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How Do Disasters Change Inter-Group Perceptions? Evidence from the 2018 Sulawesi Earthquake[1]

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Abstract

This study investigates whether and how natural disasters affect intergroup perceptions, particularly focusing on subjective expectations for dependability on other groups in emergencies. We conduct a household survey in Central Sulawesi, Indonesia, which has experienced religious conflicts and was heavily hit by the 2018 Sulawesi earthquake. Our estimation results from the survey data indicate that individuals who suffered from the earthquake exhibit higher expectations for access to emergency support from other religious groups in the future. As a possible mechanism of this change, we show that the direct and indirect experience of actual cooperation between groups after the earthquake contribute to the higher expectations of sufferers. We also find heterogeneity in the effect of the earthquake on intergroup perception, depending on, for example, the types of damage and past experiences.

Keywords: disasters, subjective expectations, helping networks, weak ties
JEL classification: D1, O12, D83, D91, H84, Q54

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1. Introduction

Natural disasters may change individual perceptions toward others. For example, a growing strand of literature finds that social preferences can change after disasters (Andrabi and Das 2017, Cassar, Healy, and von Kessler 2017, Castillo and Carter 2011, Chantarat et al. 2019, Fleming, Chong, and Bejarano 2014, Samphantharak 2014, Shoji 2018a, Voors et al. 2012). While among various aspects of individual perceptions, preferences shape economic decisions and behaviors and thus the post-disaster changes gain growing attention, the similarly essential factor determining these is subjective expectations, as summarized in Delavande, Giné, and McKenzie (2011). Regarding post-disaster changes, Chantarat et al. (2019) and Chantarat, Lertamphainont, and Samphantharak (2016) found that a severe flood in Cambodia and Thailand, respectively, reduced the perception of dependability of intragroup social networks in future floods.

This paper extends the literature, focusing on the expectations of individuals for dependability on others in different social groups from their own group in case of emergency for the following three reasons. First, intergroup social networks are an important part of social capital (Granovetter 1973; Burt 1992), which has been found to affect economic development (Knack and Keefer 1997, Putnam and Work 1993, Toya 2014, Zak and Knack 2001) and violence (DELLER and DELLER 2010, Lederman, Loayza, and Menéndez 2002, Messner, Rosenfeld, and Baumer 2004). In addition, economic growth and violence have been observed to be influenced by natural disasters (Cavallo et al. 2013, Fomby, Ikeda, and Loayza 2013, Goltz 1984, Harper and Frailing 2010, Hsiang and Jina 2014, Loayza et al. 2012, Noy 2009, Noy and Nualsri 2007, Quarantelli 1994, Raddatz 2009, Rodríguez, Trainor, and Quarantelli 2006, Sarsons 2015, Sawada, Bhattacharyay, and Kotera 2011, Shoji 2018b, Skidmore and Toya 2002, Strobl 2012, Trainor, Barsky, and Torres 2006). Therefore, to understand post-disaster development and peace, it is worthwhile to explore how disasters change intergroup perceptions.

Second, the literature often focuses on the impacts of natural disasters on social capital, violence, and economic development, and limited studies investigate whether and how disasters revise subjective expectations for emergency assistance from others. An exception is Chantarat et al. (2019) and Chantarat, Lertamphainont, and Samphantharak (2016), who examine the impact of disasters on the subjective expectation for emergency help from the government and people linked through social networks in regions where little variation in ethnicity and religion exists. However, among the three dimensions of social capital that are observed to change after natural disasters, i.e., bonding social capital within the group, bridging social capital between groups, and linking social capital between people and organizations (Andrabi and Das 2017, Fleming, Chong, and Bejarano 2014, Toya 2014), Chantarat et al. (2019) and Chantarat, Lertamphainont, and Samphantharak (2016) analyze the first and third. Therefore, we pay particular attention to the second, social capital that bridges across groups. Because bridging social capital is usually weaker (Binzel and Fehr 2013, Etang, Fielding, and Knowles

2011, Johansson-Stenman, Mahmud, and Martinsson 2009) and works differently (Granovetter 1973; Burt 1992) than bonding social capital, the two types of social capital should be affected by natural disasters differently.

Finally, existing results on the impact of disasters on perceptions toward others are mixed. Chantarat et al. (2019) and Chantarat, Lertamphainont, and Samphantharak (2016) find a negative effect of a severe flood on the expectation for emergency help from people connected through social networks and its negative effect on the number of dependable friends. These results are consistent with the negative effects of natural disasters on social capital found in Chantarat et al. (2019), Castillo and Carter (2011), Fleming, Chong, and Bejarano (2014), and Toya and Skidmore (2014).[1] In contrast, their positive effects on perceptions are found in Cassar, Healy, and von Kessler (2017), Castillo and Carter (2011), Andrabi and Das (2017), and Fleming, Chong, and Bejarano (2014). Moreover, anecdotal evidence following the 2004 Indian Ocean Tsunami shows that a disaster can have contrasting consequences for social unity and ties. The tsunami hit two conflict zones in Aceh of Indonesia and Sri Lanka, where severe military conflicts for independence had lasted for approximately three decades before the tsunami. After the tsunami, the conflict between the Indonesian government and the Free Aceh Movement was resolved, with the tsunami likely playing the primary role in leading to peace (International Crisis Group 2005, Pandya 2006, Sukma 2006). However, the same tsunami escalated the confrontation between the central government and the Tamil Tiger in Sri Lanka (Beardsley and McQuinn 2009). These contrasting results were generated possibly because the perception of others in adversary groups changed positively in Indonesia and negatively in Sri Lanka in the process of their recovery from the tsunami.[2] Therefore, testing whether disasters improve or deteriorate the expectation for emergency assistance from people in other groups and what differentiates the direction of the effect would help interpret the mixed results on the concomitant social capital and decision-related and behavioral changes found in the literature.

To answer these questions, we took the case of the 2018 Sulawesi earthquake (hereafter, the earthquake) in Central Sulawesi Province of Indonesia on September 28, 2018 and conducted a household survey of 4,154 cacao farmers in two affected regencies (local administrative units under provinces) in 2019. Using the survey data, we investigate the impact of the earthquake on the respondents' expectations for emergency support from different religious groups. Our target areas are

1 Those studies are based on econometric analysis using micro data from developing countries, while Toya and Skidmore (2014) is a country-level analysis using the data from both developed and developing countries.

2 The way the adversary group involved the recovery process was quite different in these two countries. In Indonesia, the central government and Indonesians outside Aceh provided long-lasting and great support to the devastated areas of the tsunami and played a significant role in their reconstruction and recovery process. By stark contrast, the Tamil Tiger in Sri Lanka obstinately prevented the Sri Lankan government, military, and all the other entities outside the Tamil Tiger from directly providing relief supplies, including drinking water, and ordered all to channel emergency support through Tamil Tiger's aid body (Beardsley and McQuinn 2009, International Crisis Group 2006)

suitable for this research for the following five reasons. First, the earthquake was of Mw. 7.5 and associated with a tsunami of 3 meters high and liquefaction in some areas, killing 4,340 people and causing a direct economic loss of 1.45 billion USD. Because of the substantial impact of the earthquake, we would expect possible changes in the perception toward people in other groups. Second, approximately half of the targeted areas were heavily hit by the earthquake, while the other half were not. By surveying all cacao farmers in the targeted subdistricts, our sample consists of two groups, one affected by the earthquake and the other not, that were exogenously divided by the earthquake. This natural experimental setting allows us to estimate the effect of disasters on the perceptions of different groups. Third, there were armed conflicts between Christians and Muslims in Central Sulawesi from 1998 to 2001. Even after the cease fire in 2001, open and hidden hostility existed among religious groups throughout the province (Beech and Suhartono 2018, Diprose and Ukiwo 2008, Ploughshares 2005). Therefore, it is interesting to see how perceptions of different religious groups measured by expectation of support from other religious groups in case of emergency changed after the earthquake. Fourth, because the central government of Indonesia generally restricted the activities of international nongovernmental organizations (NGOs) in the affected areas after the earthquake, providers of relief aid were mainly domestic organizations, except for official international organizations. In addition, severe damage to the local airport prevented aid groups from flying to the area in the early stage. Religious organizations located on Sulawesi Island, in addition to local volunteers and other local organizations, provided support from the very early stage.[3] Therefore, support from Muslim Indonesians to Christian Indonesians and vice versa was practiced to a large extent. Finally, our target region, Sigi and Donggala in Central Sulawesi Province, are among the three regencies hit by the earthquake and were a single regency until 2008. Therefore, these two regencies are likely to be institutionally analogous.

Our estimation results show that the earthquake enhances the expectation of farmers hit by the disaster to receive emergency support from villagers of other religions. In addition, we find that a possible mechanism of this effect is farmers' experiences of receiving or observing support activities by organizations of other religions after the earthquake. However, this effect of the earthquake on farmers' perception is not observed when the atmosphere in their village is aggressive or when they used to live in the conflict zone as a member of one of the primary religious groups involved in the conflict. Furthermore, the heterogeneity in the effect depending on the types of disasters and damage is observed.

