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ORIGINAL PAPER

The effects of trust in government on earthquake survivors' risk perception and preparedness in China

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Abstract The role of trust in natural hazards risk management has not been widely examined yet. In this paper, the correlation between trust in government and individuals' risk perception, as well as the perceived preparedness for earthquakes is examined. Survey data from 501 households in a Tibetan area in China affected by the 2010 Yushu earthquake are analyzed. The dependent variables are perceived seismic risk probability and consequences, as well as reported household preparedness for future earthquakes. The main predictor variable is trust in government, while trust in family members, trust in most of people in the society, trust in friends/relatives/colleagues, disaster impact, social support, socioeconomic and demographic variables (income, estimated house value, owned land, number of kids, gender, age, ethnicity, education, job categories, marriage status, political affiliation, religion, rural/urban residence) are used as control variables. Ordinal logistic regression models are employed in the analysis. The results indicate that people with higher degrees of trust in government perceive lower consequences of potential earthquakes and tend to prepare less. In the preparedness model, both perceived probability and consequences are additional strong and significant predictors. Potential theoretical and practical implications of these results are discussed.

Keywords Trust in government · Risk perception · Preparedness · Yushu earthquake · China

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1 Introduction

While the role of trust in risk management has been attracted many risk researchers attention (Slovic 1993; Siegrist and Cvetkovich 2000; Earle 2010; Cvetkovich and Lofstedt 2013), its role in natural hazards risk perception has not been thoroughly investigated to date (Wachinger et al. 2013). Both strength and direction of effects of trust on risk perception vary widely across different contexts in terms of hazard types and cultures (Viklund 2003). Trust is found to be an important determinant of risk perception, especially when people have limited time, knowledge, cognitive capacity or motivation to evaluate risk deliberately (Visschers and Siegrist 2008; Wachinger et al. 2013). After a thorough review of the current empirical literature, we found that the effect of trust has mainly been studied in the context of technical risks (Earle 2010), such as food safety (Lobb et al. 2007), nuclear risk (Zhu et al. 2016) or genetically modified organism risk (Poortinga and Pidgeon 2005). In turn, trust has largely been ignored in natural hazards risk scenarios. Thus, an exploration of the role of trust in natural hazards scenarios is a valuable contribution to present research.

Within behavioral research in natural hazards, few studies on perceived stakeholder characteristics, such as trust in related stakeholders, have been conducted (Solberg et al. 2010; Lindell 2013). Along with the attributes of protective actions (or termed as hazard adjustment behaviors) which include both mitigation and preparedness activities, and the features of natural hazards, the perceived stakeholder's characteristics is an inevitable determinant of individual and households' hazard adjustment behaviors (Lindell 2013). The trustworthiness of stakeholders, especially the trustworthiness of authorities, is a key trait of the perceived stakeholder's characteristics (Arlikatti et al. 2007). Results from limited empirical studies on this topic are further inconclusive. Some studies come to the conclusion that trust in government could discourage individuals' preparedness intention (Terpstra 2011) while others show that trust in government is positively related to perceived preparedness (Basolo et al. 2009).

The 2008 Wenchuan earthquake, which caused thousands of death and huge economic losses, is a watershed of disaster management in China. Since then, volunteering, donations and participation of nongovernmental organizations in disasters have become more and more common (Teets 2009). Moreover, from that time point on, the Chinese government has increasingly attempted to frame itself as a successful manager of natural disasters. The Chinese Communist Party (CCP) and government have depicted their disaster management as promoting national unity, trust and solidarity among the Chinese people (Hörhager 2015). For the Chinese government, consolidating public trust in the government's ability to manage risks is an essential element of its output legitimacy (Thiers 2003). However, while the party-state has professed its full responsibility for the welfare of its people in preventing and reacting to disasters (Salazar et al. 2011), it was only after the Wenchuan earthquake that its disaster management policies were reformed to reach more adequate levels of capability and resource investment. With relatively high degrees of trust in government in China (Norris 2011), particularly in the disaster context (Wang et al. 2012a), over-confidence in the government's disaster management capacity may diminish the individual's adoption of protective actions (Han et al. 2011). Thus, exploring the association between trust in government and natural hazard risk perception and preparedness will also paint a more nuanced picture of the role of trust in disaster mitigation and preparedness with valuable implications for the implementation of disaster management policies.

