# Social Capital and Disaster Recovery: Evidence from Sichuan Earthquake in 2008

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# Abstract

Social capital helps reduce adverse shocks by facilitating access to transfers. This study examines how various measures of social capital are associated with disaster recovery from 2008 Sichuan earthquake. We find that households having a larger Spring Festival network in 2008 do better in housing reconstruction. A larger network significantly increases the amount of government aid received for housing reconstruction. With regards to how Spring Festival network channels more government aid to the household, the results show that a larger network increases the number of people showing up to offer monetary and material support, which is linked to more government aid received. This suggests that Spring Festival network members assist the quake-affected households to apply for and obtain government aid. As for other measures of social capital, connections with government officials and communist party membership do not significantly contribute to disaster recovery. Human capital, measured by the years of schooling of household head, is also not positively correlated with housing reconstruction.

Keywords: Natural Disasters, Social Capital, Sichuan

JEL codes: Q54, H84

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# 1 Introduction

As literature on environmental shocks acknowledged, poor households in less developed economies are especially hard hit by natural disasters (Jodha and Mascarenhas, 1989; Chen, 1991; Cynthia, 2002). Urban households can rely on insurance market or other formal institutions to cope with disaster damage (Sawada 2012), but rural households are much more vulnerable and may suffer a prolonged recovery given that institutions are less established and the insurance market is under-developed (UNFCCC, 2009). There is a growing volume of studies to provide knowledge on the institutions and coping strategies, which rural households rely on for disaster recovery (Yang 2008, Halliday 2012, Takasaki 2011). This is essential for governments to draw effective disaster relief and rehabilitation policies for rural households.

Existing literature has increasingly studied the role of social capital for poor households in developing countries to cope with adverse shocks (Rodrik, 1998 & 1999). Sociologists emphasize the importance of social capital in agricultural society, in which households use reciprocal help and mutual assistance to overcome economic instability (Little 1992a). They have shown how gender-based associations (Clark 1994; Goheen 1996), kinship groups (Stone et al. 1995), and age-based organizations (Little 1992b) are assets that allow farmers to weather periods of climatic and economic turbulence. Social capital proves to be the strongest and most robust predictor of population recovery after the 1995 Kobe earthquake in Japan (Aldrich 2010). Aldrich (2012) also finds the positive role of social capital in recovery after the Great Kanto earthquake in 1923, Asian tsunami in 2004, and Hurricane Katrina in 2005. Economic literature also contributes to examine

how social bonds play a role in economic outcomes (Fafchamps and Minten 1999; Fafchamps 2000). For example, Fafchamps (1992) studies the mutual insurance character of solidarity networks. This type of transaction has been coined "generalized reciprocity" (Sahlins 1965). Rosenzweig (1988), Grimard (1997) and Carter et al. (2003) provide important insights on the role of social capital serving for the reduction of exposure to disaster risk. Nakagawa and Shaw (2004), Carter (2005) and Mogues (2006) are some initial attempts to examine the role of social capital for post-disaster recovery.

Given the importance of social capital, we still lack a standard objective measure. Literature uses diverse approaches to describe and measure social capital. Those measures used include the size of social network established by the households (Hill et. al 2003) and the characteristics of the network members (McCarty 2002). The size of social network can have paramount importance for disaster recovery. A larger social network allows households to get access to disaster updates and information on government assistance program. Having a larger social network also allows disaster-affected household to approach more network members for help in application for government disaster aid. Furthermore, a larger social network can provide more support to disaster victims, such as monetary and material help, as well as counseling assistance, which speeds up the recovery of socio-economic well-being. The characteristics of network members are also an important factor of disaster recovery. Having close connections with the "right" people, such as government officials, can facilitate access to government resources.

This paper investigates how social capital is related to recovery from natural disasters in rural areas and, specifically, we study the housing reconstruction of households in rural

Sichuan of China after the earthquake in 2008. Our study uses three different measures of social capital: (1) Size of Spring Festival network, defined as the number of people whom household interacts with during Spring Festival in 2008[7]; (2) Number of government officials whom the households have close connections with; and (3) Communist party membership of household head. We first estimate the effects of various measures of social capital on housing reconstruction. In the second part of the analysis, we explore the channels through which social capital operates.

Our findings show that the size of Spring Festival network, has a significantly positive effect on housing reconstruction. But connections with government officials do not have any significant impact. Communist party membership is also not correlated with housing reconstruction. As for the effects of human capital and physical capital, years of schooling of household head does not have any significant impact, but the size of household asset, proxied by the size of farmland, is positively associated with housing reconstruction.

In the second part, we explore the channels through which social capital operates to contribute to housing reconstruction. The results show that a larger Spring Festival network significantly increases the probability of receiving government aid for building permanent housing. The amount of aid obtained is also higher for households with a larger Spring Festival network. With regards to how Spring Festival network channels more housing reconstruction aid, the results show that a larger Spring Festival increases the number of people showing up to offer monetary and material support to the earthquake-affected household, which is associated with more disaster aid received. The

[7] Spring Festival marks the beginning of Chinese calendar and in 2008. The Spring Festival starts on February 7, 2008, which is before the occurrence of Sichuan earthquake.

findings suggest that a larger Spring Festival network raises relief and rehabilitation support received from more network members, who may help the earthquake-affected households apply for and obtain government disaster aid. However, we do not find similar effects for connections with government officials and communist party membership. Physical capital and human capital also do not have any impact on the above channels.

