Social Capital Formation and Natural Disasters: Impact of Gorkha earthquake in Nepal

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Social Capital Formation and Natural Disasters: Impact of Gorkha earthquake in Nepal *

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Abstract

Even though social capital has been studied in various contexts, its effects on communities can still be explored further. Social Capital is sometimes described as shared norms, values, and understandings that facilitate cooperation between individuals. However, these norms can be affected by external shock. This research focuses on the effects of the Gorkha earthquake, which struck Nepal in 2015, generating one of the largest humanitarian crises in recent years. Within the framework of a randomized controlled trial (RCT) designed to measure the formation of social capital in the treated communities, I will try to assess the effects the earthquake had on social capital in two moments, five months, and two years after the earthquake. Working with two data sources: survey data and a set of Lab-in-the-Field behavioral games, I find that effects on usual proxies for social capital are different between periods. Shortly after the earthquake, people living closer than 200Km to the epicenter tended to trust more on others but seemed to trust less in people from their same village. After two years, there is a shift in the general trust trend, and they seem less trusting. In contrast, they experience higher levels of trust toward foreigners and the central government that did not appear in the short term. In terms of interpersonal relations, people living closer to the epicenter visited and got fewer visits from relatives and acquaintances after the earthquake. However, two years later, they tend to have higher interpersonal relationships measured by the number of times they met up with others in the last month.

Keywords: Social Capital, Natural Disaster, Behavioral Economics, Lab-in-the-Field Games.

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1 Introduction

Although widely studied in various fields and contexts, there is still much to learn about social capital and how it can empower individuals and communities. For instance, recent literature has found that social capital is a substitute for other types of capital, such as human and cultural capital (Coleman, 1988; Schuller, 2001; Robison et al., 2002), making it a focal point of study when analyzing communities as a whole, as well as how individuals behave in those communities. These norms and social values shared between individuals can be affected by external shocks such as new policies, laws, and natural disasters within others. Although some authors have tried to assert the link between natural disasters and how communities react to them regarding possible changes in social capital, the context varies significantly between studies. As mentioned in Claridge (2018), the context in which social capital is to be measured is critical to have a correct proxy of its value. This research focuses on the effect of the 2015 Gorkha earthquake in Nepal had on social capital in a sample of districts of the country.

The Organization for Economic Co-operation and Development (OECD) defines *social capital* as: "networks together with shared norms, values, and understandings that facilitate cooperation within or among groups" (OECD, 2001). This definition understands networks primarily as linkages, bridges, and bonds that connect individuals to other individuals and groups. Nevertheless, social norms and values are a less concrete concept behind this closed definition. When focusing on this part of the social capital definition, authors have used different proxies to assess and measure social capital, such as trust (Toya and Skidmore, 2014; Dussaillant and Guzmán, 2014; Cassar et al., 2017), collective action (Yamamura, 2013), and social cohesion and inclusion (Aldrich and Meyer, 2015).

To assess these measures accurately, I will be using the data of a randomized control trial experimental program directed by the World Bank in Nepal between 2014 and 2017 called Sunaula Hazar Din[1] (SHD) – Community Action for Nutrition Project. Although the main

[1] "Sunaula Hazar Din" translates into English as the "first 1000 days". It refers to the period between

objective of the SHD program was to enable Nepal to develop better knowledge, attitudes, and practices (KAP) to improve nutritional outcomes among children, the impact evaluation was also designed to measure whether participation in the SHD program could enhance social cohesion, a well-known proxy for social capital. The treatment was randomized at the Village Development Committees (VDCs) level.[2] At the beginning of the SHD study, there were 3,914 VDCs nationwide, and every VDC has nine wards (World Bank, 2016). The program was implemented in 15 districts (see Figure 1), and I will be working with 100 VDCs where the impact evaluation team from the World Bank conducted both Lab-in-the-Field behavioral games and regular household survey measures[3]. This accounts for a sample of $4,703$ people in the two survey waves available for the study, meaning that the available data is not a panel but a repeated cross-sectional dataset.

The Gorkha earthquake struck Nepal in April 2015. It killed nearly 9,000 people and injured about 22,300. Also, it displaced about two million people (Lizundia et al., 2017), causing one of the gravest humanitarian crises in modern history.[4] It left thousands of people homeless and dependent on the governmental and international response to the natural disaster consequences. Although its impact on material goods and damages has been estimated (see: Goda et al. (2015), Lizundia et al. (2017), Platt et al. (2020)), the effects of the Gorkha earthquake on community ties have been studied with limitations in the past. In a recent paper by Panday et al. (2021), the authors focused on the effects of the earthquake in three villages of two particular rural districts of Nepal (Gorkha and Sindhupalchok). By conducting multiple qualitative methods: Participatory Video (PV), semi-structured Key Informant Interviews (KIIs), and Focus Group Discussions (FGDs), authors explore issues

conception and 24 months of age when children are most vulnerable to malnutrition (World Bank, 2016, 2018)

[2]Nepal is administratively organized into units of decreasing size: regions, districts, sub-districts (illakas), municipalities (VDCs), and wards. Nepal has 75 districts, each of which is divided into several VDCs, the number depending on the population size.

[3]Appendix A, Figure A1 Panel (A) shows the VDCs in our sample according to their SHD treatment status and Panel (B) plots the selected VDCs for Lab-in-the-Field Behavioral games.

[4]It is important to mention that the earthquake took place approximately five months before the midline data collection of the RCT when the control group had not started treatment.

'with' the communities affected by the 2015 earthquake. Although relevant for the state of the literature, this study had limitations on sample size, which might lead to problems with internal and external validity. Therefore, its results must be addressed with caution, given that they cannot be taken as a causal effect study.

To the best of my knowledge, this is the first study performed on a larger sample of districts, focused on highly disadvantaged communities and under a Randomized Control Experiment (RCT) framework. I will use the measures collected on the SHD impacted evaluation and try to answer what role the 2015 Gorkha earthquake played in forming or destroying social capital studied in communities under the SDH program. This research directly relates to the literature regarding natural disasters and social capital. In this literature, authors use the occurrence of a natural disaster as an exogenous shock that is difficult to predict or control in most cases. Therefore, possible endogenous bias can be (to a certain extent) mitigated.

For instance, one of the most related papers under this literature is that of Yamamura (2013), which studies the Great Hanshin-Awaji earthquake that struck Japan in 1995. Based on an extensive individual-level database, the author investigates how the earthquake enhances the population's investment in social capital. This paper measures social capital through participation in community activities, expressly voluntary community-building projects. The author concludes that people became more likely to invest in social capital in 1996 than in 1991. The effects of the earthquake decreased as the distance from the epicenter to the individual's place of residence increased.