This paper analyzes how trust in stakeholders, especially trust in government, impacts the risk perception and preparedness of survivors from the Yushu earthquake which occurred on April 14, 2010. Although only slightly less strong in magnitude than the 2008 earthquake, its impact was more limited as it occurred in a remote area near the Tibet Autonomous Region at the South-East of Qinghai Province at the border to Sichuan Province. Nevertheless, the government did not hold back on relief missions and resources in what has been qualified by some as a bid to transform the disaster into a showcase of the party's benevolence and resolve (Jacobs 2010).

The paper is organized as follows. First, the correlation between trust, risk perception and hazard adjustment behaviors which include both mitigation and preparedness actions is reviewed. In this literature review, factors influencing risk perception are summarized with a focus on the role of trust. Then, the determinants of individual and household hazard adjustment behaviors are discussed with an emphasis on the effects of trust. In the methods section, the sampling and data collection procedures, the measurements of dependent variables, independent variables, and control variables and the data analysis methods are presented one by one. The results of the ordinal logistic regression models are reported, and the effects of trust in government on risk perception and preparedness are highlighted. Finally, potential theory contribution and policy implementation are discussed.

2 Literature review: trust, risk perception and disaster preparedness

Due to the interdisciplinary nature of hazards research, scholars use different terms to describe trust-related variables and individual adjustment behaviors (mitigation and preparedness). Take the trust-related variables as an example, the perception of societal stakeholders (Lindell 2013), norms or shared responsibility (Solberg et al. 2010) are usually used as similar or broader terms. Regarding societal stakeholders, Aptatu et al. (2015) included respondents themselves, their peers, officials and media in their research, while Arlikatti et al. (2007) used seven stakeholder types including federal government, state government, local government, media, employer, peers (friends/relatives/neighbors, and coworkers) and the respondents themselves. Risk perception also includes various dimensions like the likelihood, dread, magnitude and consequence of hazards (Lindell 2013; Wachinger et al. 2013). Protective actions, hazard adjustment behaviors or adaptation are common terms referring to individual or household actions undertaken in anticipation of a potential hazard (Solberg et al. 2010; Lindell 2013). Preparedness is operationalized as an individual concept (Basolo et al. 2009) in some studies while it is perceived as part of adjustment behaviors in others (Lindell 2013). Our literature review covers all these studies but pays less attention to differentiating the varied concepts. In this section, after summarizing the influencing factors of earthquake risk perception and the role of trust, we propose our first group of research hypotheses. Then, we review the determinants of individual/household's hazard adjustment behaviors (including preparedness) with a focus on the effects of trust and present our second research hypothesis.

2.1 Factors influencing seismic risk perception and the role of trust

Risk attributes, information attributes, personal and demographic characteristics, socioeconomic and geographic proximity are the four groups of factors that influence individual risk perception while experience and motivation; trust and responsibility; economic and

personal capacity are the three intervening variables that affect people's both risk perception and preparedness behaviors (Wachinger et al. 2013). Risk attributes mainly include the characteristics of the risk in question, such as the perceived likelihood, dread or magnitude/consequence of the hazards. People perceive risks differently according to varied risk attributes (Slovic 1987), but some studies demonstrate that these factors are not important for the perception of natural hazards (Heitz et al. 2009). Information-related factors include information coverage, sources and trust in information sources. Age, gender, education level, income, occupation, marital status, presence of dependents, ethnicity, immigrant status, neighborhood tenure and homeownership are typically socioeconomic and demographic variables included (Lindell and Perry 2000). Some factors, such as gender and education level, seem to have a consistently significant effect on seismic risk perception, yet others, such as age or income, are less stable. Geographic proximity and disaster experience are consistent predictors of seismic risk perception in the literature. People living in a higher seismic risk area tend to have significant higher perception of earthquake risk (Armas 2008; Tekeli-Yesil et al. 2011). People's earthquake risk perception is also positively related to their disaster experience (Kung and Chen 2012; Knuth et al. 2015; Oral et al. 2015; Tian and Yao 2015), especially when they experienced severe or intensive impact (Lo and Cheung 2015).