Our paper attempts to extend our understanding on the role of social capital for disaster recovery of rural households. Also, existing literature has yet to develop a unified concept and measure of social capital and we explore various dimensions of social capital and compare the empirical results of different measures. Finally, the paper is among a few studies to examine the role of social capital in Chinese society. The role of social network is crucial in China and the country is described as a network economy (Hamilton 1989).

The paper is organized as follows. Section 2 cites some Chinese studies to describe the measure of social capital in the Chinese context, and explains the use of different measures of social capital in our study. Section 3 gives a brief background of Sichuan earthquake in 2008. Section 4 focuses on the data and descriptive statistics and Section 5 discusses the empirical strategy. Section 6 provides the results and Section 7 concludes.

# 2 Social Capital in China

Chinese sociologists and anthropologists have investigated different measures of social capital to study the importance of social capital for economic development. Bian (1997)

is the first sociologist using Spring Festival network to measure social capital of Chinese households. Spring Festival marks the beginning of the Chinese calendar, usually starting in the second half of January or the first half of February, when relatives, friends and acquaintances interact with each other. The Spring Festival can be regarded as the most important time for reunions and interactions. People having migrated to different parts of China go back to their hometowns to prepare for Spring Festival. Families visit each other and exchange of gifts occurs at that time, which has substantial importance for maintaining and expanding social network. The significance of Spring Festival is similar to that of Christmas and New Year in Western society. In a similar token, some studies consider the interactions during Christmas and New Year to measure social capital in the context of Western society. (Lin et al. 2001). Given the significance of the Spring Festival, the size of Spring Festival network, measured by the number of people whom the households interact with, can proxy for the amount of social capital which the household possesses. Such measure is now commonly adopted in Chinese sociological studies (Zhao 2003, Bian et al. 2001a and 2001b, Luo 2008). Another important measure of social capital is connections with government officials, which enables households to have better access to information and public resources. Finally, China is a communist state, and affiliation with the communist party can be beneficial for rural households to obtain special privileges. Our study uses the above three measures to gauge the level of social capital of the sample households.

For existing studies on Sichuan earthquake, Zhao has done a series of sociological research on the role of social capital (Zhao 2007, 2009, 2011 and 2012). Our paper is most relevant to Zhao (2012). He studies how the structure of Spring Festival network is

associated with funding for housing reconstruction from various sources, including household own financial asset, loans from banks, borrowings from relatives and friends, and government disaster aid. He quantifies the structure of the network by computing the proportion of non-relatives visiting the household during the Spring Festival. He also considers the occupations of the network members and uses factor analysis to compose a network score. The findings show that a Spring Festival network with a higher proportion of non-relatives enables the household to borrow more from banks, but has no effect on the amount of government aid received. Also, the network structure is only marginally associated with more borrowings from relatives and friends. Hence, Zhao's study finds that network structure is not a significant factor for obtaining government resources for housing reconstruction. This study focuses on an alternative measure, size of Spring Festival network, and investigates how network size affects housing reconstruction aid received[8]. After that, we explore how network size contributes to more government aid received.

# 3 Background of Sichuan Earthquake in 2008

The 2008 Sichuan earthquake, also known as Wenchuan earthquake, occurred on May 12, 2008 and it measured at 7.9 magnitude. The location of the earthquake's epicenter is in a rural area of Wenchuan County, Sichuan, which was 80 kilometers west-northwest of Chengdu (World Earthquakes, May 12, 2008). The earthquake caused more than 69,000

[8] We also consider network structure in our analysis. Similar to the findings of Zhao's study, we do not obtain any significant effect.

deaths, 18,000 people missing and about 4.8 million people were made homeless. Public infrastructure collapsed and provision of utilities was disrupted for an extended period. The economic losses amounted to 845 billion RMB (122 billion USD). The government declared 10 counties severely destroyed (Jizhongzaiqu) and 29 counties heavily affected (Zhongzaiqu). Figures 1 and 2 show the map of Sichuan province and the casualties caused by the earthquake in different parts of the province respectively.

{Insert Figure 1 here}

{Insert Figure 2 here}

The earthquake is among one of the deadliest in the Chinese history. Donations came from across the country and the world, which amounted to 50 billion RMB. International rescue teams arrived in the affected areas to provide relief support. The central government garnered resources across the country for the rescue and rehabilitation efforts. A three-year target was announced, in which all the homeless households should have their houses rebuilt within three years following the earthquake. To finance the housing reconstruction, the government granted each household 20,000 RMB (2,877 USD in 2008), whose house was destroyed during the earthquake, and the amount may vary depending on the size of the household. Homeless households could also apply for loans from financial institutions and about 20,000 RMB would be disbursed on average. The rest of the construction cost would be self-financed by the household.

The central government set out a clear guideline on the amount of disaster aid disbursed and which households should be given priority to receive the aid. The county and village officials were required to adhere to the policy. Yet given that the earthquake causes

substantial damage with extensive coverage, it could not be guaranteed that the aid policy could be strictly enforced in every affected village. Furthermore, communication with the public media can be disrupted after the earthquake, households may rely on private information from relatives and close friends to know more about the government relief program, such as the method of application, which government organization they should contact for the application, and the eligibility requirements, which is crucial in order to obtain the government aid. Also, the more vulnerable groups, such as the female headed households, the left-behind elderly and the ethnic minorities, may need someone to apply for the government aid on their behalf. Hence, a household with a larger social network can approach more people for support in obtaining government aid.

