required to distinguish between the short-term and long-term timelines after a disaster. Moreover, the postulation should be tested and applied to different social and cultural settings. The present study builds on these previous studies and tests how people's past experiences and perceived risks of disasters are associated with their post-disaster trust using a dataset created about a year after the major disasters in Japan.

## Forms of trust

Among the various social indicators, trust is the focus of this study. Trust is the belief that people in a society are generally trustworthy, and it is an integral part of the society (Inglehart, 1997; Uslaner, 2002). It is a socialised expectation that people have of other individuals and institutions and the society as a whole (Barber, 1983; Ritchie & Gill, 2007). Because a society requires a minimum level of trust to function, trust has been considered as a key indicator of social capital (Coleman, 1990; Delhey et al., 2011; Delhey & Newton, 2003; Fukuyama, 1995; Putnam, 2000). However, more recent studies have shown that trust is not monolithic. Trust has been distinguished based on its social scope as particularised trust and generalised trust (Crepaz et al., 2017; Newton & Zmerli, 2011; Uslaner & Conley, 2003; Whiteley, 1999). Particularised trust is that found in social proximity and extended only toward the people who the individual knows from everyday interactions

(e.g. family members, friends, neighbours, and coworkers); therefore, it is often called *in-group trust*. Generalised trust, in contrast, is an abstract attitude toward people in general, encompassing those beyond immediate familiarity to include strangers (e.g. foreigners, fellow citizens, and people one randomly meets on the street). Therefore, this form of trust is also called *out-group trust*. However, note that while some studies equate out-group trust with generalised trust (Freitag & Traunmüller, 2009; Newton & Zmerli, 2011; Welch, Sikkink, & Loveland, 2007), others distinguish between the two (Crepaz et al., 2017; Delhey et al., 2011). The latter group typically defines generalised trust as trust in most people (both known and unknown) and uses a special question from the General Social Survey: ‘Generally speaking, would you say that most people can be trusted or that you can’t be too careful in dealing with people?’ In this study, the difference between out-group trust and generalised trust will be determined by a factor analysis in the following section. As a final form of trust, political scientists have emphasised the importance of trust in political institutions or government officials (Jackman & Miller, 1996; Lee & Yi, 2018; Liu & Stolle, 2017; Mishler & Rose, 2005). For government officials and public institutions, dealing with disasters is an important duty that often leads to either an increased or decreased level of public trust and support (Arce-neaux & Stein, 2006; Han, Hu, & Nigg, 2011; Skidmore & Toya, 2013). Political recreancy – the failure of experts or institutions to execute their responsibilities to the broader society – affects people’s trust in government institutions (see Freudenburg, 1993); however, people’s expectations of the role of the government regarding natural hazards are still unclear.

The formation of trust is seen from different perspectives in the literature. Some studies stress that a person’s trust is an evaluation of his or her social environment; therefore, trust is based on concrete experiences of trustworthiness in social interaction (Coleman, 1990; Hardin, 2002). Other studies argue that trust is a general propensity, either innate or learned early in life, and is thus primarily a personal predisposition (Uslaner, 2002). Delhey and Newton (2003) claim that one’s level of social trust depends on social-psychological factors, such as personal demographics, social achievements, and personal well-being, as well as social-cultural factors, such as membership in voluntary associations, maintenance of social networks, and the characteristics of the community to which one belongs.

Despite the vastness of the related literature among sociologists, these forms of trust have not been tested in disaster studies. Therefore, this study bridges the gap between the two bodies of literature by answering the question ‘How are individuals’ disaster experiences and perceived risks of disasters associated with their different forms of trust?’ Because numerous studies have already reported a positive relationship between disaster experience and level of trust, particularly in highly developed countries (see Toya & Skidmore, 2014), this study hypothesises that disaster experience is positively associated with level of trust in Japan. However, the goal of this study is to define the more complicated relationship between direct/indirect experience and different forms of trust.