On the other hand, Toya and Skidmore (2014) studied how natural disasters could enhance societal trust, another well-known proxy for social capital. Authors find that overall societal trust increases in countries that experience significant disaster events, particularly storms. The authors found a robust positive relationship between trust levels and an overall measure of the previous period's disaster activity. However, it is relevant to mention that their analysis cannot be interpreted as a causal relation but rather as a strong correlation between these

events due to data-related restrictions.

In contrast, through experimental data from Thailand, Cassar et al. (2017) studied the relationship of trust, risk, and time preference after a natural disaster. Authors argue that disasters can transform living circumstances and lead to essential changes in individual preferences. Using a series of experiments to measure these changes in risk, pro-social behavior, and impatience, they measure the effects of the 2004 tsunami in rural Thailand. Their analysis suggests that preferences can be affected by disaster events and circumstances in the long term. In particular, their data suggest that natural disasters may cause affected individuals to become significantly more trusting, risk-averse, and impatient.

One last related paper analyzes how the 2010 earthquake in Chile served as an exogenous mechanism to build trust between neighbors and distant family members by promoting new trust networks (Dussaillant and Guzmán, 2014). The authors found that social capital levels were deficient before the disaster struck Chile yet varied significantly across the country. Consequently, this caused that when initial social capital is low, the impact of the trust-increasing effect is minor. Dussaillant and Guzmán concluded that the effects of the earthquake were not transitory but instead persisted and increased over time.

The contribution to this research's literature lies in the data source, as it comes from a randomized controlled trial environment with a more extended study period than most, if not all, of the previously mentioned research. Given both the multiple measures of social capital and the multiple settings for collecting them, this research has the potential to find a causal relationship between the natural disaster case studied and the formation (or destruction) of social capital. In the best case, this will allow us to conclude on a causal basis about the relationship between natural disasters and social capital formation and evaluate possible short- to long-term effects surrounding the proxies used. I will discuss the data and its possible advantages and limitations on subsection 2.1. Lastly, this research provides multiple measures of social capital in the context of a low-income country for an extended period, allowing me to conclude not only on the changes of social capital itself but also on some

particular dynamics of the relationship measured through time under negative shocks.

After the analysis, I found that most measures of social capital switch signs as time passes. General trust levels at midline seem to be higher than at endline. Nevertheless, when comparing the results for people from other ethnic or linguistic groups, we see that, at endline, respondents who lived closer to the epicenter tend to gain trust in strangers and people outside their village and traditions. In contrast, they perceive people from the same ethnic or linguistic background as less trustworthy and continue to have less trust in teachers and shopkeepers. In addition, traditional rural and remote places seem to have increased their feeling of trust towards the central government of Nepal. One possible reason this happened was that one of the most extensive relief programs for Nepal's reconstruction after the earthquake was unconditional cash transfers from the central government (McGoldrick, 2015; Nations, 2016). It is possible that as these rural villages had little contact or exposure to the central government in the past, they would not have had particular preferences about who or how public resources were spent. However, as they received different aid from the government and other multilateral organizations, their preferences changed, and are more engaged in political behaviors such as voting.

The rest of this research is organized as follows. Section two presents the data and statistical methods. Section three presents the results for the main specification. Section four discusses the results, and lastly, section five concludes.

2 Empirical Strategy

2.1 Data

The impact evaluations designed to measure the social capital under the SDH program had two mechanisms. First, a set of Lab-in-the-Field behavioral games and, second, a three-wave survey allowing a subset of measures typically used to capture social capital under the standard World Bank module. Through the first mechanism, the SHD impact evaluation team

implemented several behavioral games conducted in the field during the data collection periods. Respondents in all the households interviewed in the selected VDC were also invited to participate in the Behavior Game exercise, which measured social cohesion and cooperation, as well as trust and altruism. Of all eligible people who accepted this invitation, eight were randomly selected to participate. The behavior games were played in the same 100 VDCs at baseline, midline, and endline. However, the participating households were not necessarily the same. Therefore, the sample does not track a single individual through time but checks the VDC household's general feelings.

Four measures of social capital were derived from the behavioral games. Although there was only a footnote in the reports that addressed these changes, the games were adapted to resemble the design of Cardenas and Carpenter (2008). Bearing this in mind, Table 1 presents the balance of the Social Capital outcomes at the VDC level of aggregation from the behavioral games at baseline to set a broad idea of how the outcomes looked. Nevertheless, there is no accurate comparison given the change in the design. Both Table 2 and Table 1 present the balance results of the relevant outcomes and the means and standard deviations for the whole sample at the VDC level of aggregation. The sample is divided by a dummy variable (considered a "treatment" status) that accounts for those VDCs closer than 200Km to the earthquake's epicenter. This threshold was arbitrarily selected after a careful inspection of the proportion of households in self-reported affected wards distribution shown in Appendix A, Figure A3.[5] Figure 2 shows both the average level of VDC damage generated by the earthquake and reported in the Household surveys (Panel (A)) and the distribution of treatment status by distance (Panel (B)).

The first game measured trust and trustworthiness by pairing players from the same community. In the trust game, one of the players becomes a "sender" and the other a "receiver," but neither of them knows who the other player is. The sender and the receiver

[5]The midline survey had an extra module to measure the effects of the earthquake. I defined the threshold by analyzing the jumps in the distribution graph for various variables in said module. See Figure A2 for reference of the average level of destruction the sample used sustain according to the reports of the extra module.

get 12 rupees each (approx. 0.20 USD) to start, and the sender decides how many of his 12 rupees to send to the receiver. A triple the amount sent by the sender will be given to the receiver, and the receiver will decide how much to send back to the sender. The amount sent by the sender serves as a proxy for the trust level towards community members, and the amount sent back by the receiver indicates the trustworthiness level.

Comparing the results from Cardenas and Carpenter (2008) to the midline statistics[6] in the SHD midline sample, the average fraction sent for first movers was 37% which is low compared to the nearly 50% found in the literature. In contrast, the trustworthiness measure shows that second-movers return 30% of what they received in the literature, while in this survey round, the return rate was around 67%. This is translated into a return ratio that has an average of 2, while in the literature is between 1 and 1.5 (see: Table A1). At baseline and midline, there are no significant differences between communities closer to the earthquake's epicenter and those further away.