# 4 Data and Descriptive Statistics

Survey teams commissioned by Tsinghua University were dispatched in 2009 to conduct interviews in 17 villages, which were classified by the government as most heavily damaged (Jizhongzaiqu). Since after the earthquake, transportation was heavily affected and the survey teams could only visit the villages which could be accessible by cars. The survey was conducted between January and July in 2009, with most of the households interviewed in July. Before the interview, a full list of households in each village was compiled and about 30 households were randomly selected, with 558 households in the full sample. The interview was conducted in Chinese and the respondent can be any member of the selected household, who may not be the head of the household. Information on degree of earthquake damage, amount of aid received, a variety of post-earthquake assistance, and household socio-economic status were recorded in the survey.

Table 1 presents the descriptive statistics. About 82% of households report that their houses are destroyed or heavily damaged, which are no longer habitable. Among all the respondent households, 528 of them say they needed to rebuild houses. The proportion is about 95% of the overall sample. Note that some households have their original houses still habitable, but claim that they need to build a new house (14% of the total sample). Meanwhile, some households have their houses inhabitable but report that they do not need to rebuild a new house (2% of the total sample). For the 528 households who report their houses no longer habitable, about 48% of them have permanent houses rebuilt by the time of interview in 2009.

{Insert Table 1 here}

For the measures of social capital, the average size of Spring Festival network is 23.4. Given that the size of a household is 3.2, and about 85% of the household members are adults, each household interacts with 8.6 other households in the 2008 Spring Festival[9]. Only 8.2% of household heads belong to the communist party. Also, a household has close tie with 3.1 government officials on average.

With regards to the receipt of government aid, 79% of the full sample receive subsidy for building permanent housing and the average amount granted is about 20,600 RMB. Yet note that some households who need to rebuild houses do not receive any support from the government. For other descriptive statistics, most households have 6 years of schooling, having finished only elementary education. 5% of our sample households are classified by government as impoverished, and 6% are under the protection of

[9] The survey does not tell us whether those visitors are from the same village.

wubao/dibao, a form of income protection. They have 2.5 hectares of farmland and about 17% of households own orchards.

Table 2 presents the correlation coefficients between various measures of social capital. Size of the Spring Festival network is not strongly correlated with communist party membership or connections with government officials. Connections with government officials are positively correlated with household head being communist party member, but the correlation coefficient is only 0.103.

{Insert Table 2 here}

To compare households who have their houses reconstructed with those who have not, we conduct a simple t-test as shown in Table 3. The size of Spring Festival network differs significantly. Households, who managed to reconstruct houses, have a larger Spring Festival network. However, households who successfully reconstruct houses, have ties with fewer government officials and their heads are less likely to be communist party members, but the difference is just marginally significant. One possible explanation is that households having connections with more government officials may live in a better quality house to begin with and hence less likely to suffer from earthquake damage. This may also explain the negative correlation between housing reconstruction and communist party membership. Housing subsidy makes a big difference, which is significantly higher among those who successfully reconstruct houses. Also, knowledge of the government housing subsidy program is positively correlated with housing reconstruction.

{Insert Table 3 here}

Note that, houses being damaged or destroyed during the earthquake is positively associated with housing reconstruction. There are two possible explanations: (1) Households whose houses are no longer habitable after the earthquake, have a stronger need to reconstruct houses as quickly as possible, which may drive them to speed up the housing reconstruction. (2) Households, whose houses are heavily damaged during the earthquake, can be poor quality. After the earthquake, they may again reconstruct another house of low quality, which only needs a shorter time to build.

Table 3 also tells us that human capital, measured by the years of schooling of household head, is not correlated with housing reconstruction. Another measure of human capital is possession of technical license, e.g. licenses for chef, plumber and electrician, and it does not show any significant correlation. Households who managed to reconstruct houses, have a larger farmland, which suggests the importance of household wealth for reconstructing houses.

# 5 Empirical Strategy

We use simple OLS model in all of our specifications and the primary dependent variable is a housing reconstruction dummy. Specifically, to construct the variable, we only retain the households, who report the need to rebuild houses after the earthquake (95% of the overall sample). After refining our sample, we assign a value of 1 if a household has a house reconstructed by the time of interview, or 0 otherwise.

The dependent variable is a 0 or 1 dummy, which warrants the logit/probit estimation. However, we use the OLS model instead. In three of the sample villages, none of the

households interviewed managed to reconstruct a new house. Logit/probit estimation will eliminate all the sample households in those three villages from the estimation after controlling for village fixed effect, which can result in substantial sample loss.

The most important explanatory variables of our interest are various measures of social capital, which are (1) Size of the Spring Festival network, which measures the number of people whom households interacted with during the Spring Festival in 2008; (2) Number of government officials, whom the households have close connections with; and (3) A communist party membership dummy, which takes on a value of 1 if the household head is a member of the communist party.

In our study, the measures of Spring Festival network in 2008 and status of communist party membership of household head are established before the earthquake. Also, not all but most of the ties with the government officials are formed before the earthquake. Given that the interview took place after the earthquake, our data can be subject to recall error. Yet it is reasonable to believe that the recall error should be random, which will attenuate the magnitude of the estimated effects.