The importance of trust in risk management has attracted many researchers' attention (Slovic 1993; Earle 2010; Cvetkovich and Lofstedt 2013), whereas most of them are in human-related or technology risk contexts (Earle 2010). What's more, the role of trust in risk management is not consistent in empirical studies (Visschers and Siegrist 2008), although trust is proposed as one of the most important determinants of risk perception, especially when people have limited time, knowledge, cognitive capacity or motivation to evaluate risks deliberately (Visschers and Siegrist 2008; Wachinger et al. 2013). Trust's effect on risk perception is mediated by and varies across contextual factors, like the different risk agents (nuclear power plant, climate change, genetically modified food etc.) or countries (Viklund 2003). The public's perceived risk and benefit are more possibly influenced by the trust when they have little knowledge about that specific kind of risk, but such an effect is not significant for risks that they know well (Siegrist and Cvetkovich 2000). Compared with the studies linking trust to human-related risks, research about the role of trust in natural hazards risk perception is limited. For the 132 empirical studies included in Earle's review (Earle 2010), almost all of them are human-related/technological risks. Thus, more studies on the correlation between trust and natural hazards risk are needed.

The association between trust and risk perception varies according to different types of risks and societal contexts (Viklund 2003). The role of trust in authorities and feeling of responsibility to natural hazards mitigation, preparation, response and recovery could be different in individualism-oriented society and collectivism-driven society. Though earlier study on resident from lower earthquake risk regions in China has shown that trust in government would increase public's acceptance to seismic hazards (Huang et al. 2014), the role of trust in risk perception of natural hazards (earthquake specifically) among disaster victims has never been examined in China yet according to our knowledge. Therefore, this paper can add valuable contribution to current understanding of natural hazards risk perception. Based on the literature review above, we hypothesize that:

H1 Earthquake survivors have lower risk perception (in terms of probability and consequence) if they have a higher degree of trust in government.

2.2 Influencing factors of disaster preparedness and the effects of trust

Three recent literature reviews have summarized correlates and causes of individual and household's adjustment behaviors in Europe, the USA and more internationally (Solberg et al. 2010; Lindell 2013; Wachinger et al. 2013). Risk perception is a significant predictor of adjustment behaviors (mitigation or preparedness) in most studies (Ge et al. 2011; Han and Nigg 2012; Sadiq and Graham 2016). Besides the risk perception and its predictors, the perceived societal stakeholders' characteristics (Lindell and Perry 2000; Lindell 2013)/ norms and normative beliefs (Solberg et al. 2010), such as the trust in stakeholders and the perceived responsibility of mitigating and/or preparing for seismic hazard, are one category of prominent factors influencing individual and household's adjustment behaviors which include mitigation, emergency and recovery preparedness (Lindell 2013). The perceived attributes of hazards adjustment actions like the feeling of control, efficacy and fate, the usefulness of adjustment actions are the third important group of factors shaping the individual and household's adjustment behaviors. In the following paragraph, the role of perceived societal stakeholders' characteristics, especially the effects of trust and perceived responsibility on individual and household's adjustment behaviors are reviewed.

Civil authorities, news media, experts and peers are common stakeholders referred in the disaster and emergency management context (Drabek 1986). In general, the perception of the individual and household's responsibility leads to higher level of taking protective actions. In the tornado scenario, individuals appraise personal responsibility would adopt more preparedness (Mulilis and Duval 1997; Mulilis et al. 2003). A similar conclusion is confirmed in a multi-hazards environment—California residents' sense of responsibility for self-protection is a significant predictor of adjustment for wildfire, earthquake and volcano hazards (Perry and Lindell 2008). For the ongoing smog risk in China, the attribution of responsibility is found to be a significant predictor of intention to adopt protective behavior (Wei et al. 2016). However, we also found that one study reported nonsignificant correlation between the perception of personal responsibility and flood adaptation behavior (Laska 1990).

The effects of trust in authorities on individual/household hazard adjustment behaviors vary in empirical studies. Surveys from California and New Orleans in the USA show that the confidence in local government's capacity to manage a disaster is positively associated with the level of perceived preparedness for both earthquakes and hurricanes. However, the correlation between confidence in local government and actual preparedness actions (making family plan, storing supplies, mitigation and shut off utilities) are not significant for earthquakes. For hurricanes, only the effect on making family plan is significant and positive (Basolo et al. 2009). Similarly, the confidence in government is not a significant predictor of individual preparedness in North Carolina (DeYoung and Peters 2016). In another study which also examines the seismic hazard adjustments in the USA, the trustworthiness and sense of responsibility of perceived stakeholder are found to be influencing factors of hazard adjustments by both central and peripheral routes to behavioral changes (Arlikatti et al. 2007). In a preparedness intervention experiment, the positive effect of trust on earthquake preparedness changes is significant in the control group (non-intervened) while such effect in the intervention (attend a 6-h preparedness education workshop) group is not significant (Joffe et al. 2016). In Chile, trust in authorities is found to be a strong predictor of environmental hazards risk perception and degree of acceptability (Bronfman et al. 2008, 2015). However, evidence from the Netherlands demonstrates that citizen's trust in flood protection actually will reduce their perception of