## Data, variables, and method

This study used data from the Japanese General Social Survey (JGSS), a national survey conducted as part of the East Asian Social Survey (EASS) in 2012. The JGSS Research Center at the Osaka University of Commerce conducted the survey between 18 February

2012 and 15 April 2012. A total of 2,335 respondents from six Japanese regions participated in this survey. A two-stage stratified random sample was used, stratified by regional block and population size. The response rate was 58.8%. The dataset was collected through the Interuniversity Consortium for Political and Social Research.

The output variables were the different forms of trust. The JGSS included questions about respondents' trust in various groups, including family, friends, neighbours, and people they meet for the first time. Respondents chose from four suggested levels of trust: 'Not at all,' 'Not very much,' 'To some extent,' and 'A great deal.' In addition, the JGSS asked respondents the question that has been widely used as an indicator of generalised trust: 'Generally speaking, would you say that most people can be trusted?' Respondents were asked to choose from four Likert-scale answers: 'You almost always can't be too careful in dealing with people,' 'You usually can't be too careful in dealing with people,' 'People can usually be trusted,' and 'People can almost always be trusted.' For political trust, respondents were asked to what degree they trusted the local and central government officials. The respondents chose from four levels of trust: 'Not at all,' 'Not very much,' 'To some extent,' and 'A great deal.'

Table 1 shows the results of a principal component analysis of trust in different groups, which yielded a two-component solution: one weighted on political trust measures and the other weighted on in-group trust. The results for in-group trust are similar to those of previous studies (Freitag & Traunmüller, 2009; Newton & Zmerli, 2011); however, trust in people that one is meeting for the first time and trust in most people are not separately categorised. Therefore, this study categorised the measures into four groups: in-group trust, out-group trust, generalised trust, and political trust.

The experiences and perceived risks of disasters were included as explanatory variables (see Chang, 2010; Lee & Fraser, 2019; Toya & Skidmore, 2014). Regarding experiences of disasters, the respondents were asked what formal and informal channels they used for help when they encountered disaster situations in the past. Those who chose 'Never had such a problem' were coded 0 and those with other answers were coded 1. Regarding perceived risks of disasters, the respondents were asked to evaluate the possibility of earthquakes, floods, and landslides. The respondents chose from four options: 'Unlikely,' 'Less likely,' 'Likely,' and 'Most likely.'

Other factors of trust were also included (see Delhey & Newton, 2003). First, participation in organisations was included as a measure of civic engagement. The JGSS asked

**Table 1.** Principal component analysis of measures of trust with varimax rotation.

	Component	
	1	2
Trust in family	0.001	0.519
Trust in friends	0.001	0.667
Trust in neighbours	0.234	0.544
Trust in people you meet for the first time	0.289	0.369
Trust in local government officials	0.900	0.214
Trust in central government officials	0.914	0.196
'In general, most people can be trusted'	0.196	0.455
Explained variance in %	26.2	20.5
Chi square	163.85(8)	
<i>p</i> -value	<i>p</i> < 0.01	

the respondents if they participate in the following organisations: political associations, residential or neighbourhood associations, social service or volunteer groups, citizens' movements or consumer cooperative groups, religious groups, alumni associations, recreational associations (hobbies and sports), labour unions, and occupational, professional, or trade associations. Moreover, to test the personal networks affecting the level of trust, the JGSS asked the respondents the number of people they could ask for a favour, such as watering plants, feeding pets, and giving advice. The answers ranged from '0' to '10 or more.'

Urbanisation and the respondents' duration of residence were included as the community characteristics that can affect individuals' trust. Urbanisation was coded based on the objective observation of the community by the person who conducted the survey. Respondents' communities were coded as follows: 1 = 'A farm in a rural area,' 2 = 'A village in a rural area,' 3 = 'A town or small city,' 4 = 'Outskirts of a big city,' and 5 = 'A big city.' The duration of residence has been assumed to increase social trust based on long-term relationships among neighbours (Lochner, Kawachi, & Kennedy, 1999); therefore, the respondents' duration of residence was coded as follows: 1 = 'Less than 1 year,' 2 = 'Less than 3 years,' 3 = 'Less than 5 years,' 4 = 'Less than 10 years,' and 5 = 'Less than 20 years.'