This paper contributes to the existing literature in four ways. First, a growing strand of literature shows the impact of disasters on the perception or preference of sufferers. Disasters or negative economic shocks have been found to change disaster victims' risk preferences (Bchir and Willinger 2013, Cameron and Shah 2015, Cassar, Healy, and von Kessler 2017, Chantarat et al. 2019, Eckel, El-

[3] For example, Caritas Makassar, a Christian organization, was reported on the next day to be already en route to the devastated areas from the place approximately 10 hours away by car.

Gamal, and Wilson 2009, Hanaoka, Shigeoka, and Watanabe 2018, Ingwersen 2014, Page, Savage, and Torgler 2014, Reynaud and Aubert 2014, Van Den Berg, Fort, and Burger 2009, Willinger, Bchir, and Heitz 2013), time preferences (Callen 2015, Cassar, Healy, and von Kessler 2017, Voors et al. 2012), trust (Andrabi and Das 2017, Cassar, Healy, and von Kessler 2017, Chantarat et al. 2019, Fleming, Chong, and Bejarano 2014, Shoji 2018a), altruism (Cassar, Healy, and von Kessler 2017, Castillo and Carter 2011, Chantarat et al. 2019, Samphantharak 2014, Voors et al. 2012), and subjective expectations of future disasters (Cameron and Shah 2015, Chantarat, Lertamphainont, and Samphantharak 2016, Chantarat et al. 2019) and intragroup social networks (Chantarat, Lertamphainont, and Samphantharak 2016, Chantarat et al. 2019). Although most studies on social preferences and perceptions focus on the change among homogeneous groups or neighborhoods without exploring the heterogeneity across the closeness in the relationship, there are some exceptions. For example, Fleming, Chong, and Bejarano (2014) and Andrabi and Das (2017) find a positive impact of disasters on trust in strangers and foreigners, respectively. In contrast, the city-level analysis by Drago, Belloc, and Galbiati (2016) indicates that the power of political-religious leaders was substantially enhanced by an earthquake. Our results add to the literature by providing evidence on improving interreligious perceptions in a divided society after a severe disaster.

Second, our outcome measure, the expectation for access to help from other groups in case of emergency, is closely related to risk sharing behaviors. When people in various groups expect support from each other in case of emergency, they count on each other as their safety net and thus can share their risks. In particular, in rural areas of developing countries, because formal insurance mechanisms and official safety nets by the government are insufficient, informal mechanisms, such as support from relatives or friends, play an essential role in overcoming negative shocks due to disasters and other events (Besley, 1995; Rosenzweig, 1988b; Rosenzweig and Stark, 1989; Fafchamps and Lund, 2003; Fafchamps and Gubert, 2007; Angelucci et al., 2018). Among various informal mechanisms, risk sharing across groups with different attributes and preferences is found to be more effective because different groups face different idiosyncratic shocks. However, such risk sharing relationships across heterogeneous groups are rarely constructed in practice because of the costs of network formation (Fafchamps and Lund, 2003; Fafchamps and Gubert, 2007). We empirically find that the earthquake led to both actual emergency support beyond religious differences and higher expectations for intergroup support in the case of emergencies, while keeping the expectation for intragroup support at the same level with those who did not suffer from the earthquake. These findings imply that disasters can help people expand their risk-sharing networks.

Third, this paper also relates to the literature on the macroeconomic impact of disasters (Cavallo et al. 2013, Hsiang and Jina 2014, Noy 2009, Noy and Nualsri 2007, Raddatz 2009, Strobl 2012). Some of the studies find a positive impact of disasters (Fomby, Ikeda, and Loayza 2013, Loayza et al. 2012, Sawada, Bhattacharyay, and Kotera 2011, Skidmore and Toya 2002). In particular, Toya (2014) points out that disasters improve all three dimensions of social capital, i.e., bonding, bridging, and

linking social capital, leading to economic growth after disasters. Our findings provide micro evidence that supports the positive impact of disasters on bridging social capital and thus one channel of post-disaster growth. Our finding is also in line with the argument in economics that ties with physically or topologically distant agents provide large benefits (Amiti and Konings 2007, Beugelsdijk and Smulders 2003, Frankel and Romer 1999, Keller 2004, Todo, Matous, and Inoue 2016).

Last, this study contributes to a series of studies that try to understand post-disaster changes in rivalry relationships and conflicts in divided societies. How disasters change conflicts in and between divided societies has long been discussed (Beardsley and McQuinn 2009, International Crisis Group 2005, Pandya 2006, Sukma 2006). Similarly, deterioration and improvement of relationships among rivalry countries after disasters have been observed, as summarized in Kelman (2011). However, those findings mostly rely on country- or subnational-level data or qualitative case studies, and empirical studies using micro data on post-disaster changes in rivalry are lacking. Thus, it is difficult to interpret the opposing effect of disasters observed in previous literature. This study examines interreligious relationships within a rural divided community, adds new evidence, and provides practical implications.

2. Background

2.1. Conflicts between Muslims and Christians

In Central Sulawesi, Muslims (77.72% in the 2010 census) and Christians (Protestant 16.98% and Catholic 0.82% in the 2010 census) are the two major religious groups. Although gulfs between religious groups did not exist in the precolonial period or pretwenties century, religious rivalries were developed by the 1980s through policies by the Dutch Indies government and the Suharto administration. During the period called *zaman gerombolan* in the 1950s and 60s, Muslim rebels tortured or killed Christians, and some Christians retaliated. It remains a sensitive memory to both Muslims and Christians in the region (Aragon 2014). From 1998 to 2001, religious conflicts between Muslims and Christians occurred in Poso, Central Sulawesi. Because of conflicts, approximately 1,000 people were killed, and tens of thousands of people expelled from Poso (British Broadcasting Corporation 2004). Although a declaration of peace was signed by both sides in December 2001, people throughout Central Sulawesi still suffer from sporadic violence. For example, in 2005, various incidents of bombing, shooting dead, or beheading Christians occurred in the province, and on December 31, 2005, a bombing attack at a market in Palu that was popular among Christians killed seven people and made approximately 45 people wounded allegedly by Islamic militants. In September 2006, three local Catholics were executed to incite violence against Muslims. On November 27, 2020, in Sigi Regency, a terrorist attack by Muslims killed four Christians and burned down eight houses in a Christian community. More incidents exist, and such interreligious violence can also be observed for other religions, such as bombing of a Hindus temple in Poso in 2006. Because

of such historical backgrounds, people are so sensitive to religious differences that they rarely expect interreligious cooperation, even in the case of emergency.

2.2. The 2018 Sulawesi Earthquake

This region was hit by the 2018 Sulawesi earthquake that occurred on September 28, 2018. The earthquake was reported to have a moment magnitude scale of 7.5 (Mw7.5) at a depth of 20.0 km, and shaking reached IX (VIOLENT) on the 12-point modified Mercalli intensity (MMI) scale (United States Geological Survey 2018). Earthquakes equivalently categorized in the MMI include the 2004 Indian Ocean earthquakes and tsunami and the Great East Japan earthquake in 2011. It was the second most devastative disaster in Indonesia since the 2004 Indian Ocean earthquakes and tsunami, following the 2006 Yogyakarta earthquake on Java Island. The 2018 Sulawesi earthquake also triggered tsunamis, liquefaction, and landslides. There were several foreshocks of the earthquake of Mw7.5, of which the largest one was an earthquake of Mw6.1 and hit just south of the epicenter of the Mw7.5 earthquake three hours earlier. Other foreshocks were weak. In addition, a series of aftershocks followed, but even the largest aftershock was Mw5.8 and did not result in additional large damage. The disaster caused 4,340 deaths, 1.5 million affected individuals, and economic damage of 1.45 billion USD (EM-DAT 2021, OCHA 2018).[4] The damage was concentrated along the Palu-Koro fault line, as explained in detail later.

Indonesia is prone to natural disasters such as earthquakes because it is located around the collision point of three tectonic plates. However, where and when a major earthquake strikes are unpredictable by today's science and technology (Asim et al. 2018).

3. Data

3.1. Survey

We conducted a post-disaster survey of households in two of the three worst-affected districts, the Sigi and Donggala regencies, Central Sulawesi Province, Indonesia, from July to August 2019. As mentioned above, these two regencies belonged to be the same regency until 2008, only a decade ago. In addition, cocoa farmers in the 13 targeted subdistricts (out of 31 subdistricts) in these regencies were universally surveyed by an agricultural NGO one year before the disaster based on the census of cocoa farmers, although it only collects agricultural information. Our survey targeted all 4,154 cocoa farming households surveyed by the organization. Among them, 90% joined our survey. In this study, we use only the post-disaster survey data we collected because of the lack of information required for our analysis of the pre-disaster data.

In 91% of the surveyed households, we interviewed the household head. If the household head

[4] Casualties and economic damage are taken from EM-DAT, while the number of affected is from OCHA.

was unavailable, another family member, mostly the spouse of the head, responded to the survey. The survey was implemented by local enumerators who speak the local language, Bahasa Indonesia, using a questionnaire translated from English to Bahasa Indonesia.