flood likelihood, as well as the amount of dread, and this will, in turn, impede people's flood preparedness intentions (Terpstra 2011). The varied effects of trust on individual and households' natural hazards mitigation and preparedness may due to cultural sensitivity in different countries (Viklund 2003) or varied hazards types—the role of trust in natural hazards preparedness is more salient when respondents have lower familiarity or information on that kind of hazard (Paton 2007).

Unlike the USA, where the "whole community" concept is propagandized and individuals are expected to take the first step to protect themselves during disasters and emergencies (FEMA 2011), the authority for disaster management in China is largely centralized in the hands of the party-state. As the central actors in disaster mitigation, preparedness and response, trust in different levels of government can be expected to be essential to public's risk perception and preparedness. Trust is relational (Siegrist 2010) and can potentially elicit a certain sense of passivity from an individual's perspective which may lead to diminished resilience. This involves the belief that avoiding or minimizing the effect of a disaster risk can be achieved by relying on other external actors, especially the government in the Chinese cultural context. Hence, examining the trust in authorities' effect on natural hazards preparedness can contribute to our understanding of natural hazards risk perception and adjustment behaviors, including both mitigation and preparedness.

It is important to keep in mind that cultural sensitivity cannot explain the effect of trust on individual/household's adjustment behaviors alone. A comparison study from the individualism-oriented New Zealand and the collectivism-oriented Japan demonstrates that trust is a positive predictor of the earthquake preparedness intention in both countries, indicating that there may be some universal, cross-cultural equivalence in how hazards beliefs and social characteristics like community participation, collective efficacy, empowerment and trust affect the degree of natural hazards preparedness (Paton et al. 2010). In the broader Chinese culture context, which is well known for its collectivism, a survey from Taiwan demonstrates that trust (trust in government, expert and media) is a positive predictor of flood and landslides victims' mitigation intentions (Lin et al. 2007). Yet, another study on the public's risk perception and preparedness for floods in mainland China shows that trust would reduce the propensity to adopt long-term preparation against flood (Su et al. 2015). This discrepancy from similar collectivism-oriented society also reveals that the culture sensitivity may only have partial explanation power, and thus, there is a need for more investigation.

In sum, the effect of perceived societal stakeholders' characteristics, the ineluctable part of trust in specific, on individual and household's natural hazards adjustment behaviors (mitigation and preparedness) is prominent, but under-examined (Lindell 2013). Both the directions and strengths of effects are non-consistent in prior research. From one aspect, it can be assumed that excess trust in authorities and experts, which are main information source of natural hazards (Paton 2008), could hinder their mitigation and preparedness because they think the authorities would rescue them from crisis. From another aspect, trust can enhance cooperation, and thus, trust in authorities could increase the public's to adopt mitigation and preparedness for natural hazards because they have higher propensity to follow the disaster management authorities' suggestions (Solberg et al. 2010). Consequently, it can be assumed that:

H2 Survivors with higher degrees of trust in government would prepare less for the next potential earthquake because they believe that the government would help them once a disaster happened.

3 Methods

3.1 Sampling and data collection

Data used in this analysis were collected in NQ county in the summer of 2012, which was affected by the 2010 Yushu earthquake in Qinghai, China. The 7.1 Richter degree Yushu earthquake caused 2698 deaths and 270 missing in this region. Most of the residents in this region are Tibetan. The principal investigators of this study visited this region for two weeks immediately after the 2010 earthquake with a national experts team to assess the impacts of the disaster. Based on the observations and data collected during this initial visit, an empirical research design about the disaster impact, livelihoods recovery, risk perception and preparedness was drawn up. The data collection effort was implemented in the summer of 2012, about two years after the earthquake.