For personal predispositions, two variables were included. First, the respondents were asked if they had the power to make important decisions to change their lives. They chose from the following options: 'Mostly unable,' 'Somewhat unable,' 'Somewhat able,' and 'Mostly able.' Second, the respondents were asked to rate their own happiness using the following options: 'Very unhappy,' 'Unhappy,' 'Happy,' and 'Very happy.'

Respondents' age, gender, years of education, and household income were included as control variables. The JGSS coded household income on a five-point scale ranging from 1 (Far below average) to 5 (Far above average). Table 2 summarises the variables.

For regression analysis, ordinary least squares regression was performed. To manage heteroscedasticity, standard errors were also clustered by region. Dummy variables for regions were included (Table 3) for fixed effects. The variance inflation factor for all models was below 3.0, which is considered acceptable in social science research.

**Table 2.** Descriptive statistics for variables.

		Mean	Standard Deviation	Minimum	Maximum
<b>Trust</b>	In-group trust (average)	3.07	0.56	1	4
	Out-group trust	1.80	0.67	1	4
	Generalised trust	2.53	0.68	1	4
	Political trust (average)	2.45	0.68	1	4
<b>Disaster</b>	Disaster experience	0.66	0.47	0	1
	Perceived risks of disaster	2.16	0.76	1	4
<b>Social network and engagement</b>	Participation in associations	0.67	0.99	1	9
	Personal network	1.52	0.77	1	5
<b>Community characteristics</b>	Urbanisation	1.82	0.88	1	5
	Duration of residence	5.16	0.86	1	6
<b>Personal predispositions</b>	Volitional autonomy	2.66	1.12	1	4
	Happiness	2.74	0.87	1	4
<b>Control</b>	Age	53.27	16.88	16	93
	Education years	12.77	2.46	0	23
	Gender (0 = M/1 = F)	0.53	0.50	0	1
	Household income	2.59	0.90	1	5

**Table 3.** The effect of disaster experience and perceived risks of disaster on trust.

	In-group Trust (1)	Out-group Trust (2)	Generalised Trust (3)	Political Trust (4)
<b>Disaster</b>				
Disaster experience	0.040** (0.019)	0.022* (0.012)	0.008 (0.023)	0.010 (0.018)
Perceived risks of disaster	-0.002 (0.025)	-0.043*** (0.015)	-0.059*** (0.018)	-0.044** (0.020)
<b>Social network and engagement</b>				
Participation in associations	0.012*** (0.005)	0.009 (0.006)	0.038*** (0.007)	0.029*** (0.005)
Personal network	0.087*** (0.021)	0.081*** (0.025)	0.067*** (0.023)	0.093*** (0.029)
<b>Community characteristics</b>				
Urbanisation	0.0003 (0.015)	-0.021 (0.022)	0.002 (0.032)	-0.038*** (0.014)
Duration of residence	0.008 (0.013)	-0.011 (0.011)	-0.006 (0.008)	-0.008 (0.011)
<b>Personal predispositions</b>				
Volitional autonomy	0.034*** (0.006)	0.054*** (0.015)	0.065*** (0.024)	-0.017 (0.013)
Happiness	0.124*** (0.009)	0.050** (0.023)	0.078*** (0.026)	0.077*** (0.010)
<b>Personal demographics</b>				
Age	-0.002*** (0.0005)	0.004*** (0.001)	-0.0003 (0.001)	0.004*** (0.001)
Education Years	0.014** (0.006)	0.023*** (0.005)	0.035*** (0.006)	0.020*** (0.005)
Gender	0.061*** (0.016)	-0.003 (0.029)	0.024 (0.026)	0.114*** (0.017)
Household Income	0.002 (0.012)	-0.001 (0.011)	0.038*** (0.014)	0.030* (0.016)
<b>Region dummies (Ref.: Tohoku)</b>				
Kanto	-0.019 (0.013)	-0.054*** (0.012)	-0.035** (0.015)	-0.080*** (0.009)
Chubu	0.044*** (0.008)	-0.069*** (0.006)	-0.026*** (0.009)	-0.073*** (0.008)
Kansai	-0.071*** (0.008)	-0.158*** (0.013)	-0.065*** (0.011)	-0.250*** (0.009)
Chugoku/Shikoku	0.040*** (0.006)	-0.123*** (0.008)	-0.105*** (0.014)	-0.021*** (0.005)
Kyusyu	0.083*** (0.005)	-0.044*** (0.004)	-0.010 (0.007)	-0.087*** (0.003)
<b>Intercept</b>	2.307*** (0.202)	1.110*** (0.214)	1.613*** (0.097)	1.777*** (0.160)
Observations	2,050	2,050	2,050	2,050
R <sup>2</sup>	0.089	0.046	0.081	0.072
Adjusted R <sup>2</sup>	0.082	0.038	0.073	0.064
Residual Std. Error (d.f.)	0.534 (2,032)	0.650 (2,032)	0.657 (2,032)	0.663 (2,032)
F-statistic (d.f.)	11.710*** (17;2,032)	5.734*** (17;2,032)	10.485*** (17;2,032)	9.220*** (17; 2,032)