In the survey, in addition to standard questions about household characteristics, questions about expectations of possible emergency support from various sources were asked. Specifically, we asked the respondents to choose all actors they can ask for help when they are in trouble, such as when facing food or water shortages after natural disasters. The possible choices to the question include Christian organizations, Muslim organizations, Christians living in the same village, Muslims living in the same village, politicians, government officials, the village leader, and others. Thus, we can capture whether each respondent expects to obtain help from different religious groups in emergencies.

3.2. Variable Construction

Figure 1 depicts the geographic distribution of sample households, colored red, yellow, or green depending on the level of damage by the earthquake, as explained later. The two regencies stretch along the north-south direction and cover a considerably wide range of land areas, totaling 10,471.71 km^2, which is mostly mountainous. Accordingly, the households in our sample are clustered in several habitable regions located vertically on the map. Figure 1 also shows the epicenter of the mainshock, which is located close to the center of the sample households; dotted circles that show the distance from the epicenter; and all fault lines in this region provided by the GEM Global Active Faults Database by Styron and Pagani (2020). A long fault line in the center of the map, the Palu-Koro fault line, is quite close to some of the sample households, while it is not so close to others. The Sulawesi earthquake was a lateral-fault type earthquake that often concentrates physical damage along earthquake faults. The Palu-Koro fault line is the one that caused massive physical damage in the case of the 2018 Sulawesi earthquake (Geospatial Information Authority of Japan 2019). Accordingly, we observe large variations in the level of damage experienced by our sample households by the earthquake. In Figure 1, red squares representing fully destroyed houses are concentrated along the fault line, whereas green squares representing houses without any damage are often located far from the fault.

Based on this observation, we measure the intensity of the earthquake on each household by the minus log of the shortest distance from the Palu-Koro fault line to the household. We take minuses so that this measure is increasing in the degree of shocks to each household by the earthquake. In our data, although enumerators were supposed to record the longitude and latitude of each household surveyed, geolocation information is missing for 111 households, i.e., 2.98% of those who responded to the survey. In these cases, we measure the distance from the fault line by the mean value of the distance among households in the same village. Excluding these observations does not affect the baseline results, as we will explain later.

In some alternative specifications, we measure the intensity of earthquake shocks by the degree of

damage to houses. In our survey, we asked about the degree of damage to houses on a 5-point scale: no damage at all, some cracks on the wall, partly destroyed, half-destroyed, and fully destroyed. Using this item, we create a dummy variable that is coded one if the house was destroyed partly or more by the earthquake and zero otherwise.

To control for the potential effect of distance from the epicenter, we include the minus log of the distances from the epicenters of the main shock and the largest foreshock that occurred earlier on the same day. The epicenter information was taken from United States Geological Survey (2018).

In the questionnaire, we also have a multiple-choice question that asks "When you are in trouble such as food or water shortage after a natural disaster, who can you ask for help?" The answer options include Christian organizations, Muslim organizations, Christians living in the same village, and Muslims living in the same village, as well as options not related to religions such as village leaders. Combining the response to this question with the information about their religion, we create dummy variables that measure whether they expect intergroup emergency support from organizations in other religions and from villagers in other religious groups.[5] In addition, it should be noted that this question is hypothetical, and the respondents who received support from other religious organizations in the recovery process from the 2018 Sulawesi earthquake do not necessarily expect such intergroup emergency support in the future and vice versa.

In some specifications, we use an alternative outcome measure that captures whether the respondent counts the community members as a source of help in need, even if religious differences exist. Our data contain each household's helping network information. Specifically, we asked respondents to list all the people from whom they can borrow Rp. 500,000 (approximately 35 US dollars as of September 2021) when they face any difficulty due to, for example, illness, accidents, crimes, and disasters, and need money. Then, we further asked the respondents about attributes of the listed people, such as their relationships with the respondents, location, and religion. From the information, we create a dummy variable that is coded one if the respondent has named neighbors in different religious groups as a possible source of such support and zero otherwise.

3.3. Descriptive Statistics

Table 1 shows summary statistics. 20.1 percent and 12.5 percent of respondents expect that they can rely on villagers and organizations in other religious groups, respectively, to obtain emergency support. The minimum, average, and maximum distances from the Palu-Koro fault line are 0.03, 11.72, and 79.4 km, respectively. This implies that some of the households experienced quite strong tremors that caused significant damage, while others were far away enough to have no damage.

[5] For example, if a Muslim interviewee has selected Christian organizations and Christians living in the same village, then both dummy variables for the expectation for intergroup cooperation are coded one. If an interviewee is Hindu and select Muslim organizations, then only the first one, a dummy for such expectation toward other religious organization, is coded one. If a Muslim selects only Muslim Organizations, both dummy variables are coded zero.

Among the respondents to our survey, only 14.1 percent are female, possibly because we mainly surveyed household heads. More than half of them did not complete middle school. The average age among those who provided birth-year information is 45. Most of them (90.2%) never moved out of the regency in the past 20 years. A total of 1.2 percent of the respondents, dominantly Christians, used to live in Poso within the past 20 years. A total of 3.3 percent had lived outside Sulawesi Island within the past 20 years. Looking at their ethnicity, the shares of Kaili and Bugis, two major ethnicities, are 39.6 and 17.9 percent, respectively. The shares of Muslims and Christians are 50.2 and 31.3 percent, respectively. The average amount of annual cacao production is 636.9 kg, and less than 10 percent earn their income mainly from off-farm activities. According to PT Koltiva, which has a large database of Indonesian cocoa farmers, CocoaTrace, the demographics from our sample generally match the overall demographics of more than 160,000 cocoa farmers registered in CocoaTrace, although the female farmer ratio is slightly lower in our data.

4. Empirical Strategy

4.1 Conceptual Framework

In a society segregated into conflicting groups, mutual help between groups is not commonly expected. However, when a severe natural disaster impacts society, some people are in a critical situation where they lack essential goods and services, such as clean water, food, houses, and medical services. Then, they may have to ask people in another group for emergency help because people in the same group are similarly affected by the disaster. If they can successfully obtain support from the conflicting group,[6] they may positively revise their perception toward the group and expect possible assistance from the group in case of emergency in the future. As summarized in Delavande, Giné, and McKenzie (2011), past experience by individuals often predicts their expectations about future outcomes. Besides, experience of or information from others close to them is sometimes associated with their expectations. Even if they themselves have not received support from the conflicting group, but if their friends, relatives, or neighbors have received support from the group, they may also revise their perception toward the group positively. Therefore, people who suffered from a severe disaster may have higher expectations for emergency support from other groups than those who did not.

However, the mechanism of updates of individuals' perception may be more complex under uncertainty, as Kahneman et al. (1982) suggest. For instance, people tend to overvalue new information that is consistent with prior beliefs and satisfies their own current preferences and undervalue it otherwise (Kahneman et al. 1982, Nickerson 1998, Rabin and Schrag 1999). If this overvaluation is

[6] While we conducted the survey, we heard such stories in the devastated area of the earthquake. For example, a Muslim woman told us that she sought for water shortly after the 2018 Sulawesi earthquake and lined up for emergency water assistance, but she failed to obtain it from her fellow communities due to excessive demand. Therefore, she asked for help to an unfamiliar Christian organization distributing emergency aid supplies nearby, although she expected to be refused because of the historical background between Muslims and Christians. Then, she successfully obtained water from the Christian organization.

sufficiently large, people who received emergency support from other religious groups may stick to their prior belief that other religious groups would not help them and perceive the new positive signal as a coincidence. A new negative signal such as other groups' refusal to help may reinforce people's prior belief. In these cases, people who suffered from a severe disaster may have equal or lower expectations for emergency support from other groups than those who did not.

4.2. Estimation Methodologies

We estimate the impact of the earthquake on the expectations for possible emergency support beyond religious borders by ordinary least squares (OLS) using the following linear probability model with subdistrict and religion fixed effects, δ_s, δ_r, respectively:

$$ExpSupport_{i,2019} = \alpha + \beta_1 Earthquake_{i,2018} + X_{i,2019}\,\gamma + \delta_s + \delta_r + \epsilon_{i,s,r,2019}. \quad (1)$$

The dependent variable, $ExpSupport_{i,2019}$, is a dummy variable that measures whether individual *i* expects emergency support from organizations or villagers in different religious groups. *Earthquake* is a variable indicating the intensity of earthquake shocks measured by the minus log of the distance from the Palu-Koro fault line. The distance from the fault line is also used in previous literature (Andrabi and Das 2017). X is a vector of controls. We control the two major ethnicity dummies (Kaili, Bugis), female dummy, and religion dummies. The age of the respondent is also controlled. For people who do not know their age or whose age information is missing, we code age as 999. The dummy variable indicating the missing value of age is also included. We also consider the education level using the set of dummies that indicate the respondents' highest education status: elementary school incomplete, elementary school graduate, middle school graduate, high school graduate, and college graduate, setting no education as the baseline category. For some observations, education information is unavailable. In those cases, we created a dummy indicating that the education level was missing. Dummy variables for moving status in the last 20 years are also included. In particular, we considered whether each respondent had never moved out, lived outside Sulawesi Island for more than six months, or lived in Poso Regency in Central Sulawesi Province for more than six months. Poso regency is where the latest brutal conflict took place. In addition, to control the income level, total cacao production (kg/year), a set of dummies for the share of nonagricultural income (positive but less than half, half, more than half), and the interaction terms between the amount of production and each dummy for the share are included. All of the variables above are directly taken from the survey data unless otherwise mentioned. Distances from the epicenters of the 2018 Sulawesi earthquake and the largest foreshock that occurred earlier on the same day are also included as controls in the same form as the distance from the Palu-Koro fault. In estimation, we rely on robust standard errors clustered at the subdistrict level.