Questionnaire survey is the common method for acquiring information about the public's knowledge, perception and preparedness of natural hazards (Bird 2009). Thus, a household questionnaire survey was used as the primary data collection method in this study. Meanwhile, participant observation and in-depth interviews were used for qualitative data collection during the field research in the summer of 2012. Using a convenience sampling method, 600 households in three concentrated resettlement areas were identified for participation in the survey. From those, 501 questionnaires were successfully returned for analysis, adding up to a response rate of around 83.5%. Since most of the residents were Tibetan, local college students who can speak both Mandarin and Tibetan language were hired to conduct the questionnaire surveys face-to-face. One day was used for interviewers' training before the fieldwork started. In-depth interviews were mainly conducted by the principal investigators, accompanied by a local college student who knew both Mandarin and Tibetan as an interpreter. Twenty-one in-depth interviews were conducted, three of them with local officials in the three concentrated resettlement areas. This paper concentrates on the results from the standardized survey, and results from qualitative interviews will be published in a separate paper.

3.2 Measurements

3.2.1 Dependent variables

Risk perception was measured by two variables, perceived probability and perceived personal consequences of being affected by an earthquake. Risk perception has been measured in different ways, such as through the free-response method, the perceived global or national risk and specific personal consequences. Probability and severity/consequence are the most common measures used (Lindell and Perry 2000; Lindell 2013). Perceived probability was captured by the question "What do you think is the probability that another disruptive earthquake would hit this region?" Answers options on a five-point Likert scale were (1) "Absolutely not possible," (2) "Rather not possible," (3) "Not sure," (4) "Possible" and (5) "Very possible." The question "If another disruptive earthquake hit this region again, how do you think the earthquake would affect you and your family?" was used to obtain information on perceived potential consequences. Answers options were (1) as "No impact," (2) as "Slight impact," (3) as "Medium-level impact," (4) as "Big impact" and (5) as "Severe impact."

Individual adjustments to natural hazards are usually measured in two ways, either a set of hazards adjustment actions (Lindell et al. 2009) or a simple question on whether the respondent has done anything to reduce their hazards vulnerability-reported mitigation or preparedness (Weinstein et al. 2000; Blanchard-Boehm and Cook 2004). In this study, household earthquake preparedness was measured by a self-reported five scale preparedness degree. The answers to the question "Have you and your family prepared for the next potential earthquake?" ranged from one to five, representing the meaning of "No preparedness whatsoever," "Almost no preparedness," "Not sure," "Some preparedness" and "Significant preparedness." An open question about what kinds of preparedness activities had been taken was used in addition. The answers mainly covered two dimensions: mitigation (e g., reinforce building structures) and capacity building (e g., learning earthquake knowledge and/or response skills).

The frequency distribution of the three dependent variables can be found in Table 1. Overall, 64.83% of the respondents indicated that they were not sure about the possibility of a future disruptive earthquake. Only 12.59% (9.66% not possible at all, 2.93% not so possible) of our sample said that another disruptive earthquake was not possible in this region. 22.58% of them held the belief that another disruptive earthquake was possible or quite possible in this region again. If another disruptive earthquake happened again, more than half (55.17%) of them believed that they would be severely impacted. 19.83% of the respondents chose the "Big impact" option while another 4.83% selected the "Medium-level impact" option. Only 20.17% (12.07% no impact, 8.10% slight impact) believed that they would be safe. In terms of household preparedness, 39.48% indicated that they had no preparedness at all, another 12.93% said they were almost not prepared. 15.52% of them expressed that they had some preparedness, and only 2.24% of them believed that they were well prepared for the next potential disruptive earthquake.

3.2.2 Independent variable

Generally, trust has two dimensions, intention trust (believing that someone has the intention of doing something) and confidence (believing that someone has the competence to do something) (Hardin 2002). The independent variable used in this analysis is trust in governments. Trust can be measured by one single-item or by a multi-item (Hardin 2002; Earle 2010) according to different trustees. The question "How much do you trust the following organizations?" is used to inquire into the respondent's degree of trust in the central government, provincial government and local government separately. The trust degree toward each of these levels of government is measured on a five-point Likert's scale. One to five represents the meaning of "No trust at all," "Little trust," "Hard to say," "Some trust" and "Trust very much." The sum of the trust degrees in the three levels of government is used as the trust in government predictor in the analysis because factor analysis revealed that these three items can be treated as one factor, and the Cronbach's alpha test result (0.8213) also indicated good internal consistency of the three items. The trust in government predictor had a mean value of 10.24 with a standard deviation of 2.05, a minimum value of three and a maximum value of 15 (Table 2).