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ ; standard errors are clustered by region

## Results

As the first step, four regression models were structured to determine the relationship between trust and individuals' past experiences and perceived risks of disasters in Japanese society (see Table 3). Japanese people with disaster experience showed higher levels of in-group trust ( $b = 0.040$ ,  $p < 0.05$ ), which is trust toward family, friends, and neighbours. Although relatively weak, disaster experience was also positively associated with out-group trust ( $b = 0.022$ ,  $p < 0.10$ ), suggesting that Japanese people with disaster



experience have a wider radius of trust. The relationships between disaster experience with generalised trust and with political trust were not statistically significant. The results of respondents' perceived risks of disaster were contradictory. Perceived risk has a significant negative effect on out-group trust ( $b = -0.043, p < 0.01$ ), generalised trust ( $b = -0.059, p < 0.01$ ), and political trust ( $b = -0.044, p > 0.05$ ). Moreover, it did not show a significant effect on in-group trust. Although these regression results do not indicate causal relationships between variables, they suggest that disaster experience may have affected both inward- and outward-bound trust, making people sympathise with known or unknown others, whereas the perceived risks of disaster may have led the residents of high-risk areas to distrust other citizens and politicians.

Other than the disaster-related variables, participation in associations showed positive effects on trust. The effects were significant on in-group trust ( $b = 0.012, p < 0.01$ ), generalised trust ( $b = 0.038, p < 0.01$ ), and political trust ( $b = 0.029, p < 0.01$ ); however, the effect on out-group trust was not significant. The presence of personal networks also showed strong positive effects on all forms of trust. With higher numbers of people that the respondents could ask for favours, the in-group ( $b = 0.087, p < 0.01$ ), out-group ( $b = 0.081, p < 0.01$ ), generalised ( $b = 0.067, p < 0.01$ ), and political trust ( $b = 0.093, p < 0.01$ ) were higher. These results support the claims of the social capital theory, which argues that individuals' active participation in civic associations and a complex web of social networks increase social and political trust (see Delhey & Newton, 2003; Lee & Yi, 2018).

Urbanisation did not have significant effects on in-group, out-group, and generalised trust, but its effect was negative on political trust ( $b = -0.038, p < 0.01$ ), meaning that the residents of urban areas have a lower level of trust in politicians than the residents of rural areas. The duration of residence did not show significant effects on any form of trust.

The respondents having the ability to make important life decisions were more likely to have higher in-group ( $b = 0.034, p < 0.01$ ), out-group ( $b = 0.54, p < 0.01$ ), and generalised trust ( $b = 0.065, p < 0.01$ ); however, volitional autonomy did not have a significant effect on political trust. Self-rated happiness had significant positive effects on all forms of trust: its effects are significantly positive on in-group ( $b = 0.124, p < 0.01$ ), out-group ( $b = 0.050, p < 0.05$ ), generalised ( $b = 0.078, p < 0.01$ ), and political trust ( $b = 0.077, p < 0.01$ ).