The SHD team implemented a *Voluntary Cooperation Mechanism* game to measure cooperation. Each player receives five cards and can (secretly) contribute as many as they want to a public pot, and the rest will go to a private pot. For each card in the public pot, all players will get 3 rupees each; and for each card in the private pot, the specific player will get 12 rupees. Therefore, the more people contribute to the public pot, the better it gets, but an individual player might do better if they decide not to contribute.[7] In this case, the average contribution of the players to the public pot was about 51% of their initial endowment at midline. This is consistent with the findings of Cardenas and Carpenter (2008). In this case, there is a significant at the 10% level difference between communities closer to the epicenter than those further away at baseline. However, this difference does not hold at midline.

[6] A more preferable and valid comparison given the differences in design at baseline.

[7] The cooperation game changed compared to the baseline game played. At baseline, each player is given one blank card and another card with an "X" sign – representing a public good - and is instructed to turn in one of the two cards. For each "X" card that is turned in, every person in the group receives four rupees. For those players that kept the "X" card, however, they receive 20 rupees in addition to the amount determined by the number of "X" cards turned in. The public goods game measures how much each player is willing to contribute to the collective good of the community.

In order to measure the altruism level in each community, a dictator game was conducted. In the game, each player is given 40 rupees (approx. 0.60 USD) and decides how much they will donate to a needy family in the community. The measure for altruism from the "Dictator game" is that players donated on average 40% of their endowment to the family in need at midline. This is in line with the usual findings in the developing world (Cardenas and Carpenter, 2008).

All game players were interviewed prior to the start of the games, as well as those not selected to play. As I mentioned, there were three lines of surveys. The baseline survey was conducted before the intervention started between August 2013 and early January 2014. The SHD intervention began in early 2014, and the VDC sample was randomly divided into two groups. The first group started treatment immediately ("Early Starters"), and the second group acted as a pure control until midline. Then the World Bank conducted a midline survey about two years after the first survey (between August 2015 and September 2015) and five months after the earthquake. After midline, the control group started treatment (also referred to as "Late Starters"). Lastly, endline was conducted three years and eight months after the baseline survey (April through June 2017) and about two years after the earthquake first happened. These surveys included a subset of measures typically used to capture social capital under the standard World Bank module. I have grouped three sets of variables corresponding to trust and trustworthiness, public goods and cooperation, and interpersonal relationships. Table 2 presents the outcomes in each group and the balance at baseline, taking into account the distance from the earthquake's epicenter. We can observe significant differences in general trust (p-value: 0.083), trust in people from the same village (p-value: 0.096), In-group and out-group trust (p-values 0.073 and 0.006, respectively), and the level of trust strangers (p-value: 0.007) for the first group of outcomes. There is also a significant difference in political behavior, measured by reporting having voted in the last election (p-value: 0.065). Lastly, having people over or visiting them at their homes also shows a significant difference (p-value: 0.001 in both cases). Given significant differences in

some of these outcomes at baseline, I will be running a series of specifications that control for the average of the outcome at baseline by VDC, which resembles a sort of ANCOVA specification to account for these differences.

In each of the three groups and following the methodology for summary index used in Anderson (2008), I pooled multiple outcomes into a single measure for each assessment. A summary index or Anderson Index is a weighted mean of several standardized outcomes. The weights are calculated to maximize the amount of information captured in the index. This method is robust to over-testing because each index represents a single test; therefore, the probability of false rejection does not increase as additional outcomes are added to the index (Anderson, 2008). Another advantage of the summary index includes a statistical test for a program's "general effect" on a set of outcomes. Additionally, it is potentially more potent than individual tests at attaining statistical significance due to the multiple outcomes that approach marginal significance as they are being aggregated into a single index.

In addition to these two data sets, I have mapped a dataset that will include the spatial information at the VDC level for relevant variables regarding the Gorkha earthquake. It includes variables to identify the intensity and distance from the earthquake's epicenter and other information that might affect social capital formation at this level of administrative aggregation.

2.2 Methodology

In order to estimate the effect of the Gorkha earthquake on the social capital for the survey-related outcomes, I will run the following econometric specifications. First, I will discuss only the effects of the earthquake as shown in Equation 1, where $y_{ir,t}$ is the social capital outcomes for the individual, i, in VDC, r, in time, t, that can be midline or endline, $\bar{y}_{r,b}$ is the average by VDC of the dependent variable at baseline, and T_r signals whether the household is at a distance less than equal to 200 Km from the epicenter of the earthquake. Z_r is a vector of VDC controls that do not vary over time, including the variable through which the treatment

for SHD was assigned. Lastly, ε_{rt} is an error term with probabilistic distribution $N(0,1)$.

$$y_{i,r,t} = \theta_0 + \theta_1 T_r + \theta_2 \bar{y}_{i,r,b} + \gamma Z_r + \varepsilon_{i,r,t} \tag{1}$$

In order to review the results for the Lab-in-the-Field games, I will be running a similar specification but without the baseline outcome lag, given the difference in the implementation of the first survey wave. For these outcomes, I will additionally be controlling for the risk aversion measure calculated by the experimental games survey. Equation 2 shows the econometric specification for this section. For both equations, the coefficient of interest would be θ_1, which accounts for the effects of the earthquake.

$$y_{i,r,t} = \theta_0 + \theta_1 T_r + \gamma Z_{r,t} + \varepsilon_{i,r,t} \tag{2}$$

As an additional exercise, I conducted an analysis that will try to account not only for the earthquake effects on the formation of social capital but also for possible treatment effects and spillover from the SHD program. Equation 3 and Equation 4 show the specifications run for the survey-related outcomes and for the behavioral games, respectively.

$$y_{i,r,t} = \theta_0 + \theta_1 T_r + \theta_2 SHD_r + \theta_3 T_r SHD_r + \theta_4 \bar{y}_{i,r,b} + \gamma Z_r + \varepsilon_{i,r,t} \tag{3}$$

$$y_{ir,t} = \theta_0 + \theta_1 T_r + \theta_2 SHD_r + \theta_3 T_r SHD_r + \gamma Z_{r,t} + \varepsilon_{i,r,t} \tag{4}$$

Where the coefficient for SHD_r is the effect of being in an early treated VDC (early starters), and the coefficient for the interaction term accounts for the effect of being in an early treated VDC and being closer to the epicenter of the earthquake. For this analysis, I would like to further understand the role of Community-Driven Development (CDD) programs, such as SHD, on the formation of social capital. The results for all the outcomes mentioned before can be found in Appendix A