4.3. Identification Strategies

Our identification assumption is that the treatment variable *Earthquake*, or the distance from the Palu-Koro fault to each household, is exogenous. This assumption is likely to hold because earthquakes along the Palu-Koro fault line have been rare and unpredictable, as their recurrence interval is approximately 700 years over the past 2000 years (Bellier et al. 2001). However, there may be systematic differences between households living near active faults and others in their attributes. If unobserved characteristics of each household in error terms are correlated with the treatment variable, its effect on perception estimated by OLS is biased.

To check whether the above assumption holds, we conduct two types of tests. First, we conduct balance tests to confirm that our treatment variable is uncorrelated with observed household characteristics, regressing several variables on our treatment variable with a set of fixed effects. The results shown in Table 2 indicate that the treatment variable is not significantly correlated with cacao production of the household or the gender or education level of the respondent. However, there remains a possibility that the treatment variable is still correlated with unobserved characteristics, such as pre-disaster social preferences, but we cannot test the correlation due to lack of pre-disaster data. Therefore, we further conduct a placebo test, regressing the variable for post-disaster perception on the distance from an active dextral fault line in the same regency, other than the Palu-Koro fault line, as shown in Figure 1.[7] The results presented in Table 3 indicate that the effect of the placebo variable is statistically insignificant, suggesting that the distribution of individual perceptions toward other groups is generally unrelated to the distance from an active dextral fault. Therefore, we assume that prior to the 2018 Sulawesi earthquake, unobserved household characteristics that determine perceptions toward other groups are not correlated with the distance from the fault line that caused the 2018 Sulawesi earthquake.

5. Results

5.1. Benchmark Results

Table 4 shows the benchmark results from OLS estimations of equation (1). We first estimate the impact of the level of physical shocks by the earthquake, *Earthquake*, defined by the minus log of the km distance from the Palu-Koro fault to each household. We find in columns (1)-(3) of Table 4 that the effect of earthquake shocks on expectations for emergency support from villagers in other religious

[7] Placebo tests are originally referred to medical experiments to test the effectiveness of medicine by giving one group of patients an ineffective medicine or placebo and the other group possibly effective medicine. Accordingly, one basic way to conduct a placebo test in econometric analysis is replicating analysis using a fake treatment as the key independent variable, as explained in World Bank (2016). Although analysis using a fake outcome, such as pretreatment value of the outcome, as the dependent variable is sometimes called a placebo test in the literature. In this chapter, we use the term "placebo test" when we use a fake treatment variable as the key independent variable, because our data do not include pre-disaster information that can be used as a fake outcome variable.

groups is statistically significant.[8] The size of the coefficient in column (3) using the full set of control variables and fixed effects indicates that doubling the distance from the fault lowers the probability of positive expectation by 4.66 percentage points. Because its average probability is 20 percent (Table 1), this effect is economically significant. As shown in Appendix Table 1, such a significant change has not been observed for the expectation for village leaders or for those in the same religion.[9]

In columns (4)-(6) of Table 4, the effect of earthquake shocks on expectations for emergency support from organizations, rather than villagers, in other religious groups is estimated. Although the effect is positive and significant in column (4), it is not in columns (5) and (6) where fixed effects are included. These results imply that the earthquake may not have changed the expectation for support from organizations of other religious groups.

5.2. Robustness Checks

To check the robustness of the baseline results, we experimented with several alternative methods and specifications. First, our benchmark results are generated from OLS estimations of a linear probability model, following previous studies such as Drago, Belloc, and Galbiati (2016) to estimate the impact of earthquakes on socioeconomic outcomes. The linear probability model has an advantage over binary response models, such as logit and probit models. For example, with logit or probit models, all the observations for which the independent variables perfectly predict the outcome are dropped from the analysis. In our case, if the expectation dummy of all households in a particular subdistrict is zero or one, these households are dropped from the estimation. In addition, unlike estimators from linear probability models, fixed-effects logit estimators may be biased due to the incidental-parameters problem because the sample size for some religions or subdistricts is not large (Wooldridge 2002). However, we conduct logit estimations that correspond to columns (1) and (4) in Table 4. In the logit estimations, we do not use religion and subdistrict fixed effects to avoid dropping households with the same outcome within the religion or subdistrict as described above. The marginal effects evaluated at the means of all independent variables shown in columns (1) and (2) of Table 5 confirm the baseline results in columns (1) and (4) in Table 4 from the linear probability model.

Second, as explained in Section 3.2, when households lack information on their longitude and latitude, we replace the missing value of the distance from the fault line with its average within each village. In this robustness check, we drop these households without locational information, or 2.98

[8] In an alternative specification, we replace log of distance measures with quadratic form of distances. For 98% of observations, the effect of the distance on the expectation for villagers of other religions uniformly decreases in the distance, although the coefficient of the single term is only weakly significant.

[9] The reason why we do not observe any negative effect of the earthquake on the intragroup expectation, unlike Chantarat et al. (2019), is possibly because of a relatively high ratio of recipients of informal support, 39.5%, and a low ratio of those suffering from misallocation of support, only 12.4%, although 42.3% complain that aid allocation was not fair. Chantarat et al. (2019) observes 6% for the former and similarly limited support from other sources in a sample where 65% are flooded households. Similarly, Chantarat, Lertamphainont, and Samphantharak (2016) observe low ratios of receipt.

percent of all households, and repeat the baseline analysis. Columns (3) and (4) of Table 5 provide quite similar results to those of the baseline in columns (3) and (6) in Table 4.

Third, we experiment with an alternative treatment variable that measures the level of shocks of the earthquake. Our baseline treatment variable, the minus log of the distance from the fault line, may not adequately measure the level of damage to each household because geographic situations, such as the hardness of the ground, vary. Therefore, we alternatively use a dummy variable that takes a value of one if the house of a household was damaged partly, by half, or completely by the earthquake. This variable can measure the level of damage to each household more directly. However, because the quality of a house is endogenously determined by the household, including its unobserved characteristics that may also be correlated with its perception toward other groups, it should be emphasized that using the level of damage to houses may cause larger bias due to endogeneity than using the distance from the fault line. The results from the use of the alternative treatment variable are shown in columns (5) and (6) of Table 5. We find a positive and significant effect not only on the expectation for emergency support from villagers in other religious groups but also on that from organizations of other religious groups. The cause of the difference from the baseline result cannot be pinned down as mentioned above.

Finally, we use an alternative outcome measure based on each household's helping network. As explained in Section 3.2, this measure is a dummy variable that is coded one if the respondent named neighbors in different religious groups as a possible source of monetary support when she faces difficulties and zero otherwise. The results presented in Table 6 indicate a positive effect of the earthquake on reliance on neighbors of other religions, showing consistency with the results from the baseline outcome measure.

Overall, our results on the effect of the earthquake on the expectation for help from villagers of other religions are quite robust to various specifications, as shown in columns (1)-(3) of Table 4, columns (1), (3), and (5) of Table 5, and Table 6. In contrast, the effect on the expectation for help from organizations of other religions is positive and significant in column (4) of Table 4 and columns (2) and (6) of Table 5 but insignificant in columns (5)-(6) of Table 4 and column (4) of Table 5. One possible reason for the lack of robustness regarding the expectation for help from organizations of other religions may be insufficient variations in the distance from the fault line to each household once we control for subdistrict dummies. However, the difference between the longest and shortest distances within the subdistrict is on average 16 km. The mean, median, 75th percentile and 99th percentile of the distance in the subsample of damaged households are 5, 2, 6, and 24 km, respectively. Therefore, the distance from the fault line to households within each subdistrict is likely to vary sufficiently so that estimations of the effect of distance are possible. However, we are still concerned about the lack of robustness of the results using the expectation for help from other religious organizations and hence will hereafter rely on the more robust results using the expectation for help from villagers of other religions.

5.3. Heterogeneity

In this subsection, we will explore heterogeneity in the effect of the disaster on perception toward other groups, depending on the types of damage and disasters at the household level and characteristics at the household and village level.

Effect of Various Types of Damage and Disasters

First, we disaggregate the earthquake shock into specific damage types and explore the difference across types of damage. Specifically, we consider five types of damage to each household by the earthquake reported in the survey: damage to its house measured by a dummy variable to show if the house was destroyed partly or more; damage to its business assets measured by a dummy to show if the business assets were damaged so much that the damage negatively affected the production; loss of any household member, relative, or close friend; injury of the respondent; and injury of any household member, relative or close friend.