The regression estimates the impact of pre-earthquake social capital on post-earthquake recovery. There may exist some confounding factors which can affect both household social capital and housing reconstruction, e.g. household wealth and socio-economic status. To address this issue, we control for a list of variables on the pre-earthquake household characteristics. The control variables can be broadly classified into three categories: (1) Human capital, measured by years of schooling of household head and number of household members possessing technical licenses, e.g. licenses for chef,

plumber or electrician etc.; (2) Household wealth, estimated by size of farmland and orchard ownership[10]; (3) Socio-economic status, a dummy which takes on a value of 1 if household is impoverished as classified by the government. Another measure of socio-economic status is a dummy of safety net protection (wubao/dibao), which is assigned a value of 1 if the household is under the protection of safety net. Furthermore, we also include some other control variables, such as the size of household, gender, age, age-squared, marital status of household head and status of residential registration (hukou). The survey also asks the households about the degree of housing damage and any incidence of mortality, which allows us to estimate the effect of earthquake damage on housing reconstruction. Finally, we include the village fixed effect to account for any time-invariant village unobserved characteristics.

The empirical strategy consists of three steps. In step 1, we estimate the effect of social capital on housing reconstruction. In step 2, we use the same set of control variables and examine how social capital affects some plausible channel variables, including (1) the amount of government aid received for housing reconstruction; (2) knowledge on the government aid program; (3) a dummy indicating whether the households have received support to build temporary housing; and (4) number of people providing monetary and material support. Among all four channels, government aid obtained is the most important contributing factor to housing recovery. To further investigate how social capital channels more government aid to the household, we examine how monetary and material support received, and the knowledge on the government aid program are

[10] It would be ideal to control for pre-earthquake annual household income and total household asset, which can be highly correlated with both social capital and status of housing reconstruction. Unfortunately, such information is not collected in the survey.

correlated with the government aid obtained. Finally, we re-estimate the effect on housing reconstruction as in step 1, but adding the channel variables in our specification.

Since the application and allocation of housing subsidy and all other disaster recovery programs are all administered at the village level, it is highly plausible that the error term in our specification is subject to arbitrary correlation within village. Clustering errors at the village level do not work well as we only have 17 villages in the samples. Hence, we use block bootstrapping as suggested by Bertrand et al. (2004) to address the issue of small number of cluster[11],[12].

# 6 Results

Table 4 shows the effects on housing reconstruction and column (4) gives the results using the full specification. The size of Spring Festival network has significantly positive impact on housing reconstruction at 5% level of significance in every specification. Increasing the network size by 10 raises the probability of housing reconstruction by 0.014 as shown in column (4). On the other hand, connection with government officials does not significantly contribute to housing reconstruction. The communist party

[11] Standard robust clustering gives similar results though the significance of effects of Spring Festival network on housing reconstruction and government aid received drop from the level of 5% to 10%. Without clustering, the robust standard errors are even larger, which drives the effect of Spring Festival on housing reconstruction insignificant, but the impact on housing subsidy received remains significant. The results suggest that, once controlling for village fixed effect and other covarites, there exists negative intra-correlation among households in the same village on housing recovery. This may suggest that competition exists among village households for government resources for housing reconstruction. The results based on standard robust clustering and without clustering are available upon requests.

[12] Block bootstrapping may still lead to inconsistent estimate of standard error given a small number of cluster. We also use wild bootstrapping method suggested by Cameron et al. (2008). Yet we need to drop the village fixed effect from the regression equation as the method does not allow for fixed effect estimation. The overall results obtained are similar, even though the correlation between housing aid obtained and monetary support received from network becomes insignificant. The results are available upon requests.

membership of household head even lowers the probability. One possible explanation is that households having a strong tie with government officials are more likely to have a better quality house to begin with and hence less likely to suffer from housing damage. Yet the negative significance is marginal at 10% and disappears in the full specification as shown in column (4). Among the three measures of social capital, the size of social network is the only significant factor contributing to reconstructing houses.

{Insert Table 4 here}

Table 4 shows that the role of human capital is limited. Both years of schooling and possession of technical license do not show significant effect on housing reconstruction in any specification[13]. The increase in R-squared is also little upon including the two variables in the regression. On the other hand, household wealth, proxied by the size of farmland, has positive effects, which shows the positive relationship between household wealth and housing reconstruction. All other factors, including household size, age and gender of household head, and status of being impoverished, do not affect housing reconstruction. Furthermore, the degree of housing damage and mortality are not correlated with housing reconstruction.

We now examine the effects of social capital on various channel variables. Table 5 shows the results on government subsidies. Expanding the network size by 10 can raise the chance of receiving housing subsidy by 0.013. Also, the amount of housing subsidy received increases by 14%. The increase in total government aid is also significant but only marginally as shown in column (3). Spring Festival network primarily affects the

[13] The lack of significant effects may be due to multi-collinearity. We separately estimate the effects of the two variables of human capital and obtain similar results.

housing aid received by the households, but has much smaller impact on other kinds of aid, such as mortality compensation, living assistantship. On the other hand, communist party membership does not significantly contribute to the amount of government aid received. Connection with more government officials also does not show any significant impact.

{Insert Table 5 here}

Table 5 shows that the degree of housing damage does not significantly affect the probability of receiving aid for housing reconstruction, which may point to the aid mistargetting. Mortality due to earthquake does not increase subsidy received for housing reconstruction, but more miscellaneous aid received, which is primarily in the form of mortality compensation. Also, note that female-headed households are more disadvantaged in obtaining government aid and are 26% less likely to receive housing subsidy compared with the male-headed households as shown in column (1). Human capital has no significant effect on the government aid received. Households with larger farmlands do not receive less aid, which suggests poor households are not particularly advantaged in obtaining government subsidy.