Among the personal demographic characteristics, the effect of age was negative on in-group trust ( $b = -0.002, p < 0.01$ ) but positive on out-group ( $b = 0.004, p < 0.01$ ) and political trust ( $b = 0.004, p < 0.01$ ). The effects of education were positive on all forms of trust: in-group ( $b = 0.014, p < 0.05$ ), out-group ( $b = 0.023, p < 0.01$ ), generalised ( $b = 0.035, p < 0.001$ ), and political trust ( $b = 0.020, p < 0.01$ ). Female respondents had higher levels of in-group ( $b = 0.061, p < 0.01$ ) and political trust ( $b = 0.224, p < 0.01$ ) than their male counterparts. Gender did not have an effect on out-group and generalised trust. Moreover, the effects of household income were positive on generalised ( $b = 0.038, p < 0.01$ ) and political trust ( $b = 0.030, p < 0.10$ ).

Finally, for all the models in Table 3, five regional dummy variables were included for fixed effects; however, the coefficients of the dummy variables indicated each region's aggregated levels of trust in reference to the Tohoku region. The coefficients of the regional dummy variables showed that the Tohoku region had significantly higher levels of out-group, generalised, and political trust than the other five regions; however, the in-group trust in Tohoku was not clearly higher or lower than that in other regions.

Because the residents of the Tohoku region had recently been exposed to disaster events, as the next step, 12 additional regression models were structured to gain deeper understanding of the forms of trust in the Tohoku region vis-à-vis other regions (see Table 4). For models in Table 4, dummy variables for all regions except the Tohoku region were excluded to determine how trust in the Tohoku region is statistically different from that in the other regions. Moreover, interaction terms were included to determine how the experiences and perceived risks of disasters affect the residents of the Tohoku region.

Compared with the residents of other regions, Tohoku residents (see models 1, 4, 7, and 10) showed higher levels of social and political trust: out-group ( $b = 0.081, p < 0.01$ ), generalised ( $b = 0.043, p < 0.01$ ), and political trust ( $b = 0.099, p < 0.01$ ). However, the in-group trust of Tohoku residents was not statistically different from that of the residents of other regions, meaning that regional experience of disaster did not significantly affect in-group trust. The interaction variable of the Tohoku region and disaster experience (see models 2, 5, 8, and 11) shows that among Tohoku residents, disaster experience tended to have a positive effect on in-group ( $b = 0.035, p < 0.10$ ) and out-group trust ( $b = 0.048, p < 0.01$ ). The interaction variable did not show statistically significant effects on generalised and political trust. The interaction variable of the Tohoku region and perceived risks of disaster (see models 3, 6, 9, and 12) showed that the Tohoku residents who perceived a high risk of disaster tended to have higher levels of out-group ( $b = 0.028, p < 0.10$ ) and generalised trust ( $b = 0.087, p < 0.01$ ) than the Tohoku residents who did not perceive a high risk of disaster. While the overall effects of the perceived risks of disaster are negative in Japan, this result is interesting in that the negative effects significantly decreased among Tohoku residents. This may be attributable to the Tohoku residents' recent or on-going experiences of major disasters that have affected their perceived risks of disaster, which needs to be clarified in further studies.

## Discussion

The goal of this study was to investigate the social impact of natural hazards by examining the effects of the experiences and perceived risks of disaster on different forms of trust in the context of Japan. Importantly, the survey used in the study was conducted about one year after the Triple Disaster; therefore, the results of the Tohoku region were also expected to show implications of the social impact of the disasters. The most important finding of this study is that the two aspects of disaster (actual and perceived) have different effects on trust. Previous studies have emphasised either the negative or positive social impacts of disasters (e.g. Brunisma et al., 2007; Fischer, 1998; Miller, 2006; Papanikolaou et al., 2012; Quarantelli & Dynes, 1977); however, the results of the present study did not reveal a simple dichotomy.