3.2.3 Control variables

There are two sets of control variables in this analysis. The first set consists of variables referring to trust in other stakeholders (Arlikatti et al. 2007). Family trust (trust in family members), general trust (trust in most of the people in the society), specific trust (trust in

Table 1 Frequency distribution of response variables (%)

	Probability	Consequence	Preparedness
1	9.66	12.07	39.48
2	2.93	8.10	12.93
3	64.83	4.83	29.83
4	12.41	19.83	15.52
5	10.17	55.17	2.24

Table 2 Basic statistics of trust variables and other explanatory variables

Variable	Observations	Mean	SD	Min	Max
Government trust	501	10.24	2.05	3	15
Family trust	501	4.86	0.42	1	5
General trust	501	2.95	0.79	1	5
Specific trust	501	19.47	2.72	10	25
Social support	501	24.11	4.94	12	36
Disaster impact	501	2.44	1.40	1	5
N of family members	501	4.70	1.92	1	13
N of kids	501	1.97	1.52	0	8
Income	501	27,685.35	60,230.08	0	1120,000
House value	501	59,746.47	96,462.87	0	1594,000
Land (acre)	501	5.31	24.37	0	397.53

close relatives, distant relatives, close friends, general friends and neighbors) are the three other trust-related variables. A question similar to the trust in government question employing the same Likert scale was used. Family trust and general trust ranged from one to five with a mean value of 4.86 and 2.95, respectively. The specific trust is the sum of trust degrees in close relatives, distant relatives, close friends, general friends and neighbors because factor analysis result and the Cronbach's alpha test result (0.8096) indicated the reliability of treating these five items as one variable. Specific trust has a mean value 19.47 with a standard deviation of 2.72.

Demographic variables, socioeconomic factors, perceived disaster impact and social support degrees were the second set of control variables used in this analysis. The demographic variables included age (grouped), gender, ethnicity, *Hukou* status (registration as rural or city resident), religion, marriage status, political affiliation status [whether a member of the China Communist Party (CCP)], main job categories and education levels. A detailed distribution of these demographic variables can be found in Table 3. The selected area was a county located in the Tibet Plateau and severely affected by the 2010 Yushu earthquake. Most of the respondents were Tibetan (99.2%), with Tibetan Buddhism (98.6%) religion beliefs, and rural (97.21%) *Hukou* registration. Most of the samples were adults between 18 and 65 years old (88.82%), 41.92% of them were female, 71.06% of them were married and 93.61% of them were not China Communist Party members. Gathering was the main livelihood strategies (64.67%) for the survey respondents, and 83.23% of them had no education experience.

The basic statistics of other explanatory variables like social support, prior disaster impact, the number of family members, the number of kids within family, household

Table 3 Controlled demographic variables

Variables	Freq.	Percent	Cum.
Age group			
Under 18	20	3.99	3.99
19–30	76	15.17	19.16
31–40	164	32.73	51.9
41–50	154	30.74	82.63
51–65	51	10.18	92.81
Older 65	36	7.19	100
Gender			
Female	210	41.92	41.92
Male	291	58.08	100
Ethnicity			
Han	4	0.8	0.8
Tibetan	497	99.2	100
Hukou			
Rural	487	97.21	97.21
Urban	14	2.79	100
Religion			
Tibetan Buddhism	494	98.6	98.6
Christian	6	1.2	99.8
Tao	1	0.2	100
Marriage			
Married	356	71.06	71.06
Divorced	41	8.18	79.24
Widowed	49	9.78	89.02
Single	55	10.98	100
Party			
CCP	32	6.39	6.39
Others	469	93.61	100
Job			
Agricultural	25	4.99	4.99
Work	20	3.99	8.98
Gathering	324	64.67	73.65
Business	9	1.8	75.45
Other	123	24.55	100
Education			
Illiteracy	417	83.23	83.23
Primary	60	11.98	95.21
Middle	10	2	97.21
High	4	0.8	98
College	10	2	100
Total	501	100	

annual income, estimated value of the house and land owned by the family are presented in Table 2. On average, the households in our sample had 4.7 family members and 1.97 kids. The standard deviation of the number of family members was 1.92 while the standard deviation of the number of kids was 1.52. In terms of economic status, the 501 households had an average annual income of 27,685.35 RMB, an average estimated house value of 59,746.47 RMB and an averaged owned land of 5.31 acres. The standard deviation of annual income, estimated house value and land owned were 60,230.08, 96,462.87 and 24.37, respectively. The disaster impact question captured the respondent's perceived disaster impact from the 2010 earthquake. The question was "Overall, how do you think the 2010 Yushu earthquake affected you and your family?" and the answers were a score series from one to five, representing the meaning of "No impact," "Slight impact," "Hard to say," "Major impact" and "Severe impact." The disaster impact score had a mean value of 2.44 with a standard deviation of 1.40.