We investigate how Spring Festival network channels more government aid to the household. We first examine two plausible channels, which are (1) knowledge on government aid; and (2) number of people offering monetary and material support after the earthquake. Table 6 shows that a larger Spring Festival network does not contribute to better knowledge. On the other hand, communist party membership is significant in increasing the knowledge. Yet connection with more government officials does not affect

the self-rated knowledge. Furthermore, education of household head is not significantly associated with the self-rated knowledge of the program, so is the possession of technical license. Yet the response is self-rated, which is subject to bias and measurement error. Household with deceased members has more knowledge, which suggests that households suffering mortality may have a greater need of government support, and hence they receive more details about the government relief program, or they spend more efforts to collect the information.

{Insert Table 6 here}

Next, we consider the effect of social capital on the monetary and material support received. The dependent variable in column (2) counts the number of people whom households receive monetary and material support from after the earthquake. A larger Spring Festival network leads to significantly more help received after the earthquake, which suggests that social network provides direct monetary and material support to the affected households. The larger the social network, the higher the likelihood some people in the network will show up to offer help after the earthquake. Yet connections with government officials and community party membership do not lead to help received from more people.

We re-estimate the effect of Spring Festival network on government aid obtained by adding the above two channel variables as shown in column (4). For comparison, we include the results from the specifications without the two channel variables, which are the same as shown in column (2) of Table 5. More money and material support received is significantly associated with more housing subsidy obtained, which suggests people

offering monetary and material support may also assist the household in applying for government aid. Yet such significant correlation is not observed between knowledge on subsidy and government aid received. This points to the fact that self-rated knowledge may not truly reflect the household knowledge on the government relief program. With regards to the effect of Spring Festival network, upon including the channel variables, the magnitude and the significance drop. Hence, the above results suggest that a larger Spring Festival network lead to household receiving support from more network members, who can also help the earthquake-affected households apply for and obtain government aid. Meanwhile, the role of Spring Festival network to facilitate the flow of information on government aid program is not significant.

We also consider another form of help received by the households after the earthquake. In Table 7, the dependent variable of column (2) is a dummy, which takes on a value of 1 if the household receives support for building temporary housing, such as tents and compartment houses. Probability of receiving help in building temporary housing increases by 0.047 if network size expands by 10. Meanwhile, household size is negatively correlated with the support received, which can be due to more abundant labor resources in a larger household and they need less outside help to rebuild temporary housing.

{Insert Table 7 here}

In our final step, we include the channel variables to re-estimate the impacts on housing recovery as shown in Table 8. For comparison, we also show the results from the specification without the channel variables. In column (3), the specification does not

include knowledge on subsidy since amount of government aid is controlled for. Yet we still retain the variable of monetary and material support as monetary and material support received after the earthquake may have direct impact on housing reconstruction independent of government aid obtained. The results show the effect of network size drops substantially and the significance is eliminated after including the channel variables. The receipt of government aid is strongly correlated with housing reconstruction. Other channel variables, including help received to build temporary housing, monetary and material support received and knowledge of government subsidy program, are positively correlated with housing reconstruction, but not significantly. These findings show that Spring Festival network can help households obtain more housing subsidy, which is crucial for housing reconstruction.

{Insert Table 8 here}

We finally conduct a vulnerability analysis, to examine the factors of housing damage and mortality during the earthquake as shown in Table 9. Housing damage is positively associated with Spring Festival network. One possible explanation is that households with a larger network may have their houses located in crowded areas, and hence the houses are more likely to collapse during the earthquake. Yet we still need further investigation to explain the positive correlation. On the other hand, household education is negatively correlated with housing damage, which may suggest that more educated household head may build a better quality house to lower the vulnerability to disaster damage. This may partly explain why human capital has no effect on housing reconstruction. As for mortality, social capital and human capital have no significant impact.

{Insert Table 9 here}

# 7 Conclusion

Our study shows that social capital is important for housing reconstruction after the Sichuan earthquake in 2008. Expanding the size of Spring Festival network by 10 in 2008 raises the likelihood of housing reconstruction by 0.014. A larger network channels more housing subsidy to the households, provides support for building temporary housing, as well as offers direct monetary and material support after the earthquake, which can have positive effects on housing reconstruction. With regards to how Spring Festival network channels more government aid to the household, the evidence shows that a larger network increases the number of people showing up to offer monetary and material support, which is linked to more government aid received. This suggests that Spring Festival network members assist the households to apply for and obtain government aid.

Our two other measures of social capital, connection with government officials and communist party membership do not show significant impacts on housing reconstruction. With regards to the effects of human capital on disaster recovery, education of household head and possession of technical license are not positively linked to housing reconstruction.

Social capital has been enormously studied in existing literature but we are still finding a commonly recognized measure of social capital for the empirical study. The measure should be cultural specific and designed according to the context of the study. At this point, Chinese sociologists are still discussing the most appropriate measure of social

capital in Chinese rural society. Our study focuses on the size of Spring Festival network, communist party membership and connection with government officials. Yet more efforts should be devoted to developing an appropriate measure in the context of disaster recovery in rural economies of China.

This study examines the link between social capital and disaster recovery. The analysis, however, is based on the cross-sectional data, and causal interpretations should be given cautions. We estimate the effect of pre-earthquake social capital on the housing reconstruction after the earthquake, and the estimation should not be subject to reverse causality. The most likely confounding factors are some pre-earthquake unobserved household characteristics, such as the household head's ability to expand social network, which can also affect housing reconstruction. Longitudinal data collected before and after the earthquake can be useful to establish the causal relationship between social capital and disaster recovery.