The results in Table 7 suggest that damage to business assets has a similarly positive effect to that of housing damage on the expectation for support from villagers in other religious groups, while loss of any household member, relative, or close friend has a negative and significant impact. This finding is consistent with Whitt and Wilson (2007), who find that stress due to the loss of any family member discourages cooperation among evacuees in the United States because such stress makes people turn inward-looking. In addition, the effect of own injury of the respondent or injury of any household member, relative or close friend is not significant at the 5-percent level. Overall, the results of Table 7 imply that although damage to physical assets by the earthquake promoted the expectation for help from people of other religions, loss of any close person led to the opposite effect, deteriorating perception toward other groups.

Second, we explore whether the effect differs by disaster type. The earthquake triggered landslides, tsunamis, fissures, liquefaction, and tremors. In our sample, all of the households reporting liquefaction also suffered from fissures. Therefore, we create three dummy variables indicating landslides, tsunamis, and fissures or liquefaction, including them as independent variables in addition to the distance from the fault line in the baseline equation. The results are presented in column (4) of Table 7. The effect of the distance from the fault line is similar to that in the baseline result in column (3) of Table 4. Landslide shows a significantly positive effect on the expectation for intergroup emergency support. However, the effect of the dummy for fissures or liquefaction is negative and significant. A total of 68.8% of households affected by a fissure or liquefaction in our sample lost people close to them, and the share is higher than that in households affected by any other disaster type. Therefore, we interpret that the negative coefficient of the dummy for fissures or liquefaction in this heterogeneity analysis is driven by the higher possibility of loss of close persons in the areas affected by a fissure or liquefaction. Castillo and Carter (2011) consistently point out that a shock that is too large might negatively affect cooperation. Tsunami does not show a significant effect.

Share of the Same Religious Group Members in Their Neighborhood

Third, religious homogeneity within the village may affect the change in the perception toward other religious groups. If most households in a village believe in one particular religion so that they helped each other after the earthquake but did not necessarily receive support from other religious groups, their view against intergroup cooperation may not have been improved. Moreover, if all households in a village share a religion, the expectation for support from people in the same village but in the other religions should be zero. In our sample, 11.15% of the sample households are located in villages where all respondents share a religion. Because our sample includes only cocoa farmers and excludes households with other professions, we cannot perfectly capture the share of each religion in each village. However, assuming that the share of each religion for cocoa farmers is similar to its share for all households, we create a dummy variable that is coded one if all the cocoa farmers in our sample belong to the same religion and zero otherwise. In other words, we assume that the dummy indicates whether the religious homogeneity of the village is quite high. Then, we include the dummy and its interaction term with the treatment variable, *Earthquake*, as independent variables and estimate equation (1) to examine how the effect of the earthquake varies depending on the religious homogeneity.

In column (5) of Table 7, we find that the coefficient of the interaction term is negative and significant, and the size is similar to that of the distance from the fault line. These findings imply that in villages with religious homogeneity, the effect of the earthquake on perception toward other religious groups is insignificant, as hypothesized above.

Past Experiences

Finally, we explore the impact of past experiences, such as those in previous severe natural disasters, and the religious conflict between Christians and Muslims in Poso, Central Sulawesi from 1998 to 2001. In our sample, some, mostly Christians, have lived in Poso in the last 20 years, i.e., during or after the conflict. They may have stronger hostility against their opponent group and may react differently to the earthquake. We create a dummy variable that indicates experiences in previous more severe natural disasters and another that indicates previous living experience in Poso and the interaction terms with the earthquake variable to estimate the effect of past experiences.

Using the whole sample, no interaction term in column (1) of Table 8 shows a significant effect, suggesting that on average, no heterogeneity in the effect of the earthquake was caused by experiences of living in a conflict area or past severe disasters. We further focus on the subsample of Christians for two reasons. First, in our sample, respondents who have lived in Poso are mostly Christians. Second, their experience during devastation in past disaster events may differ between Muslims, which make up the majority of the population, and comparatively fewer Christians. Even though the damage could be more severe at the individual level, the regional impact of disasters that struck during past decades was much smaller and gained less attention from other areas. Thus, available support from Christians may have been limited in the past events, and thus Christians might have had to rely on others, even

when majority Muslims could deal with the disaster only among support from their fellows. The results in column (2) of Table 8 indicate negative and significant coefficients of the dummy for the experience of living in Poso and its interaction with the earthquake measure, suggesting that Christians who lived in Poso were less likely to improve in perception toward other religious groups after the earthquake. We interpret this as showing that people with considerable hostility toward conflicting groups based on their lively experiences find it more difficult to overcome it even when they are provided an opportunity to receive from conflicting groups. In contrast, the coefficients of the dummy for experiencing any previous severe disaster and its interaction with the earthquake measure are positive and significant. These findings imply that Christians who experienced more severe disasters in the past were likely to have higher expectations for interreligious support than those without. In other words, the effect of disasters on perception toward other groups can be persistent, and thus, accumulating experiences of natural disasters can bring better perception toward others.

Atmosphere

Furthermore, we investigate whether the effect of the earthquake on the respondent's expectation for intergroup emergency support is affected by the atmosphere of her neighborhood. In villages where neighbors tend to be irritated and aggressive, people may be more pessimistic about the possibility of obtaining help from their neighbors. Because asking other religious groups for help is riskier in villages in a bad atmosphere than in calm and peaceful villages, people may be more hesitant to do so in the former type of village. To test this hypothesis, we measure the level of bad atmospheres in the neighborhood of each respondent by the share of villagers who answered that they often or quite often found people in their village and the surrounding areas getting easily irritated or having got into frequent arguments recently. Adding this variable and its interaction term with the earthquake variable into the baseline equation, we run the estimation. The result is presented in column (3) of Table 8, showing a negative and significant coefficient of the interaction term. This finding implies that a bad atmosphere in a village obstructs intergroup cooperation among people in the village and thus obstructs improvement in the perception toward others.

5.4. Mechanism

Finally, we explore the possible mechanism behind the better perception of the victims of the earthquake toward other groups, following the method of testing for mediation by Baron and Kenny (1986). We consider the receipt of intergroup support in the wake of the 2018 Sulawesi earthquake and the presence of such support in the respondents' villages as mediator variables. In our data, we can identify those who have received support from Christian organizations or from Muslim organizations at the household level. Using the information, we create a dummy variable that is coded one if the respondent received any assistance from organizations of different religious groups after the earthquake and zero otherwise. Furthermore, we calculate the share of recipients of such intergroup support in each village and create a dummy variable that is coded one if the share is 50% or higher.

Then, we examine the correlation of each of the mediator variables with our treatment variable representing the damage by the earthquake, *Earthquake*, and with our outcome variable representing post-disaster perception toward other religious groups, *ExpSupport*. In mediation analysis, if the correlation coefficient of Earthquake on *ExpSupport* is economically zero, it is considered a complete mediation. If the size of the coefficient is reduced but still different from zero, it is a partial mediation, and potentially additional paths can exist. Because identifying the conclusive mechanism is beyond this study, we aim to capture partial mediation. To test the joint significance of paths, we use bootstrap standard errors and bias-corrected confidence intervals with 5,000 replications that are recommended by Preacher and Hayes (2008).

The results are presented in Table 9. In column (1), as a reference, the relationship between the minus log of kilometer distance from the fault, *Earthquake*, and the expectation for emergency support from villagers in different religious groups, *ExpSupport*, is presented. The coefficient of *Earthquake* suggests that if the distance from a fault is doubled, *ExpSupport* decreases by 12 percentage points. This correlation is statistically significant. In columns (2) and (3), we confirm that *Earthquake* is positively correlated with the respondent's receipt and her neighbors' receipt of emergency support from organizations of other religious groups. In columns (4)-(6), we add the two support-related mediator variables into the estimation model used in column (1) and repeat the OLS estimation. The positive and significant coefficients for both of the support-related variables in columns (4)-(6) suggest that both their own receipt of support from organizations in other religious groups and the receipt of such support by many neighbors are associated with a better perception toward other religious groups. These findings imply that through receiving support from organizations of different religious groups, observing such support to neighbors, or hearing positive rumors of such support, people improve their impressions of religious groups different from theirs and positively update their expectations against villagers in those religious groups.

Similar positive effects are observed even if we limit our sample to households with housing damage caused by the earthquake, as shown in Appendix Table 2. Some may be concerned about the endogeneity of the mediator variables for the receipt of interreligion support. Unobserved characteristics in error terms such as the personality of respondents or their previous interactions with those in different groups may be correlated with the receipt of support. If this is the case, the estimated coefficient will be biased. To address this concern, we repeat the analysis using instrumental variable (IV) estimations. Specifically, as a set of instruments, we utilize a dummy variable indicating whether the majority of people in each village observed any organization of different religious groups (either Muslim or Christian organizations) after the earthquake and a dummy indicating whether the majority did not see any government or nongovernment organization after the earthquake. These dummy variables indicate the presence of support organizations in the respondent's neighborhood, rather than receipt of support from these organizations, and thus are determined by external factors, such as the level of damage at the village level and accessibility to the village, not by characteristics of each

household. Moreover, the dummies for the presence of support organizations are prerequisites for the receipt of support from them and thus are suitable instruments. The results from the IV method using these instruments shown in Appendix Table 3 are essentially the same as those presented in Table 9.