The social support score had a mean value of 24.11, with a standard deviation of 4.94, a minimum value of 12 and a maximum value of 36 (as shown in Table 2). It was the sum of the social support degrees that the respondent can get from eight sources. The eight sources were friends, neighbors, family members, other relatives, communities, banks, other financial firms and others. The respondents were asked to rate the support degree they can receive from eight sources using a five Likert's scale, one as "Cannot get help," two as "May not get help," three as "Not Sure," four as "May get help" and five as "Can get help."

3.3 Data analysis methods

Three ordinal logit regression models were constructed using earthquake perceived risk probability, earthquake risk consequence and preparedness degree as dependent variables, respectively. For the preparedness model, risk perception (probability and consequence) was treated as independent variables as well. The statistical software Stata 13.1 was used for data analysis.

4 Results

Results from the three ordered logit regressions of the perceived seismic risk probability, perceived consequence and preparedness for earthquakes are reported in Table 4. All three regressions included the control variables given in Tables 1 and 2. Coefficients for demographic and socioeconomic variables are not reported here because none of them is statistically significant at a five percent level. Aside from the individual and household characteristics, we are mostly interested in the roles of different forms of trust and social support. Overall, it is apparent that these factors do not alter the perception of risk probability given that most of the coefficients are not significant at the 5% level. However, some forms of trust and social support do affect how people estimate the consequence of potential earthquakes and their preparedness for such events.

First of all, trust in government has a negative impact on both perceived consequence from a potential earthquake and earthquake preparedness. Just as assumed, trust in government indicated that people would rely more on the government to help them when disasters happened, and thus, it reduced self-protective efforts. Trust in government has no significant impact on the perceived probability of a potential earthquake. Both social support degrees and prior disaster impacts have a positive effect on people's perceived

Table 4 Ordinal logit regression results

	Preparedness	Probability	Consequence
Perceived probability	0.830*** (0.107)		
Perceived consequence	0.181* (0.076)		
Family trust	0.164 (0.242)	−0.485* (0.240)	0.078 (0.245)
General trust	0.010 (0.119)	0.113 (0.130)	−0.067 (0.123)
Specific trust	−0.050 (0.039)	−0.063 (0.043)	0.120** (0.040)
Government trust	−0.104* (0.049)	0.059 (0.053)	−0.103* (0.052)
Impact	0.242*** (0.070)	0.014 (0.071)	0.380*** (0.073)
Support	0.139*** (0.023)	0.014 (0.021)	0.075*** (0.021)
N	501	501	501
Pseudo R^2	0.163	0.049	0.078

Standard errors in parentheses.
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

consequences and disaster preparedness. It is understandable that if people experienced a higher disaster impact before, they would expect higher losses during a future potential disaster, and they would prepare more for an upcoming disaster. Higher levels of social support would also allow them access to resources for preparing for disasters. But social support's positive impact on the perceived consequence does not follow common intuition.

Trust in family members has significant negative impact on perceived earthquake risk probability, but effects on preparedness and perceived consequence are not statistically significant. None of general trust's (trust in most of the people in our society) effects on probability, consequence and preparedness is significant. Specific trust has a significant positive effect on perceived consequence, but nonsignificant effects on preparedness and perceived probability. If respondents have higher levels of trust in their neighbor and relatives (specific trust), they report less estimated consequence of potential earthquakes. The direction of this influence, similar to that of higher levels of social support, is somewhat surprising. It is worth mentioning here that an endogeneity problem may arise in this estimate. Trust and estimate of consequence may be affected by similar factors that are not captured by the control variables. However, it might be explained by looking at the relationship between communication and trust. If specific trust is high, this indicates that these actors are trusted sources of communication and the disaster damage they suffered will be more present in an individual's mind and perhaps added to their personal level of damage to create a picture of a more devastating disaster.