Social capital substantially facilitates disaster recovery for rural households and plays an even more important role than education. The impact of social capital is even greater in China, where the workings of society are primarily operated on relationship, “guanxi”. Our findings raise an important concern: Among all the disaster-affected households, the isolated groups in rural areas with small social networks are especially vulnerable. They obtain less support from the government and suffer a slower pace of recovery. A proper targeting of government relief and rehabilitation aid should not just focus on the damage suffered by the households, but also their access to social capital.

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**Figure 1: Map of Sichuan Province**

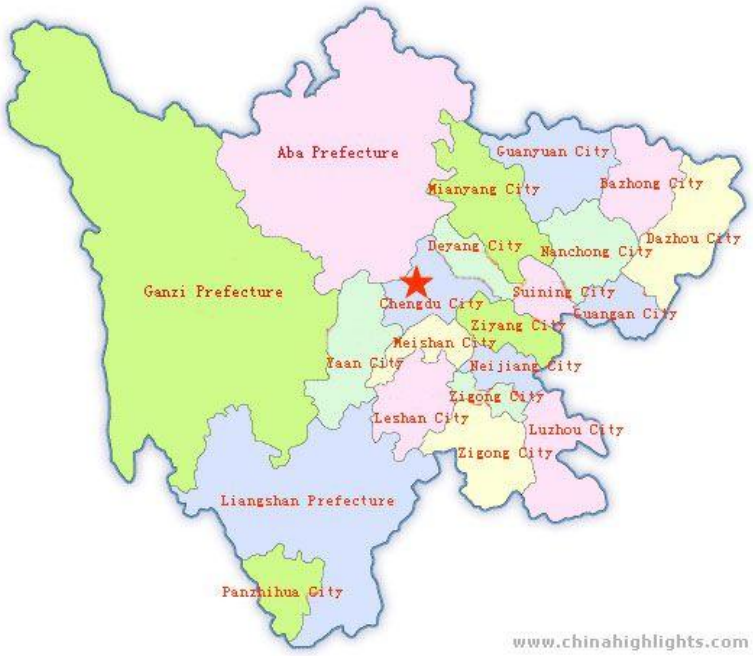


**Figure 2: Epic-center and Casualties of Sichuan Earthquake in 2008**

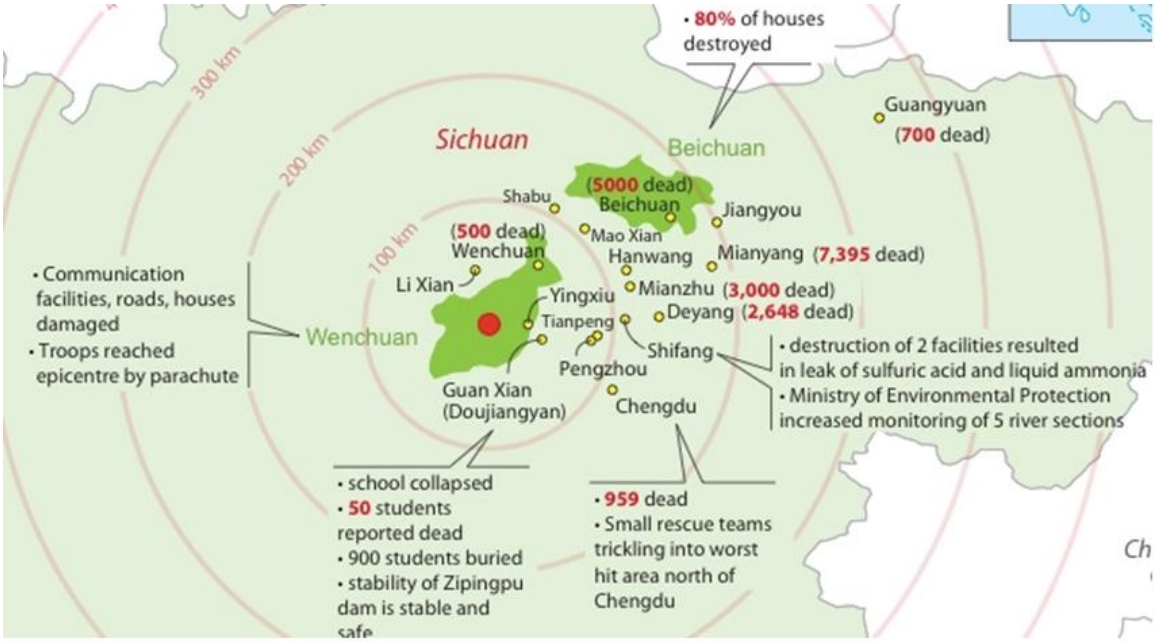

**Table 1: Descriptive Statistics**

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Housing Reconstruction | 528 | 0.48 | 0.50 | 0 | 1 |
| Spring Festival Network | 539 | 23.44 | 18.65 | 0 | 108 |
| Government Officials | 558 | 3.06 | 3.76 | 0 | 50 |
| Communist Party | 558 | 0.082 | 0.28 | 0 | 1 |
| House Rebuilding Subsidy | 558 | 0.79 | 0.41 | 0 | 1 |
| House Subsidy Amount | 440 | 20600 | 6800 | 1000 | 52000 |
| Total Government Aid | 558 | 24440 | 14000 | 0 | 126800 |
| Knowledge on Subsidy | 556 | 2.74 | 0.70 | 1 | 4 |
| Money and Material Support | 557 | 4.43 | 6.07 | 0 | 70 |
| Temp House Rebuilding | 558 | 0.61 | 0.49 | 0 | 1 |
| 1. House Intact | 554 | 0.022 | 0.15 | 0 | 1 |
| 2. House Slightly Damaged | 554 | 0.15 | 0.36 | 0 | 1 |
| 3. House Damaged | 554 | 0.24 | 0.43 | 0 | 1 |
| 4. House Destroyed | 554 | 0.58 | 0.49 | 0 | 1 |
| Death | 558 | 0.059 | 0.24 | 0 | 1 |
| Schooling: Household Head | 552 | 6.04 | 3.48 | 0 | 14 |
| License Holding | 558 | 0.14 | 0.39 | 0 | 2 |
| Household Size | 558 | 3.20 | 1.11 | 1 | 7 |
| Impoverished | 557 | 0.048 | 0.22 | 0 | 1 |
| Wubao/Dibao | 558 | 0.057 | 0.23 | 0 | 1 |
| Female Headed | 556 | 0.049 | 0.22 | 0 | 1 |
| Age: Household Head | 557 | 50.81 | 12.81 | 18 | 90 |
| Farmland | 555 | 2.47 | 1.40 | 0 | 7 |
| Orchard Ownership | 555 | 0.17 | 0.38 | 0 | 1 |

Notes: "Housing Reconstruction" is a dummy variable: 1 = House has been rebuilt by the time of interview. "Spring Festival Network" measures the number of people whom households interact with during the Spring Festival in 2008. "Communist Party" is a dummy: 1 = Household head is a Communist party member. "Government officials" measures the number of government officials whom the households have close connections with.

**Table 2: Correlation between Three Different Measures of Social Capital**

| | Spring Festival Network | Communist Party | Government Officials |
|---|---|---|---|
| Spring Festival Network | 1 | | |
| Communist Party | 0.048 | 1 | |
| Government Officials | 0.065 | 0.103 | 1 |

Notes: See notes below Table 1 for description of the three measures of social capital