The Japanese people with actual disaster experience trust not only the people they know (family, friends, and neighbours) but also the people they do not know (people they are meeting for the first time). This suggests that individuals with actual disaster experience may have learned to extend their trust to outsiders and sympathise with people they do not personally know, which is associated with the positive image of others in the aftermath of a disaster. This finding is reinforced by the Tohoku residents' level of out-group and generalised trust, which is higher than that of the rest of the Japanese society. Furthermore, Tohoku residents with disaster experience have higher levels of

**Table 4.** The effect of disaster experience and perceived risks of disaster on trust: Tohoku region.

	In-group trust			Out-group trust			Generalised trust			Political trust		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<b>Disaster</b>												
Disaster experience	0.035 (0.023)	0.031 (0.025)	0.035 (0.023)	0.028** (0.012)	0.022* (0.012)	0.028** (0.012)	0.009 (0.024)	0.010 (0.027)	0.009 (0.024)	0.019 (0.019)	0.021 (0.021)	0.019 (0.019)
Perceived risks of disaster	0.002 (0.024)	0.002 (0.024)	-0.001 (0.028)	-0.042*** (0.016)	-0.042*** (0.016)	-0.045*** (0.017)	-0.058*** (0.018)	-0.058*** (0.018)	-0.071*** (0.016)	-0.041** (0.020)	-0.041** (0.020)	-0.037 (0.024)
<b>Social network and engagement</b>												
Participation in associations	0.012*** (0.004)	0.012*** (0.004)	0.012*** (0.004)	0.008 (0.006)	0.008 (0.006)	0.008 (0.006)	0.038*** (0.007)	0.038*** (0.007)	0.038*** (0.007)	0.029*** (0.005)	0.029*** (0.005)	0.029*** (0.005)
Personal network	0.088*** (0.020)	0.088*** (0.020)	0.088*** (0.020)	0.081*** (0.026)	0.081*** (0.026)	0.081*** (0.026)	0.068*** (0.023)	0.068*** (0.023)	0.068*** (0.023)	0.092*** (0.029)	0.092*** (0.029)	0.092*** (0.029)
<b>Community characteristics</b>												
Urbanisation	-0.014 (0.012)	-0.014 (0.012)	-0.014 (0.013)	-0.020 (0.015)	-0.020 (0.015)	-0.020 (0.015)	0.003 (0.028)	0.003 (0.028)	0.004 (0.028)	-0.048*** (0.013)	-0.048*** (0.013)	-0.049*** (0.013)
Duration of residence	0.007 (0.013)	0.007 (0.013)	0.007 (0.013)	-0.013 (0.010)	-0.013 (0.010)	-0.013 (0.010)	-0.007 (0.008)	-0.007 (0.008)	-0.007 (0.008)	-0.010 (0.012)	-0.010 (0.012)	-0.010 (0.012)
<b>Personal predispositions</b>												
Volitional autonomy	0.033*** (0.006)	0.033*** (0.006)	0.033*** (0.006)	0.053*** (0.015)	0.053*** (0.015)	0.053*** (0.015)	0.064*** (0.023)	0.064*** (0.023)	0.064*** (0.023)	-0.019 (0.014)	-0.019 (0.014)	-0.019 (0.014)
Happiness	0.123*** (0.010)	0.122*** (0.010)	0.123*** (0.010)	0.049** (0.024)	0.049** (0.024)	0.050** (0.023)	0.079*** (0.026)	0.079*** (0.026)	0.080*** (0.026)	0.073*** (0.010)	0.073*** (0.010)	0.073*** (0.010)
<b>Personal demographics</b>												
Age	-0.002*** (0.0005)	-0.002*** (0.0005)	-0.002*** (0.0005)	0.004*** (0.001)	0.004*** (0.001)	0.004*** (0.001)	-0.0002 (0.001)	-0.0002 (0.001)	-0.0002 (0.001)	0.004*** (0.001)	0.004*** (0.001)	0.004*** (0.001)
Education Years	0.014** (0.006)	0.014** (0.006)	0.014** (0.006)	0.024*** (0.005)	0.024*** (0.005)	0.024*** (0.005)	0.035*** (0.006)	0.035*** (0.006)	0.035*** (0.006)	0.020*** (0.005)	0.020*** (0.005)	0.020*** (0.005)
Gender	0.059*** (0.016)	0.059*** (0.016)	0.059*** (0.016)	-0.005 (0.028)	-0.005 (0.028)	-0.005 (0.028)	0.025 (0.026)	0.025 (0.026)	0.026 (0.026)	0.108*** (0.019)	0.108*** (0.019)	0.108*** (0.019)
Household Income	0.003 (0.011)	0.003 (0.011)	0.003 (0.011)	-0.0004 (0.011)	-0.0003 (0.011)	-0.001 (0.011)	0.038*** (0.014)	0.038*** (0.014)	0.037*** (0.013)	0.034* (0.018)	0.034* (0.018)	0.034* (0.018)
<b>Tohoku region</b>												
Tohoku	-0.009 (0.022)	-0.034 (0.032)	-0.052 (0.039)	0.081*** (0.020)	0.048* (0.025)	0.022 (0.042)	0.043*** (0.009)	0.051** (0.024)	-0.142*** (0.028)	0.099*** (0.030)	0.111*** (0.034)	0.153*** (0.055)
Tohoku × disaster experience		0.035* (0.020)			0.048*** (0.015)			-0.012 (0.027)			-0.017 (0.027)	
Tohoku × perceived risks of disaster			0.020 (0.027)			0.028* (0.016)			0.087*** (0.012)			-0.026 (0.022)