The main assumptions that must hold for the estimation to work depend mainly on the exogeneity of the earthquake as an external shock. First, the intervention was unrelated to the outcome at baseline, meaning that the treatment allocation was not determined in any way by the earthquake. This assumption must hold, given that the randomization of the treatment was performed at least a year and a half before the earthquake. Hence, the earthquake represents an external shock with no significant relation to the treatment assignment. To further assess this hypothesis, I conducted an Instrumental variable analysis, instrumenting the self-reported measure of being affected by the earthquake gotten by the additional module in the midline survey by the distance dummy mentioned in previous equations (T_r) or the VDC's centroid distances to the earthquake (continuous variable). The results were inconclusive to support the assumption due to a weak instruments problem.[8]

3 Results

3.1 Lab-in-the Field Measures

Columns (1) and (2) of Table 3 account for the results of the trust game. At midline, we observe that the fraction of money sent (trust measure, column (1)) by the players closer to the Epicenter increases by 1.8% compared to the control mean but is not statistically significant. However, at endline this behavior shifts signs and becomes statistically significant at the 1% level. Players at VDCs closer to the earthquake's epicenter send 9.3% less money as a fraction of their endowment to their receiver than their counterpart. In contrast, at midline, players that take the role of receiver send back 8.7% less money (as a fraction of what they were sent), showing that they are less trustworthy. At the endline survey, the fraction of money sent back is even smaller (11.1% less than compared to the control mean). Hence, we observe that the earthquake might have negatively affected social capital

[8]I tried different measures for the instrument, including a polynomial form, but the Wald F-statistics were too little to have a conclusive argument to support the assumptions. The results for the different specifications can be seen in Appendix B.

formation trends measured through trust. First, we observe that in the short run, players closer to the earthquake epicenter were more generous with the fraction of money they sent to their counterparts. However, in the long run, they were less inclined to trust that the other player would return the money. Second, in the short and long run, people are less inclined to share the money they receive even when their payoff is a multiple of the money sent to them by someone in their community, showing lower levels of trustworthiness.

Column (3) of the same table shows the results of the Cooperation Mechanism game. In the short run, people closer to the epicenter are less inclined to cooperate and contribute to providing public goods to their community (4 percentage points (pp) less than their counterparts further away). Nevertheless, at endline, players contribute 2pp more cards to the public good pot compared to the control group. However, none of these effects are statistically significant.

Column (4) shows the results of the dictator game, which is the measure of altruism. In this case, players closer to the natural disaster epicenter at midline contribute 0.001 standard deviations (sd) more than those in the control group. However, at endline, players in these places send about 0.04 sd less money than those further away from the epicenter. Nevertheless, these results are not statistically significant.

3.2 Household Survey Measures

Trust

Table 4 and Table 5 show the results of the main specification estimates on the trust outcomes group. Column (1) of Table 4 presents the results for the general trust level. At midline, people who live in VDCs closer to the disaster's epicenter were 7.1pp more likely to say they trust people. However, at endline, the coefficient of interest changed signs, making people closer to the epicenter 3.5pp less likely to say they generally trust people. Neither of these results is statistically significant. Columns (2)–(4) show the results on trust outcomes specific to people from the same village. Five months after the earthquake, there appears to be a

decrease in general trust in people from the same village (0.7pp), but the coefficient is not statistically significant. Moreover, respondents closer to the disaster zone are less likely to think others would take advantage of them when given a chance (10.4pp). They are less driven to think people would not pay back when lent money (6.8pp); these coefficients are statistically significant, at least at the 5% level. Two years after the earthquake, people from the same VDCs closer to the epicenter think that the people from the same village can be trusted to a greater extent (2.3pp). In contrast to the midline results, respondents think people are more likely to take advantage of them when given a chance by 1.1pp, but it loses its statistical significance. Lastly, the respondents at endline still think that people from the same village would not pay back the money lent to them but to a lesser extent (Midline: 5.5pp).

On the other hand, in- and out-group trust seem to be negatively affected five months after the first earthquake. Participants in nearer VDCs consider that both people from their same ethnic or linguistic group/race/caste/tribe (in-trust) or different groups (out-trust) can be trusted to a lesser extent (4.4pp and 4.2pp). The result for in-trust seems to maintain its sign at endline in contrast to the out-trust coefficient. At endline, participants are more likely to trust people from other ethnic or linguistic groups in about 2.7pp. This result is statistically significant at the 10% level.

Additionally, each column in Table 5 shows the trust level for different professions or groups of people. The household surveyed asked to which extent the respondent trust each category. According to the results, at midline, people who lived at VDCs closer than 200 Km to the epicenter of the earthquake tended to have higher levels of trust in shopkeepers (3.5pp) and the police (0.9pp) and trust less in the local and central government (2.3pp and 4.6pp, respectively), teachers (6.7pp), medical personnel (5.2pp), and people from other countries (2.8pp).[9] Moreover, at endline, almost two years after the earthquake, people changed their tendencies to trust shopkeepers, the local and central government, and foreigners. People

[9]Only the coefficients for Teachers and Nurses and Doctors are statistically significant.

living in VDCs closer to the disaster area are 7.7pp more likely to trust the country's central government (statistically significant at the 1% level) than the control. Furthermore, their trust in strangers from other countries also increased on average by about 15.1pp.

Public Goods and Political Behavior

The results regarding behavior towards public goods provision and political behavior can be found in Table 6. Columns (1)–(3) show the likelihood that people in the respondent's village are willing to spend time or resources on activities that generate community well-being. As can be observed from column (1), five months after the earthquake, people in VDCs closer to the epicenter report thinking it is 4pp less likely that their neighbors are willing to help them if they are in need. This effect is reduced in magnitude two years after the earthquake but maintains the negative sign. Although, they are not statistically different from 0.

Column (2) presents the results on whether the respondent believes the community would punish a member if they did not participate in community activities. At midline, people living in VDCs closer to the epicenter think it is about 4pp less likely that a punishment for not participating will occur. However, at endline, the coefficient's magnitude and sign change. Respondents are inclined to believe that punishment is 9.5pp more likely at any level of statistical significance. Column (3) refers to the respondents' beliefs on whether people from their village would work together to solve a common problem, precisely a problem related to the water supply.[10] In this case, respondents who live closer to the epicenter think it is, on average, more likely that people would work together to solve such problems (1.3pp) at midline. However, the general feeling changes by endline, making it less likely by 2.3pp than the control group.

Regarding political behavior, column (4) shows that between midline and endline there was a shift in having voted in the last election. A few months after the earthquake, people in closer VDCs report voting less on average than those further away from the epicenter.

[10]The question reads: "If there was a water supply problem in this community, how likely is it that people will cooperate in trying to solve the problem?".