Moreover, the coefficient of the distance from the fault line in column (6) of Table 9 is not zero but much smaller than that in column (1) and statistically significant only at the 10-percent level compared with the significance level of 5 percent in column (1). These results suggest that the effect of damage by the earthquake on the expectation of emergency support from other religious groups is partially mediated by the direct and indirect experience of receiving support from other religious groups. This is further confirmed by the statistical significance of the indirect effects or the effects given to the outcome by the earthquake via the mediator variables presented at the bottom of Table 9. Therefore, we conclude that the earthquake provided its victims an opportunity to cooperate beyond religious differences, and their receipt of support from organizations of other religious groups or observation of such support to their neighbors led to higher expectations for future emergency support from other religious groups.

6. Discussion and Conclusion

Using household-level data collected in Central Sulawesi hit by the 2018 Sulawesi earthquake, this paper examines how experiencing a severe natural disaster changes perception toward others. This region is suitable for this analysis because psychological barriers to other religious groups are high due to the cruel interreligious conflict in this province that lasted until the early 2000s followed by sporadic attacks until recently. We find that people affected by the earthquake more severely tend to expect support from other religious groups in the future more. We interpret this result as showing that experiencing natural disasters can improve the perception of affected people toward other groups. Furthermore, our mediation analysis reveals that the better perception of the earthquake victims toward conflicting groups is partially driven by receiving support from the conflicting groups after the earthquake and observing such interreligion support to neighbors.

Our findings are consistent with the previous findings of positive effects of natural disasters on perception toward others outside their neighborhood by, for example, Fleming, Chong, and Bejarano (2014), and Andrabi and Das (2017). Our study extends the literature by finding a positive effect of disasters on perceptions toward conflicting groups within a village. Our conclusion is also in line with another experience in Indonesia in which the ethnic conflict in Aceh was resolved after the 2004 Indian Ocean Tsunami. In addition, our result implies that experiencing a severe disaster can expand social capital, including risk-sharing networks with groups with different attributes. Because positive effects of social capital on economic development are often found in the literature, our finding further supports existing studies that found a positive effect of natural disasters on economic growth at the country level (Skidmore and Toya 2002).

However, our results should be viewed with caution because we also find substantial heterogeneity

in the effect of the earthquake on perception toward other religious groups, depending on characteristics of damage by the earthquake, households, and villages. For example, while the effect of damage to houses and production assets by the earthquake on perception toward other religious groups is generally positive, the effect of loss of close persons is negative. When people were affected by fissures or liquefaction that caused major casualties by the earthquake, their perception toward other religious groups tended to deteriorate. Therefore, the possibility that a disaster can worsen perception toward others within a divided society should not be undervalued, especially when applying the baseline findings of this paper to disasters or devastated areas with more casualties; the 2018 Sulawesi earthquake reportedly caused 4,340 deaths to the 1.5 million affected people out of the total population of 2.9 million (Neilan 2018, OCHA 2018). In addition, we find that the victims of the earthquake who have lived in a region of major fatal conflicts were less likely to be different from people with little damage by the earthquake in their perception toward conflicting groups, possibly because of their substantial hostility against conflicting groups based on their lively experiences. Furthermore, we also find that the atmosphere of neighborhoods matters to the change in their perception. The heterogeneity in the effect of the earthquake on perception toward others found in this study may explain mixed results in the empirical literature on the effect of disasters on social relationships (Andrabi and Das 2017, Cassar, Healy, and von Kessler 2017, Castillo and Carter 2011, Chantarat et al. 2019, Fleming, Chong, and Bejarano 2014, Toya and Skidmore 2014).

This study provides a policy implication for emergency support after natural disasters. Emergency support by a particular religious, ethnic, cultural, or regional group should be provided not only to victims who are in or closely related to the group but also to victims in various groups. Such attempts will help expand risk-sharing networks, improve intergroup perception, and may lead to peace. However, to maximize the positive effect of intergroup support, additional care may be necessary for those losing their close persons.

Finally, we should mention several caveats of this paper. First, we assume that our treatment measure, the minus log of the distance from the fault line to each household, is not correlated with the error term of the estimation equation. Although we tried to justify our assumption by the balance tests (Table 2) and the placebo tests (Table 3), we cannot directly control pre-disaster perception due to a lack of data. Second, although our mediation analysis suggests that receiving or observing support from other groups is a possible channel of the effect of experiencing the earthquake on perception toward other groups, we do not show the complete mechanism. We leave more precise analysis of the mechanism to future research.

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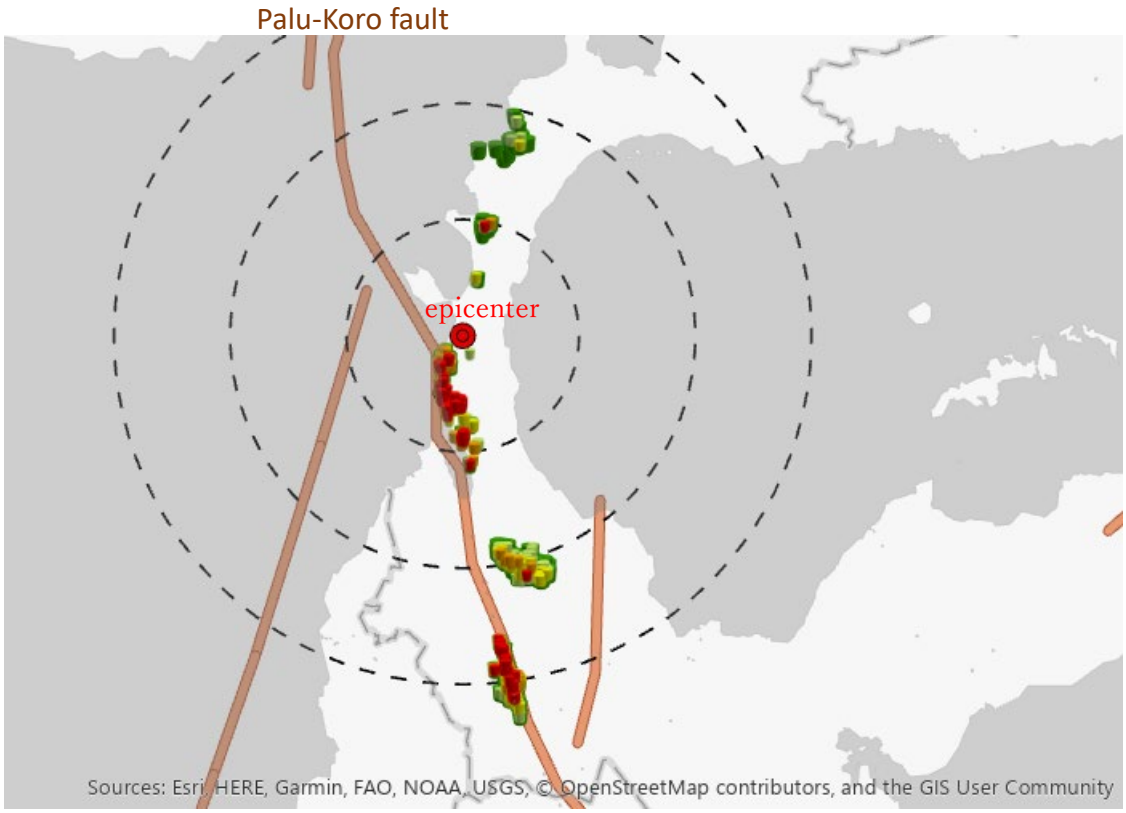
Figure 1: Distribution of housing damage



Note: Each pin indicates a household's location and is colored by housing damage rank, with red for fully destroyed houses, green for no damage, and colors close to green having less damage. Damage rank categories include fully destroyed, half destroyed, partly destroyed, cracks on the wall, and no damage at all. Lines in brown are active faults identified by the GEM Global Active Faults Database by Styron, Richard, and Marco Pagani (2020). The epicenter of the mainshock is drown in the center of the map with its concentric circles.

Table 1: Summary statistics

Variable	Mean	S.D.	Min	Max
Expectation for support from villagers in different religious groups	0.201	0.401	0	1
Expectation for support from organizations in different religious groups	0.125	0.331	0	1
km from fault	11.717	13.170	0.025	79.443
-ln (km from fault)	-1.867	1.165	-4.375	3.672
-ln (km from epicenter)	-4.459	0.692	-5.104	-2.116
-ln (km from epicenter of the largest foreshock)	-4.190	1.050	-5.013	0.867
Female	0.141	0.349	0	1
Muslim	0.502	0.500	0	1
Christian	0.313	0.464	0	1
Kaili	0.396	0.489	0	1
Bugis	0.179	0.384	0	1
College graduate	0.0190	0.136	0	1
High school graduate	0.187	0.390	0	1
Middle school graduate	0.262	0.440	0	1
Primary school graduate	0.383	0.486	0	1
Primary school incomplete	0.063	0.242	0	1
Age	45.391	11.179	17	114
total cacao production (kg/year)	636.855	530.080	0	8595
off farm income share (=half)	0.223	0.417	0	1
off farm income share (<half, >0)	0.206	0.404	0	1
off farm income share (>half)	0.098	0.298	0	1
never moved out in past 20 years	0.902	0.300	0	1
once lived outside Sulawesi for more than 6 months in past 20 years	0.033	0.179	0	1
once lived in Poso for more than 6 months in past 20 years	0.012	0.110	0	1

Note: Statistics for age are those for the subsample consisting of observations with age information.