<b>Intercept</b>	2.358*** (0.196)	2.360*** (0.195)	2.363*** (0.194)	1.024*** (0.201)	1.027*** (0.200)	1.031*** (0.200)	1.565*** (0.092)	1.564*** (0.092)	1.588*** (0.105)	1.699*** (0.146)	1.698*** (0.145)	1.693*** (0.149)
Observations	2,050	2,050	2,050	2,050	2,050	2,050	2,050	2,050	2,050	2,050	2,050	2,050
R <sup>2</sup>	0.083	0.083	0.083	0.043	0.043	0.043	0.079	0.079	0.080	0.063	0.063	0.063
Adjusted R <sup>2</sup>	0.077	0.077	0.077	0.036	0.036	0.036	0.073	0.073	0.074	0.057	0.057	0.057
Residual Std. Error (d.f.)	0.535 (2,036)	0.536 (2,035)	0.536 (2,035)	0.650 (2,036)	0.650 (2,035)	0.650 (2,035)	0.657 (2,036)	0.657 (2,035)	0.656 (2,035)	0.665 (2,036)	0.665 (2,035)	0.665 (2,035)
F-statistic (d.f.)	14.177*** (13; 2,036)	13.173*** (14; 2,035)	13.173*** (14; 2,035)	6.690*** (13; 2,036)	6.479*** (14; 2,035)	6.478*** (14; 2,035)	13.481*** (13; 2,036)	12.513*** (14; 2,035)	12.698*** (14; 2,035)	10.546*** (13; 2,036)	9.790*** (14; 2,035)	9.803*** (14; 2,035)

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ ; standard errors are clustered by region.

out-group trust than the Tohoku residents without disaster experience, and the Tohoku residents' high level of trust also extends to officials of government institutions. The interactions during extraordinary situations may have left positive psychological impressions toward others.

Nevertheless, the relatively weak effect of disaster experience on generalised trust compared with out-group trust requires further study. Many studies have equated out-group trust, which refers to trust in strangers and people from different backgrounds, with generalised trust, which refers to trust in most people (Freitag & Traunmüller, 2009; Newton & Zmerli, 2011; Welch et al., 2007). Such studies would expect similar effects of disaster experience on both out-group and generalised trust based on the assumption that both forms of trust represent citizens' trust in the broader society that goes beyond their homogeneous groups. However, the effects of disaster experience on generalised trust in this study were not as strong as those on out-group trust. The difference may be attributable, in part, to the different wording of the questions for these two forms of trust or the Japanese respondents' different interpretations of the questions.