Regardless, this effect is not statistically different from 0. In contrast, two years after the earthquake, people in closer VDCs are 16pp more likely to have voted in the last election. This effect is significant at any level usually used in literature.

Interpersonal Relationships

For the outcomes of the interpersonal relationships, the household survey asks how many times in the last month the person either met up with a person in a public place, how many times they received visitors at home, or visited someone at their home. On average, respondents who live nearer than 200 Km to the epicenter at the midline met 0.45 times more with people in public places (column (1)), received 0.71 times fewer visits to their house (column (2)) and went to other people's homes 1.01 times less (column (3)), than the respondents living at VDCs further away. None of these coefficients are statistically different from 0.

In contrast, at the endline, personal relationships and visiting trends seem to have shifted on average. Respondents closer than 200 Km to the epicenter met up in public places in about the same order of magnitude as they did in midline (about 0.41 times more than the control group). However, two years after the earthquake, people closer to the epicenter tend to receive visitors 1.8 more times than those in the control group and visit people in their homes almost 2.4 times more than their counterparts. These last two effects seem to be significant at any level.

Anderson Index

As was mentioned before, I have calculated a summary index to account for possible over-testing problems. Table 8 presents the results of such indexes. Column (1) presents the estimation results for the Anderson Trust Index. It includes all the variables presented at Table 4 and Table 5. Column (2) presents the results of the Public Goods (Cooperation) Index. This case includes only the first three outcomes in Table 6. Lastly, column (3) presents

the summary index for the three outcomes in the interpersonal relationships section.

At midline, we observe a null effect for all three indexes. However, when focusing on the endline estimates, all three coefficients are positive in sign and statistically significant. The trust index is 13 points higher for people who live closer to the epicenter than those who live in VDCs more than 200 Km from it. On average, the public good index is 10 points higher than that of people further away. These coefficients changed both sign and magnitude compared to the midline result. Lastly, the interpersonal relationship index for people closer than 200 Km to the epicenter is almost 21 points higher than their control counterpart.

4 Discussion

The main objective of this paper was to understand the possible effects the Gorkha Earthquake had on social capital. Through various methods to measure it and considering the setting for the data, I expected to overcome the usual problems found in the literature by estimating a causal effect rather than examining a correlation between the outcomes and the natural disaster event. As it has been stated plenty of times in the literature, one of the main reasons there is still room for learning on this topic is that there is no consensus in the literature on a single definition and measuring strategy for social capital.

When analyzing the results for trust outcomes, I observed a shift in the trend of the feeling of trust and trustworthiness across both the Lab-in-the-Field games and the survey response. About five months after the earthquake, people were more inclined to trust others even when their perception of trustworthiness over them was less intense than before. These might be a direct effect of the earthquake and the perceived losses respondents had. On the one hand, they find themselves in a vulnerable situation and rely more on one another (In-group trust). However, most people need help and can not give much in return. Another possible scenario is that help might be perceived as a finite resource, explaining the negative signs on their perception of people from the villages taking advantage of them or not paying

back the money they borrowed. These results seem to align with the ones found in Cassar et al. (2017). In the short run, people tend to increase their trust in others. However, as time passed after the earthquake, people became less trusting of others. They also continued to perceive that other people in their same village were less trustworthy and started trusting more in strangers or foreigners than people closer to them, such as shopkeepers and teachers. A surprising result is a sudden increase in trust towards the central government and the reported turnout on the last elections before the endline survey.

A possible explanation for both trusting more in foreigners and the central government could be that the amount of exposure of people from rural Nepal had to strangers and the central government presence before the disaster was minimal (Nations, 2016). As humanitarian response increases in various rural zones and with it the exposure to these organizations and people, they may perceive their new presence and the help they bring as a nudge towards trusting them (see McGoldrick (2015); Nesbitt-Ahmed (2017); Rabi et al. (2015)). Likewise, the extended presence of the central government in deeply rural Nepal could have affected their political behavior. A possible response is that after the disaster and the new governmental presence, people are more involved and interested in holding the government accountable and maintaining the benefits gotten during this period.

Similarly, cooperative behavior seems to be affected differently between the short and the long run observed in the data. While the perceived likelihood of people from the village working for a common goal seems to have decreased as more time has passed since the earthquake, the community seems to be more willing to punish those who do not participate or engage in community-based activities. This may be because people became more engaged in providing services to other people in their village during the post-earthquake reconstruction period. This result is in line with those found in Yamamura (2013), yet the magnitude is smaller in my case.

Lastly, it seems that interpersonal relationship behaviors experienced a valley moment after the event. People in VDCs closer to the epicenter tended to visit or share less with their

acquaintances at home and in the homes of others. However, two years after the earthquake, we can observe that interpersonal ties are strengthened again. On average, people who lived closer to the epicenter tend to visit their acquaintances more and receive them more often in their homes. Even if I do not have a clear explanation as to which mechanisms could explain these shifts in behavior, it would be interesting, in future research, to explore possible mechanisms.