**Table 3: Descriptive Statistics by Status of Housing Reconstruction**

| (Housing Reconstruction = 1) - (Housing Reconstruction = 0 ) | | |
|---|---|---|
| | (1) | (2) |
| Spring Festival Network | 5.79*** | (1.643) |
| Communist Party | -0.049* | (0.024) |
| Government Officials | -0.44* | (0.17) |
| House Rebuilding Subsidy Dummy | 0.22*** | (0.033) |
| House Subsidy Amount | 7400*** | (819.5) |
| Temp House Building Dummy | 0.014 | (0.043) |
| Total Government Aid Amount | 8980*** | (1134) |
| Knowledge on Subsidy | 0.21*** | (0.059) |
| Money and Material Support | -0.44 | (0.48) |
| House Damaged or Destroyed | 0.14*** | (0.031) |
| Death | -0.044* | (0.02) |
| Schooling: Household Head | 0.077 | (0.304) |
| License Holding | -0.0054 | (0.035) |
| Household Size | 0.050 | (0.095) |
| Impoverished | -0.011 | (0.018) |
| Wubao/Dibao | -0.0064 | (0.02) |
| Age: Household Head | -2.61* | (1.118) |
| Farmland | 0.36** | (0.121) |
| Orchard Ownership | -0.24*** | (0.031) |

Notes: Differences in means and the standard errors are reported in columns (1) and (2) respectively. House destroyed or damaged is an indicator variable: 1 = Households report house damaged or destroyed during the earthquake. Temp House Building Dummy is an indicator variable: 1 = Household received support for building temporary housing after the earthquake. ( *** p<0.01, **p<0.05, * p<0.1)

## Table 4: Housing Reconstruction and Social Capital, OLS

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | House Reconstruct | House Reconstruct | House Reconstruct | House Reconstruct |
| Spring Festival Network | 0.00175** | 0.00182** | 0.00157** | 0.00137** |
| | (0.000787) | (0.000765) | (0.000704) | (0.000687) |
| Government Officials | 0.00743 | 0.00718 | 0.00498 | 0.00288 |
| | (0.00944) | (0.00986) | (0.00916) | (0.00925) |
| Communist Party | -0.107* | -0.105* | -0.107* | -0.0707 |
| | (0.0559) | (0.0572) | (0.0630) | (0.0602) |
| Schooling: Household Head | | -0.0011 | -0.00101 | -0.00753 |
| | | (0.00618) | (0.00626) | (0.00695) |
| License Holding | | 0.027 | 0.0334 | 0.0421 |
| | | (0.0378) | (0.0355) | (0.0362) |
| Farmland | | | 0.0430** | 0.0426** |
| | | | (0.0176) | (0.0180) |
| Orchard Ownership | | | -0.0997* | -0.0858 |
| | | | (0.0532) | (0.0626) |
| Household Size | | | | -0.0209 |
| | | | | (0.0182) |
| Impoverished | | | | 0.0430 |
| | | | | (0.0917) |
| Wubao/Dibao | | | | -0.0237 |
| | | | | (0.102) |
| Female Headed | | | | 0.0450 |
| | | | | (0.139) |
| 2.House Slightly Damaged | 0.100 | 0.0937 | 0.101 | 0.128 |
| | (0.256) | (0.256) | (0.269) | (0.304) |
| 3. House Damaged | 0.252 | 0.239 | 0.252 | 0.259 |
| | (0.271) | (0.268) | (0.282) | (0.325) |
| 4.House Destroyed | 0.421 | 0.414 | 0.412 | 0.426 |
| | (0.269) | (0.267) | (0.278) | (0.317) |
| Death | 0.0163 | 0.0218 | 0.0209 | 0.0539 |
| | (0.0672) | (0.0658) | (0.0737) | (0.0777) |
| Observations | 506 | 500 | 497 | 492 |
| R-squared | 0.088 | 0.089 | 0.103 | 0.122 |
| Number of village | 17 | 17 | 17 | 17 |