Apart from the actual disaster experience, the Japanese respondents' perception of risk or fear of disaster tended to have negative effects on trust. The perceived risks of disaster showed significant negative effects on out-group, generalised, and political trust, although the effect on in-group trust is not statistically significant. Disaster preparedness requires the allocation of physical and material resources, which are generally insufficient in communities at all administrative levels. People may have lost their trust in others, particularly unknown others or people from different backgrounds, when trying to prepare for possible disasters and protect their families and properties. Moreover, the relative low levels of trust in other regions compared with the Tohoku region reveal a negative psychological effect of disasters in regions without direct damage.

The negative effect of perceived risks of disaster on political trust provides political implications. Previous studies have shown that trust in the government depends on citizens' evaluations or perceptions of the performance of government institutions (Jackman & Miller, 1996; Mishler & Rose, 2005). The results of this study in the context of Japan support these studies by showing that citizens' fear of disasters is negatively associated with their evaluation of the performance of government institutions and politicians in their regions. However, Tohoku residents who had higher levels of political trust than the residents of other regions did not clearly show how their perceived risks affect their government support. Studies should be conducted to better understand the relationship between perceived risk and disaster experience and its impact on political trust at different group levels.

In addition to the disaster-related variables, there are some noteworthy findings on other variables. Citizens' social networks and active civic engagements have positive effects on their level of trust, which supports the social capital theory (Putnam, 2000). Individuals' participation in associations and their personal networks are closely related to all forms of trust, implying that associations and networks make people more open and inclusive toward outsiders and individuals in general. Another important finding is the role of education. This study shows that educated respondents have higher levels of all forms of trust. Educated people tend to have a broader radius of trust and positively view outsiders as well as politicians. By contrast, the respondents' duration of residence did not strongly affect any form of trust. This finding is inconsistent with the assumption

that long-term residents maintain healthy relationships with their neighbours, which would increase their level of trust in others (Lochner et al., 1999). Other demographic factors invite further research: senior citizens in Japan tend to have higher out-group and political trust, females in Japan have higher in-group and political trust, and household income increases generalised and political trust.

## Conclusion

Disaster experience can make people more trusting, whereas the fear of disaster has an opposite effect. The low trust among people without direct exposure to disaster may stem from negative interactions or the tragic portrayal of disasters and disaster-stricken areas. However, in disaster-stricken areas, there are various interpretations and narratives of disaster, recovery, and resilience that can present a different image on disaster. Therefore, more collaborative efforts between media, the government, and local disaster managers can mitigate the fear and negative effects of disaster perception among citizens, particularly those without disaster experience. The findings of this study may reflect Japanese cultural characteristics and thus may not be generalisable to other social contexts. Therefore, further comparative studies may help deepen our understanding of how social behaviours are affected by natural events as well as by other community emergencies, such as terrorism, crime, and community health (e.g. Hawdon, Ryan, & Agnich, 2010; Lee, 2019; Lee & Cho, 2018; Takagi, Ikeda, Kobayashi, Harihara, & Kawachi, 2016).

This study has a number of limitations that can be addressed by further research. The disaster variables in this study did not consider the type, magnitude, or timing of disasters. Research is required to assess whether people's attitudes toward and trust in others change depending on the different characteristics of disasters. Moreover, this study did not compare pre-disaster trust with post-disaster trust owing to the lack of accessible data. It simply considered the fact that the survey was conducted in 2012, a year after the Triple Disaster occurred in the Tohoku region; therefore, the results suggest only statistical association between disaster and people's level of trust and do not indicate any causal relationship. Furthermore, because the variables were chosen from a general social survey that was not designed for disaster studies, the key variables could be associated with other survey questions, causing omitted variable bias. Further studies can address these problems to increase the estimation accuracy of this study.

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No potential conflict of interest was reported by the author.

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