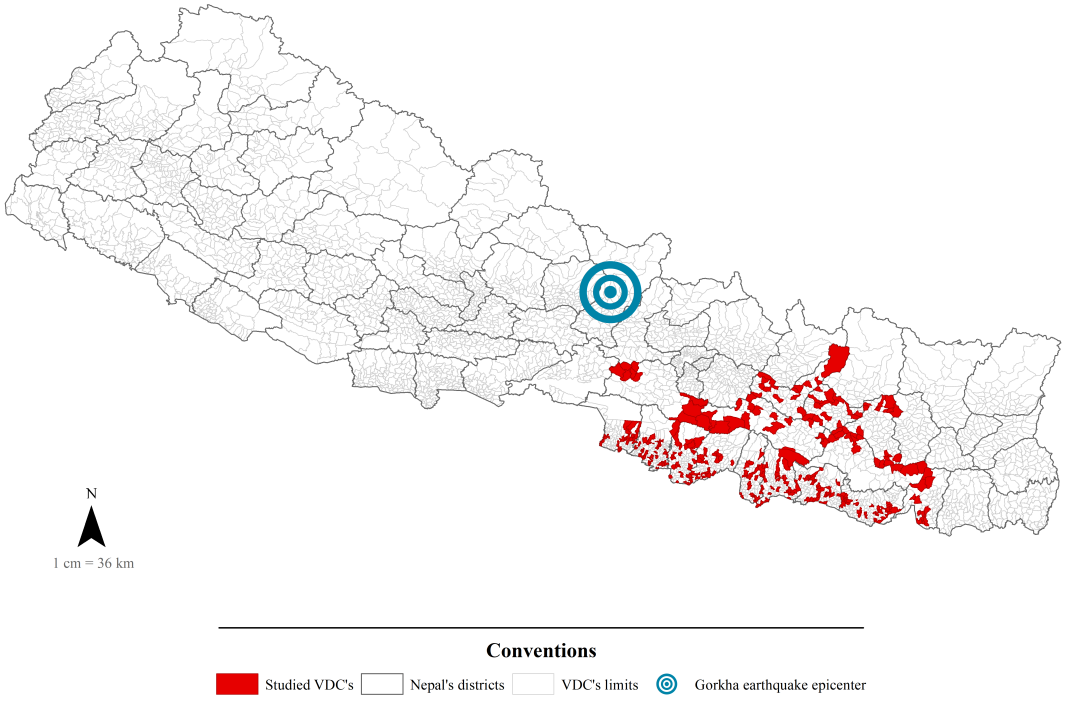
5 Conclusion

Although there is a clear relationship reviewed in the literature that states a strong correlation exists between the distance to the epicenter of the earthquake and the damages sustained by a particular place. It is also true that distance might not be the only variable that affects this damage level. Altitude, soil characteristics, and other geographical characteristics might also be of value when trying to understand the level of damage observed in a community, not only in monetary damages. On the other hand, another critical indicator of possible social capital formation is how much social capital the community had before the external negative shock (Dussaillant and Guzmán, 2014; Yamamura, 2013).

Even if the expected results for the program and the accurate measurement of social capital formation were not met, possibly because of data-related limitations, long-term social capital formation results are still interesting. First, there is a clear shift in behavior in the short versus the long term when analyzing different measures of social capital. Second, even though in very limited cases the results have proven to be statistically significant, the summary indexes proved that at least two years after the natural disaster happened, the results found are probably not a false positive result given that these checks are robust to over-testing. Finally, it opens the door to further research that would be needed to understand the mechanisms through which these results have come to be in the short and long term.

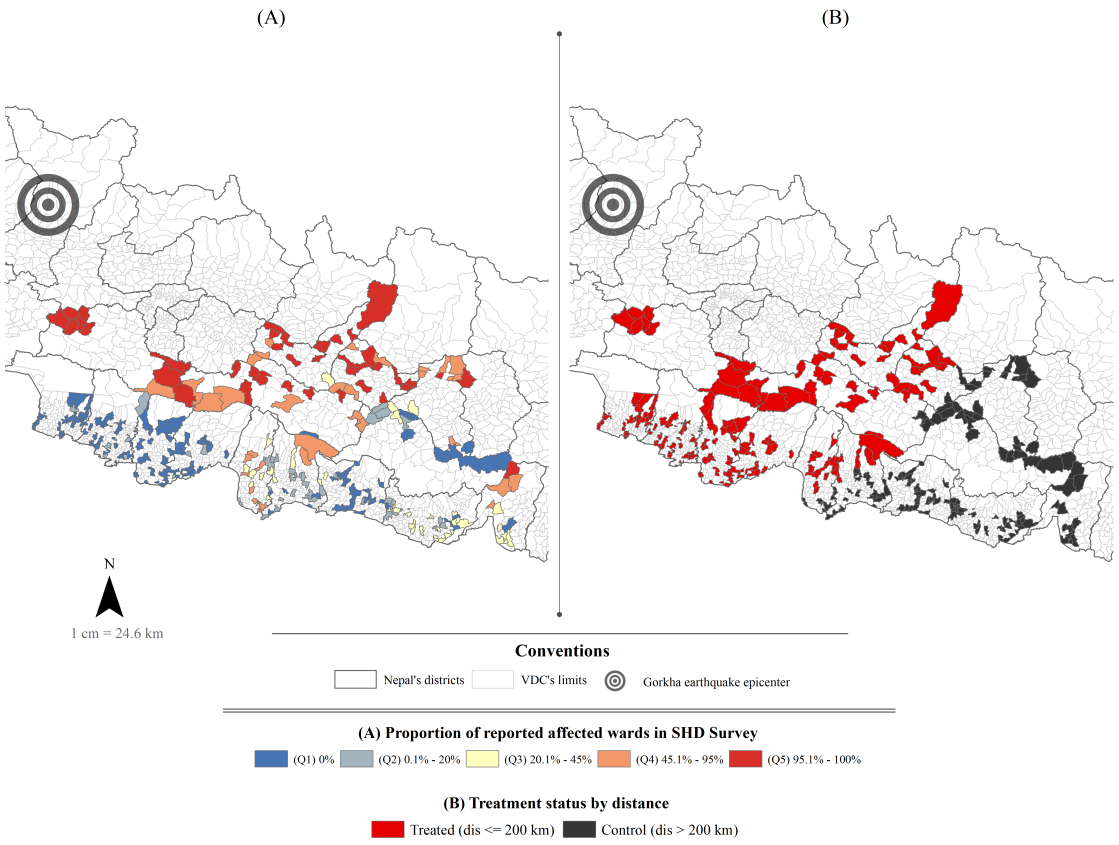
6 Figures

Figure 1: Sunaula Hazar Din – Community Action for Nutrition Project – Scope



Note: In red are the Village Development Committees (VDCs) selected to be part of the Sunaula Hazar Din Project. There were 282 VDCs included in the study in 15 primarily rural districts in Nepal.

Figure 2: Reported Damage and Treatment status by distance from the epicenter



Note: Panel (A) shows the average proportion of wards affected by Village Development Committees (VDCs). The color depends on the quintile the VDC lands in the distribution. Panel (B) displays the distribution of treatment status generated by the distance from the epicenter.

7 Tables

Table 1: Baseline Outcomes Balance Table - Lab-in-the-Field Games

	Distance to the Epicenter						T-test
	> 200Km		≤ 200Km		All		P-value
Variable	N	Mean/SD	N	Mean/SD	N	Mean/SD	(1)-(2)
Trust	42	0.587	58	0.513	100	0.544	0.042
		(0.196)		(0.164)		(0.181)	
Trustworthiness	42	0.360	58	0.334	100	0.345	0.403
		(0.160)		(0.152)		(0.155)	
Cooperation	42	0.619	58	0.549	100	0.578	0.067
		(0.179)		(0.192)		(0.189)	
Altruism	42	0.425	58	0.383	100	0.401	0.230
		(0.193)		(0.150)		(0.170)	

Notes: Mean baseline Lab-in-the-Field games outcome by treatment group at the Village Development Committee (VDC) level. Standard deviations are in parentheses. The last column reports the p-values for the difference in means t-test.