Table 2: Balance Test

	(1)	(2)	(3)
Sample:	All	All	All
Method:	LPM	LPM	LPM
Dependent variable:	Total cacao production (kg/year)	Female	Middle school graduates or higher
- ln (km from fault)	-5.990	0.000	-0.000
	(48.641)	(0.015)	(0.030)
N	3,641	3,641	3,641
R-squared	0.132	0.057	0.050
Controls	No	No	No
Religion FE	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes

Note: Robust standard errors clustered at the subdistrict level are in parentheses. *, **, and *** signify statistical significance at the 10, 5, and 1% levels, respectively. As religion FE, we include the Muslim dummy and Christian dummy. While these data are basically cross-sectional, we have some panel structures for some agriculture-related items. Even when we use total cacao production from pre-disaster data, we do not observe any significant effect. Because the pre-disaster data have many missing values, 1053 out of 3641 observations, we prefer to present the result using the value for the year that includes the month of the earthquake in between, which was collected after the earthquake.

Table 3: Placebo Test

	(1)	(2)
Sample:	All	All
Method:	LPM	LPM
Dependent variable:	Expectation for emergency support from other religious groups	
Support from:	villagers	organizations
- ln (km from another fault)	-0.0261	-0.202
	(0.229)	(0.132)
N	3,641	3,641
R-squared	0.403	0.276
Mean Dep.	0.201	0.125
Controls	Yes	Yes
Religion FE	Yes	Yes
Subdistrict FE	Yes	Yes

Note: Robust standard errors clustered at the subdistrict level are in parentheses. *, **, and *** signify statistical significance at the 10, 5, and 1% levels, respectively. *Placebo* is measured by minus log of the distance from an active fault other than the Palu-Koro fault. As religion FE, we include the Muslim dummy and Christian dummy. Controls include age, dummy indicating if no information on age is available, ethnicity dummies (Kaili, Bugis), female dummy, dummies for the highest education achieved (college graduates, high school graduates, middle school graduates, primary school graduates, primary school incomplete, missing education information), total cacao production (kg/year), interaction terms between total cacao production (kg/year) and off-farm income share dummies, off-farm income share dummies (positive but less than half, half, more than half), residential history (never moved out, once lived outside Sulawesi Island, once lived in Poso), minus of log of the distance from the epicenter, and minus of log of the distance from the epicenter of the largest foreshock. Mean Dep.=mean of the dependent variable

Table 4: Baseline Results

	(1)	(2)	(3)	(4)	(5)	(6)
Sample:	All	All	All	All	All	All
Method:	LPM	LPM	LPM	LPM	LPM	LPM
Dependent variable:	Expectation for emergency support from other religious groups					
Support from:	villagers	villagers	villagers	organizations	organizations	organizations
- ln (km from fault)	0.120***	0.0484**	0.0466***	0.0944***	-0.0288	-0.0209
	(0.0320)	(0.0160)	(0.0137)	(0.0198)	(0.0254)	(0.0281)
Observations	3,641	3,641	3,641	3,641	3,641	3,641
R-squared	0.121	0.379	0.406	0.111	0.252	0.273
Mean Dep.	0.201	0.201	0.201	0.125	0.125	0.125
Controls	No	No	Yes	No	No	Yes
Religion FE	No	Yes	Yes	No	Yes	Yes
Subdistrict FE	No	Yes	Yes	No	Yes	Yes

Note: Robust standard errors clustered at the subdistrict level are in parentheses. *, **, and *** signify statistical significance at the 10, 5, and 1% levels, respectively. As religion FE, we include the Muslim dummy and Christian dummy. Controls include age, dummy indicating if no information on age is available, ethnicity dummies (Kaili, Bugis), female dummy, dummies for the highest education achieved (college graduates, high school graduates, middle school graduates, primary school graduates, primary school incomplete, missing education information), total cacao production (kg/year), interaction terms between total cacao production (kg/year) and off-farm income share dummies, off-farm income share dummies (positive but less than half, half, more than half), residential history (never moved out, once lived outside Sulawesi Island, once lived in Poso), minus of log of the distance from the epicenter, and minus of log of the distance from the epicenter of the largest foreshock. “Mean Dep.” indicates the mean of the dependent variable.

Table 5: Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	All	All	Subsample with full information	Subsample with full information	All	All
Method	Logit	Logit	LPM	LPM	LPM	LPM
Dependent variable	Expectation for emergency support from other religious groups					
Support from	villagers	organizations	villagers	organizations	villagers	organizations
- ln (km from fault)	0.116***	0.0774***	0.0428***	-0.0228		
	(0.0321)	(0.0212)	(0.0130)	(0.0285)		
housing damage (≧partly damaged)					0.136***	0.0533**
					(0.0361)	(0.0230)
Observations	3,641	3,641	3,547	3,547	3,641	3,641
R-squared			0.420	0.277	0.418	0.276
Wald chi2	11.69	7.60				
Pseudo R-squared	0.127	0.154				
Log pseudo likelihood	-1594.451	-1160.074				
Mean Dep.	0.201	0.125	0.202	0.127	0.201	0.125
Controls	No	No	Yes	Yes	Yes	Yes
Religion FE	No	No	Yes	Yes	Yes	Yes
Subdistrict FE	No	No	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the subdistrict level are in parentheses. *, **, and *** signify statistical significance at the 10, 5, and 1% levels, respectively. As religion FE, we include the Muslim dummy and Christian dummy. Controls include age, dummy indicating if no information on age is available, ethnicity dummies (Kaili, Bugis), female dummy, dummies for the highest education achieved (college graduates, high school graduates, middle school graduates, primary school graduates, primary school incomplete, missing education information), total cacao production (kg/year), interaction terms between total cacao production (kg/year) and off-farm income share dummies, off-farm income share dummies (positive but less than half, half, more than half), residential history (never moved out, once lived outside Sulawesi Island, once lived in Poso), minus of log of the distance from the epicenter, and minus of log of the distance from the epicenter of the largest foreshock. Mean Dep.=Mean of the dependent variable

Table 6: Alternative Dependent Variable

	(1)	(2)
Sample	All	All
Method	LPM	LPM
Dependent variable	Any neighbor in other religious groups in helping networks	
- ln (km from fault)	0.0128**	0.0146**
	(0.00580)	(0.00535)
Observations	3,641	3,641
R-squared	0.013	0.046
Mean Dep.	0.017	0.017
Controls	No	Yes
Religion FE	No	Yes
Subdistrict FE	No	Yes

Note: Robust standard errors clustered at the subdistrict level are in parentheses. *, **, and *** signify statistical significance at the 10, 5, and 1% levels, respectively. As religion FE, we include the Muslim dummy and Christian dummy. Controls include age, dummy indicating if no information on age is available, ethnicity dummies (Kaili, Bugis), female dummy, dummies for the highest education achieved (college graduates, high school graduates, middle school graduates, primary school graduates, primary school incomplete, missing education information), total cacao production (kg/year), interaction terms between total cacao production (kg/year) and off-farm income share dummies, off-farm income share dummies (positive but less than half, half, more than half), residential history (never moved out, once lived outside Sulawesi Island, once lived in Poso), minus of log of the distance from the epicenter, and minus of log of the distance from the epicenter of the largest foreshock. Mean Dep.=Mean of the dependent variable

Table 7: Heterogeneous Effect (1)

	(1)	(2)	(3)	(4)	(5)
Sample	All	All	All	All	All
Method	LPM	LPM	LPM	LPM	LPM
Dependent variable	Expectation for emergency support from villagers in other religious groups				
housing damage (≧partly damaged)	0.0977***	0.132***	0.0977***		
	(0.0273)	(0.0343)	(0.0278)		
big damage on business assets	0.0717***		0.0741***		
	(0.0191)		(0.0189)		
loss of family, relatives/close friends	-0.0924***	-0.0835***	-0.0705***		
	(0.0186)	(0.0168)	(0.0222)		
Injured	0.0958	0.103*	0.120*		
	(0.0575)	(0.0553)	(0.0643)		
family/relatives/close friends injured			-0.0396*		
			(0.0202)		
- ln (km from fault)				0.0583***	0.0510***
				(0.0126)	(0.0135)
landslides				0.267***	
				(0.0730)	
tsunamis				-0.0240	
				(0.181)	
Fissures/liquefaction				-0.0901**	
				(0.0326)	
dummy for homogeneous village					-0.109**
					(0.0419)
- ln (km from fault)×dummy for homogeneous village					-0.0524***
					(0.00984)
Observations	3,641	3,641	3,641	3,641	3,641
R-squared	0.427	0.424	0.428	0.446	0.407
Mean Dep.	0.201	0.201	0.201	0.201	0.201
Controls	Yes	Yes	Yes	Yes	Yes
Religion FE	Yes	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the subdistrict level are in parentheses. *, **, and *** signify statistical significance at the 10, 5, and 1% levels, respectively. As religion FE, we include the Muslim dummy and Christian dummy. Controls include age, dummy indicating if no information on age is available, ethnicity dummies (Kaili, Bugis), female dummy, dummies for the highest education achieved (college graduates, high school graduates, middle school graduates, primary school graduates, primary school incomplete, missing education information), total cacao production (kg/year), interaction terms between total cacao production (kg/year) and off-farm income share dummies, off-farm income share dummies (positive but less than half, half, more than half), residential history (never moved out, once lived outside Sulawesi Island, once lived in Poso), minus of log of the distance from the epicenter, and minus of log of the distance from the epicenter of the largest foreshock. Mean Dep.=Mean of the dependent variable