5 Discussion and conclusion

The role of trust in natural hazards risk perception and individual/household's hazards adjustment behaviors like mitigation and preparedness is under-examined in empirical studies (Solberg et al. 2010; Lindell 2013; Wachinger et al. 2013). This study goes a step further in analyzing the relationship between trust in government and individual risk

perception and reported preparedness, specifically for seismic risk in China. The respondents are survivors of the 2010 Yushu earthquake. As with prior study from the Netherlands (Terpstra 2011), but in contrast to research from the USA (Basolo et al. 2009), the results of this survey demonstrate that trust in government tends to decrease the respondents' perceived consequences of and reported preparedness for future potential earthquakes, just as hypothesized. The effect of trust on perceived seismic risk probability is not significant, which violates our hypothesis. Although prior research has shown that trust will reduce the perceived probability of floods going to occur (Terpstra 2011), the causal link between trust and perceived probability of natural hazards is not intuitive. The social psychological and cognitive processes of risk perception are so complicated that they still need more investigations in future.

Having successfully managed the Yushu earthquake may have increased the level of trust in government and therefore of support of political authorities. This is in line with the goals of the Chinese Communist Party, which has been pursuing widespread rural reform policies, such as "Building a New Socialist Countryside" (社会主义新农村建设) and the more recent "New-Type Urbanization Plan 2014–2020" (新型城镇化规划) (Trappel 2016). However, it has also had the paradoxical consequence of placing high expectations, in the form of a continued performance burden, on the party-state for future natural disasters. A survey on people's attitudes toward disaster insurance conducted in 2012 provided similar results (Wang et al. 2012b). People from regions with a greater multi-hazards threats showed less willingness to accept disaster insurance because they tended to expect the government to cover losses. The authors' qualitative interviews also showed that many survivors voiced opinions on the Chinese government's emergency management which demonstrated an awareness of a mutual dependency between rural residents and the party-state—the first relying on the latter for guidance in dealing with the disaster, and the latter on the first for political support. This finding further highlights the political characteristics of natural hazard risk management in China. In order to strengthen its output legitimacy and therefore the stability of the political system, the party-state has prominently positioned itself as the competent authority in terms of disaster management. The subjective experience of effective government support seems to have a side-effect that may diminish individual resilience, and these unexpected effects should be paid attention to in disaster and emergency management.

Besides trust in government, we also explored the effects of trust in other stakeholders (family members, relatives, friends, neighbors and most of the people in the society) on seismic risk perception and reported preparedness. All variables related to trust in other stakeholders studied here had no significant impact on the reported preparedness in our study. Also, no correlations between general trust and perceived seismic likelihood, perceived consequences and reported preparedness were significant. This differs from findings from a previous study conducted in Europe, which indicated that general trust was a significant source of variation in perceived risk in Sweden, Spain, the UK and France, though this variation remained unexplained in that study (Viklund 2003). One explanation could be the cultural difference, and another reason could be the differences in measurement. We solely used one question to inquire respondents' general trust, while Viklund employed a 42 item scale which had four dimensions. Our study revealed that individuals with higher trust in family members perceived a lower probability of earthquakes, while the specific trust was positively associated with the perceived consequences. The feeling of safety provided by close relationships and bonding may lead to the underestimation or even denial of hazards (Armas 2006).

Based on the discussion above, we believe that future research needs to be elaborated and improved from three directions. First, various dimensions of trust in different stakeholders, especially intention and confidence (Hardin 2002; Siegrist 2010) need to be differentiated. Divergent impact of varied forms of trust in different stakeholders may play different, even contrary roles in natural hazards risk perception and hazard adjustment behaviors. Another variable we did not consider in our analysis is the feeling of responsibility in disaster mitigation, preparedness, response and recovery, and future research including both trust and feeling of responsibility might be a valuable contribution. Third, since our results mainly based on a sample of the 2010 Yushu earthquake survivors in the Tibetan area (most of them are Tibetans), more studies targeting on wider population using random sampling method are needed.

In conclusion, our results show that trust in government reduces disaster survivors' perceived consequences of natural hazards risks and their preparedness for future disasters. This highlights the central importance of studying the effects of different dimensions of trust for different types of hazards. Certain types of trust can have an ambiguous effect of defecting responsibility and, therefore, potentially increasing vulnerability by diminishing people's willingness to prepare for future occurrences of natural hazards.

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