Table 2: Baseline Outcomes Balance Table – Household Survey

Variable	Distance to the Epicenter: Bellow 200 Km N	Bellow 200 Km Mean/SD	Above 200 Km N	Above 200 Km Mean/SD	All N	All Mean/SD	T-test P-value (1)-(2)
***Trust Outcomes*:**							
General Trust on people	42	0.650 (0.320)	58	0.756 (0.280)	100	0.712 (0.300)	0.083
Trust on people from the village	42	0.750 (0.121)	58	0.806 (0.192)	100	0.783 (0.167)	0.096
People from the village would take advantage	42	0.735 (0.159)	58	0.727 (0.136)	100	0.731 (0.145)	0.781
People don't trust to lend/ borrow money	42	0.756 (0.132)	58	0.699 (0.171)	100	0.723 (0.158)	0.073
Trust on people from same group/race/caste/tribe	42	0.761 (0.110)	58	0.831 (0.133)	100	0.801 (0.128)	0.006
Trust on people from other group/race/caste/tribe	42	0.622 (0.189)	58	0.592 (0.227)	100	0.604 (0.212)	0.483
Shopkeepers	42	0.724 (0.156)	58	0.684 (0.166)	100	0.701 (0.162)	0.224
Local government officials	42	0.708 (0.163)	58	0.675 (0.208)	100	0.689 (0.190)	0.396
Central government officials	42	0.750 (0.134)	58	0.714 (0.195)	100	0.729 (0.172)	0.300
Police	42	0.719 (0.184)	58	0.720 (0.190)	100	0.720 (0.187)	0.989
Teachers	42	0.820 (0.147)	58	0.845 (0.139)	100	0.834 (0.142)	0.382
Nurses and doctors	42	0.810 (0.143)	58	0.852 (0.115)	100	0.834 (0.129)	0.100
Strangers (Foreigners)	42	0.221 (0.164)	58	0.320 (0.188)	100	0.279 (0.184)	0.007
Anderson Trust Index	42	-0.026 (0.344)	58	0.020 (0.252)	100	0.000 (0.293)	0.443
***Public Goods Outcomes*:**							
People from the village are willing to help	42	0.747 (0.120)	58	0.767 (0.203)	100	0.758 (0.172)	0.572
Punishment for not participating in community activities	42	0.621 (0.212)	58	0.548 (0.257)	100	0.579 (0.240)	0.138
Likelyhood of cooperation to solve water supply problems	42	0.856 (0.136)	58	0.810 (0.189)	100	0.830 (0.169)	0.183
Anderson Public Goods Index	42	0.055 (0.360)	58	-0.040 (0.487)	100	0.000 (0.438)	0.286
***Political Behaviour*:**							
Vote in the last local election	42	0.513 (0.246)	58	0.390 (0.373)	100	0.442 (0.330)	0.065
***Interpersonal Relations Outcomes*:**							
Met with people in a public place (last month)	40	3.486 (2.196)	53	3.866 (2.676)	93	3.703 (2.475)	0.466
Times people visited your home (last month)	42	2.560 (1.192)	54	5.830 (6.142)	96	4.399 (4.931)	0.001
Times you visited people in their home? (last month)	41	2.252 (1.058)	52	6.203 (7.043)	93	4.461 (5.646)	0.001
Anderson Interpersonal Index	42	-0.298 (0.253)	55	0.038 (0.735)	97	-0.108 (0.599)	0.006

Notes: Mean baseline HH Survey outcome by treatment group at the Village Development Committee (VDC) level. Standard deviations are in parentheses. Last column reports the p-values for difference in means t-test.

Table 3: Earthquake Effects for Lab-in-the-Field Games Outcomes.

	(1) Trust	(2) Trustworthiness	(3) Cooperation	(4) Altruism
Panel A: Midline (5 months after Earthquake)				
Less than 200 Km	0.018	-0.087*	-0.040	0.001
	(0.032)	(0.051)	(0.029)	(0.034)
Observations	800	788	800	800
Control Mean	0.356	0.717	0.530	0.396
Control SD	0.228	0.625	0.261	0.233
Adj. R^2	0.004	0.001	0.008	0.002
Panel B: Endline (24 months after Earthquake)				
Less than 200 Km	-0.080***	-0.111***	0.020	-0.038
	(0.025)	(0.038)	(0.022)	(0.030)
Observations	796	773	796	796
Control Mean	0.395	0.682	0.445	0.385
Control SD	0.244	0.644	0.240	0.216
Adj. R^2	0.048	0.013	0.000	0.013

Note: Coefficients are OLS estimates controlled by the randomization variable used to assign treatment in Sunaula Hazar Din and a Risk Aversion measure. I report clustered standard errors at the VDC Level in parentheses. Trust accounts for the amount sent by the sender in a Trust Game as a fraction of their endowment. Trustworthiness reports the amount returned by the receiver in a Trust Game as a fraction of what they were sent. Cooperation reports the proportion of cards put in the public pot from the player's endowment. Altruism is the amount of money sent by the player in a Dictatorship game. * $p < 0.10$, ** $p < 0.05$, ***, $p < 0.01$.

Table 4: Earthquake Effects on Trust Outcomes - Part I.

	People	People for the village			Group Trust	
	(1)	(2)	(3)	(4)	(5)	(6)
	General Trust	General Trust	Would take advantage	Would not pay when lend money	In-Trust	Out-Trust
Panel A: Midline (5 months after Earthquake)						
Less than 200 Km	0.071	-0.007	-0.104***	-0.068**	-0.044	-0.042
	(0.045)	(0.027)	(0.026)	(0.027)	(0.026)	(0.029)
Observations	1482	1482	1482	1482	1482	1482
Control Mean	0.715	0.803	0.803	0.820	0.803	0.723
Control SD	0.452	0.229	0.225	0.214	0.204	0.280
Adj. R^2	0.014	0.001	0.074	0.043	0.028	0.009
Panel B: Endline (24 months after Earthquake)						
Less than 200 Km	-0.035	0.023	0.011	-0.055***	-0.018	0.027*
	(0.069)	(0.019)	(0.012)	(0.012)	(0.016)	(0.016)
Observations	2360	2360	2360	2360	2360	2360
Control Mean	0.487	0.231	0.251	0.263	0.274	0.314
Control SD	0.500	0.183	0.179	0.173	0.158	0.176
Adj. R^2	0.001	0.012	-0.000	0.015	0.006	0.005

Note: Coefficients are ANCOVA estimates that control for the mean outcome at baseline and the randomization variable used to assign Sunaula Hazar Din treatment status. I report clustered standard errors at the VDC Level in parentheses. Columns (1) and (2) are dummy variables that account for whether the respondent trusts people in general and people from their village. Column (3) accounts for the likeliness of believing people from their village would take advantage of them if given a chance. Column (4) reports the likelihood of people from the village **not** paying back a loan. Columns (5) and (6) report the respondents' belief in whether people from the same or different ethnic or linguistic groups/race/caste/tribe as themselves can be trusted, respectively. * $p < 0.10$, ** $p < 0.05$, ***, $p < 0.01$.