Table 8: Heterogeneous Effect (2)

	(1)	(2)	(3)
Sample	All	Christian	All
Method	LPM	LPM	LPM
- ln (km from fault)	0.0472**	0.108**	0.0544***
	(0.0170)	(0.0416)	(0.0158)
dummy for living experience in Poso	-0.0784**	-0.293***	
	(0.0348)	(0.0197)	
- ln (km from fault)×dummy for living experience in Poso	0.0161	-0.121***	
	(0.0675)	(0.0175)	
dummy for severer disaster experience	-0.0685	0.364***	
	(0.135)	(0.0923)	
- ln (km from fault)×dummy for severer disaster experience	-0.00764	0.244***	
	(0.0376)	(0.0427)	
bad-mood in village			-0.334***
			(0.0641)
-ln (km from fault) ×bad-mood in village			-0.112***
			(0.0191)
Observations	3,641	1,141	3,641
R-squared	0.406	0.273	0.411
Mean Dep.	0.201	0.172	0.201
Controls	Yes	Yes	Yes
Religion FE	Yes	No	Yes
Subdistrict FE	Yes	Yes	Yes

Note: Robust standard errors clustered at the subdistrict level are in parentheses. *, **, and *** signify statistical significance at the 10, 5, and 1% levels, respectively. As religion FE, we include the Muslim dummy and Christian dummy. Controls include age, dummy indicating if no information on age is available, ethnicity dummies (Kaili, Bugis), female dummy, dummies for the highest education achieved (college graduates, high school graduates, middle school graduates, primary school graduates, primary school incomplete, missing education information), total cacao production (kg/year), interaction terms between total cacao production (kg/year) and off-farm income share dummies, off-farm income share dummies (positive but less than half, half, more than half), residential history (never moved out, once lived outside Sulawesi Island, once lived in Poso), minus of log of the distance from the epicenter, and minus of log of the distance from the epicenter of the largest foreshock. Mean Dep.=Mean of the dependent variable

Table 9: Mediation Analysis

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	All	All	All	All	All	All
Method	LPM	LPM	LPM	LPM	LPM	LPM
Dependent variable	Expectation for emergency support from villagers in other religious groups	Receipt of interreligious support	Receipt of interreligious support by majority in village	Expectation for emergency support from villagers in other religious groups		
-ln (km from fault)	0.120***	0.136***	0.127***	0.0623**	0.0731**	0.0541*
	(0.0320)	(0.0303)	(0.0269)	(0.0265)	(0.0322)	(0.0282)
dummy for support from organizations of different religious groups				0.423***		0.316***
				(0.0963)		(0.0920)
dummy for share of those receive support from organizations of different religious groups≧ 50% in village					0.367***	0.178**
					(0.0864)	(0.0716)
Observations	3,641	3,641	3,641	3,641	3,641	3,641
R-squared	0.121	0.163	0.145	0.266	0.230	0.282
Mean Dep.	0.201	0.191	0.186	0.201	0.201	0.201
Controls	No	No	No	No	No	No
Religion FE	No	No	No	No	No	No
Subdistrict FE	No	No	No	No	No	No
Effect	Coef.	Bootstrap SE		95% Bias-Corrected Conf. Interval		
indirect effect via own experience of receipt	0.043	0.004		[0.036, 0.051]		
indirect effect via neighbors' experience	0.023	0.003		[0.016,0.030]		
total indirect effect	0.066	0.004		[0.058,0.074]		

Note: Robust standard errors clustered at the subdistrict level are in parentheses. *, **, and *** signify statistical significance at the 10, 5, and 1% levels, respectively. Mean Dep.=Mean of the dependent variable. Indirect effect via own experience of receipt indicates that via a mediator variable dummy for support from organizations of different religious groups, while indirect effect via neighbors' experience is that via a mediator variable dummy for share of those receive support from organizations of different religious groups ≧50% in village. They are calculated by multiplying the coefficients of each path involved. The total indirect effect is the sum of these calculated indirect effects.

Appendix Table 1: Impact on the expectation for other entities

	(1)	(2)	(3)	(4)
Sample	all	all	all	all
Method	LPM	LPM	LPM	LPM
Dependent variable	Expectation for emergency support from			
Belief about	villagers in the same religion		village leader	
-ln (km from fault)	0.195***	0.0368	0.0821	-0.0313
	(0.0672)	(0.0338)	(0.0480)	(0.0477)
Observations	2,969	2,969	3,641	3,641
R-squared	0.206	0.546	0.000	0.233
Mean Dep.	0.353	0.353	0.475	0.475
Controls	No	Yes	No	Yes
Religion FE	No	Yes	No	Yes
Subdistrict FE	No	Yes	No	Yes

Note: Robust standard errors clustered at the subdistrict level are in parentheses. *, **, and *** signify statistical significance at the 10, 5, and 1% levels, respectively. As religion FE, we include the Muslim dummy and Christian dummy. Controls include age, dummy indicating if no information on age is available, ethnicity dummies (Kaili, Bugis), female dummy, dummies for the highest education achieved (college graduates, high school graduates, middle school graduates, primary school graduates, primary school incomplete, missing education information), total cacao production (kg/year), interaction terms between total cacao production (kg/year) and off-farm income share dummies, off-farm income share dummies (positive but less than half, half, more than half), residential history (never moved out, once lived outside Sulawesi Island, once lived in Poso), minus of log of the distance from the epicenter, and minus of log of the distance from the epicenter of the largest foreshock. Mean Dep.=Mean of the dependent variable.

Appendix Table 2: Estimation of the impact of support using the sample of households with damage

	(1)	(2)	(3)
Sample	suffered	suffered	suffered
Method	LPM	LPM	LPM
Dependent variable	Expectation for emergency support from different religious groups		
Belief about	villagers	villagers	villagers
dummy for support from organizations of different religious groups	0.283***		0.206***
	(0.0468)		(0.0380)
dummy for share of those receive support from organizations of different religious groups≧50% in village		0.278***	0.158***
		(0.0261)	(0.0258)
Observations	2,338	2,338	2,338
R-squared	0.515	0.505	0.524
Mean Dep.	0.243	0.243	0.243
Controls	Yes	Yes	Yes
Religion FE	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes

Note: Robust standard errors clustered at the subdistrict level are in parentheses. *, **, and *** signify statistical significance at the 10, 5, and 1% levels, respectively. As religion FE, we include the Muslim dummy and Christian dummy. Controls include age, dummy indicating if no information on age is available, ethnicity dummies (Kaili, Bugis), female dummy, dummies for the highest education achieved (college graduates, high school graduates, middle school graduates, primary school graduates, primary school incomplete, missing education information), total cacao production (kg/year), interaction terms between total cacao production (kg/year) and off-farm income share dummies, off-farm income share dummies (positive but less than half, half, more than half), residential history (never moved out, once lived outside Sulawesi Island, once lived in Poso), minus of log of the distance from the epicenter, and minus of log of the distance from the epicenter of the largest foreshock. Mean Dep.=Mean of the dependent variable.

Appendix Table 3: Estimation of the impact of support with the IV method

	(1)	(2)	(3)	(4)
Sample	all	all	all	all
Method	IV	IV	IV	IV
Dependent variable	Expectation for emergency support from different religious groups			
Belief about	villagers	villagers	villagers	villagers
-ln (km from fault)	0.0845***	0.0775***	0.0910***	0.0841***
	(0.0243)	(0.0249)	(0.0280)	(0.0286)
dummy for support from organizations of different religious groups	0.445***	0.450***		
	(0.108)	(0.121)		
dummy for share of those received support from organizations of different religious groups≧50% in village			0.289***	0.289***
			(0.0619)	(0.0696)
Observations	3,641	3,641	3,641	3,641
R-squared	0.195	0.206	0.219	0.229
Mean Dep.	0.201	0.201	0.201	0.201
Controls	No	some	No	some
Religion FE	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes
Cragg-Donald Wald F statistic (weak identification test)	529.63	491.24	2934.31	2853.71
Wu-Hausman test P-value (endogeneity test)	0.001	0.004	0.906	0.873
Hansen J statistic P-value (Over identification test)	0.188	0.176	0.190	0.185

Note: Controls for this table are female dummy, Kaili dummy, Bugis dummy, total cacao production (kg/year), education level dummy (1 if middle school graduates or higher, 0 otherwise), age, and dummy for those without information on age. Subdistrict dummies are partialled out in estimating. The exogeneity of the dummy for the share of those who received support from organizations of different religious groups ≥50% in villages cannot be rejected. Mean Dep.=mean of the dependent variable