Table 5: Earthquake Effects on Trust Outcomes - Part II.

	Level of trust on						
	(1) Shopkeepers	(2) Local government	(3) Central government	(4) Police	(5) Teachers	(6) Nurses & Doctors	(7) Foreigners
Panel A: Midline (5 months after Earthquake)							
Less than 200 Km	0.035	-0.023	-0.046	0.009	-0.067***	-0.052**	-0.028
	(0.027)	(0.030)	(0.034)	(0.036)	(0.019)	(0.020)	(0.034)
Observations	1482	1482	1482	1482	1482	1482	1482
Control Mean	0.751	0.692	0.676	0.623	0.905	0.892	0.550
Control SD	0.223	0.245	0.268	0.298	0.173	0.187	0.288
Adj. R^2	0.012	0.002	0.030	0.003	0.030	0.022	0.068
Panel B: Endline (24 months after Earthquake)							
Less than 200 Km	-0.015	0.025	0.077***	0.019	-0.011	-0.014	0.151***
	(0.017)	(0.016)	(0.019)	(0.020)	(0.016)	(0.016)	(0.022)
Observations	2360	2360	2360	2360	2360	2360	2360
Control Mean	0.303	0.289	0.290	0.303	0.117	0.117	0.391
Control SD	0.194	0.190	0.218	0.277	0.190	0.188	0.242
Adj. R^2	0.006	0.003	0.036	0.004	-0.000	0.003	0.067

Note: Coefficients are ANCOVA estimates that control for the mean outcome at baseline and the randomization variable used to assign Sunaula Hazar Din treatment status. I report clustered standard errors at the VDC Level in parentheses. All columns account for the level of trust on each label. The variables can take values 0 (Trustful to a very small extent), 0.33 (Trustful to a small extent), 0.66 (Trustful to a great extent), or 1 (Trustful to a very great extent). * $p < 0.10$, ** $p < 0.05$, ***, $p < 0.01$.

Table 6: Earthquake Effects on Public Goods Outcomes.

	Likelihood that people for the village			Last Election
	(1) Willing to help	(2) Punish for not participating	(3) Cooperation to solve problems	(4) Voted
Panel A: Midline (5 months after Earthquake)				
Less than 200 Km	-0.040*	-0.041	0.013	-0.043
	(0.023)	(0.044)	(0.028)	(0.037)
Observations	1482	1482	1482	1912
Control Mean	0.788	0.663	0.792	0.884
Control SD	0.215	0.325	0.224	0.320
Adj. R^2	0.009	0.074	0.030	0.023
Panel B: Endline (24 months after Earthquake)				
Less than 200 Km	-0.006	0.095***	-0.023	0.160***
	(0.016)	(0.019)	(0.019)	(0.029)
Observations	2360	2360	2360	2601
Control Mean	0.284	0.251	0.284	0.679
Control SD	0.177	0.213	0.206	0.467
Adj. R^2	0.003	0.045	0.004	0.039

Note: Coefficients are ANCOVA estimates that control for the mean outcome at baseline and the randomization variable used to assign Sunaula Hazar Din treatment status. I report clustered standard errors at the VDC Level in parentheses. Columns (1) – (3) report how likely the respondent considers that people from their village will perform the action stated in the label. Column (4) is a dummy variable that signals whether or not the respondent voted in the last election. * $p < 0.10$, ** $p < 0.05$, ***, $p < 0.01$.

Table 7: Earthquake Effects on Interpersonal Relations Outcomes.

	Meeting people in the last month		
	(1) In a public place	(2) In your home	(3) In their home
Panel A: Midline (5 months after Earthquake)			
Less than 200 Km	0.453	-0.714	-1.011
	(0.584)	(0.661)	(0.612)
Observations	1376	1422	1378
Control Mean	1.364	2.566	2.389
Control SD	3.240	4.649	4.030
Adj. R^2	0.023	0.475	0.555
Panel B: Endline (24 months after Earthquake)			
Less than 200 Km	0.413	1.840***	2.351***
	(0.338)	(0.665)	(0.619)
Observations	2192	2266	2195
Control Mean	2.162	5.113	4.178
Control SD	3.022	4.988	4.453
Adj. R^2	0.030	0.102	0.105

Note: Coefficients are ANCOVA estimates that control for the mean outcome at baseline and the randomization variable used to assign Sunaula Hazar Din treatment status. I report clustered standard errors at the VDC Level in parentheses. Columns (1) – (3) report the number of visits in the last month the respondent has had in the different places stated on the label. * $p < 0.10$, ** $p < 0.05$, ***, $p < 0.01$.

Table 8: Earthquake Effects on Aggregated Index Outcomes by group.

	Anderson Index		
	(1) Trust	(2) Public Goods	(3) Interpersonal
Panel A: Midline (5 months after Earthquake)			
Less than 200 Km	-0.010	-0.081	0.051
	(0.063)	(0.080)	(0.123)
Observations	1482	1482	1437
Control Mean	0.503	0.855	-0.352
Control SD	0.531	0.588	0.698
Adj. R^2	0.025	0.015	0.235
Panel B: Endline (24 months after Earthquake)			
Less than 200 Km	0.125**	0.100***	0.208***
	(0.048)	(0.030)	(0.075)
Observations	2360	2360	2289
Control Mean	-0.387	-0.581	-0.060
Control SD	0.422	0.373	0.636
Adj. R^2	0.022	0.013	0.049

Note: Coefficients are ANCOVA estimates that control for the mean outcome at baseline and the randomization variable used to assign Sunaula Hazar Din treatment status. I report clustered standard errors at the VDC Level in parentheses. Columns (1) account for the summary index for all the outcomes in Table 4 and Table 5. Column (2) is the summary index for columns (1) – (3) of Table 6. Column (3) reports the summary index for the variables in Table 7. All indexes were calculated following Anderson (2008). * $p < 0.10$, ** $p < 0.05$, ***, $p < 0.01$.

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