Notes: OLS coefficients are reported with robust standard errors in parentheses, bootstrapped at the village level. All regressions include village fixed effect. "House Reconstruct" is a dummy: 1 = Household has rebuilt house by the time of interview. For house damage, the base group is the households whose houses remain intact. ( *** p<0.01, **p<0.05, * p<0.1)

**Table 5: Government House Rebuilding Aid and Social Capital, OLS**

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | House Rebuilding Subsidy | House Subsidy Amount | Total Aid Amount |
| Spring Festival Network | 0.00133** | 0.0140** | 0.00266* |
| | (0.000646) | (0.00647) | (0.00140) |
| Government Officials | -0.00795 | -0.0781 | 0.0295 |
| | (0.00547) | (0.0556) | (0.0260) |
| Communist Party | 0.0482 | 0.290 | 0.0418 |
| | (0.0584) | (0.560) | (0.0997) |
| Schooling: Household Head | 0.00198 | 0.0179 | 0.00411 |
| | (0.00330) | (0.0352) | (0.00915) |
| License Holding | 0.0334 | 0.401 | 0.0560 |
| | (0.0420) | (0.410) | (0.0735) |
| Farmland | 0.000274 | -0.00737 | 0.00874 |
| | (0.00877) | (0.0866) | (0.0249) |
| Orchard Ownership | -0.0389 | -0.327 | -0.115 |
| | (0.0575) | (0.554) | (0.103) |
| Household Size | -0.0275 | -0.263 | -0.00725 |
| | (0.0209) | (0.206) | (0.0775) |
| Impoverished | 0.0203 | 0.0505 | 0.0576 |
| | (0.0950) | (0.864) | (0.159) |
| Wubao/Dibao | -0.0121 | -0.0242 | -0.0347 |
| | (0.0995) | (0.899) | (0.173) |
| Female Headed | -0.264** | -2.686** | -0.456* |
| | (0.125) | (1.231) | (0.260) |
| 2.House Slightly Damaged | -0.0189 | -0.262 | -0.454 |
| | (0.199) | (2.003) | (0.431) |
| 3. House Damaged | 0.0317 | 0.233 | -0.288 |
| | (0.194) | (1.977) | (0.437) |
| 4.House Destroyed | 0.156 | 1.429 | -0.174 |
| | (0.182) | (1.864) | (0.438) |
| Death | 0.0180 | 0.121 | 0.501*** |
| | (0.0475) | (0.505) | (0.131) |
| Observations | 492 | 492 | 492 |
| R-squared | 0.094 | 0.090 | 0.123 |
| Number of village | 17 | 17 | 17 |

Notes: OLS coefficients are reported with robust standard errors in parentheses, bootstrapped at the village level. All regressions include village fixed effect. "House Rebuilding Subsidy" is a dummy variable: 1 = household has received house rebuilding subsidy. "House Subsidy Amount" is the logged value of one plus house rebuilding subsidy received. "Government Aid Amount" is the logged value of one plus total amount of disaster aid received. ( *** p<0.01, **p<0.05, * p<0.1)

**Table 6: Channels of Social Capital for Government House Rebuilding Aid, OLS**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Subsidy Knowledge | Money and Material | House Subsidy | House Subsidy |
| Money and Material | | | | 0.0515** |
| | | | | (0.0220) |
| Subsidy Knowledge | | | | 0.259 |
| | | | | (0.220) |
| Spring Festival Network | 0.00215 | 0.0522*** | 0.0140** | 0.0109* |
| | (0.00134) | (0.0185) | (0.00647) | (0.00599) |
| Government Officials | 0.0130 | 0.193 | -0.0781 | -0.0830 |
| | (0.0141) | (0.187) | (0.0556) | (0.0587) |
| Communist Party | 0.281*** | 0.442 | 0.290 | 0.214 |
| | (0.0873) | (1.143) | (0.560) | (0.527) |
| Schooling: Head | 0.00698 | 0.212*** | 0.0179 | 0.00352 |
| | (0.00978) | (0.0539) | (0.0352) | (0.0393) |
| License Holding | 0.0856 | 0.413 | 0.401 | 0.360 |
| | (0.0907) | (0.802) | (0.410) | (0.423) |
| Farmland | -0.0133 | -0.109 | -0.00737 | -0.0143 |
| | (0.0289) | (0.190) | (0.0866) | (0.0848) |
| Household Size | 0.000675 | -0.191 | -0.263 | -0.232 |
| | (0.0331) | (0.249) | (0.206) | (0.210) |
| Impoverished | -0.0730 | -0.122 | 0.0505 | 0.0724 |
| | (0.175) | (1.570) | (0.864) | (0.881) |
| Wubao/Dibao | -0.0852 | 1.322 | -0.0242 | -0.0790 |
| | (0.148) | (1.298) | (0.899) | (0.918) |
| Female Headed | -0.00533 | 2.419 | -2.686** | -2.614** |
| | (0.178) | (1.565) | (1.231) | (1.196) |
| 2.House Slightly Damaged | 0.0990 | 1.870*** | -0.262 | -0.415 |
| | (0.212) | (0.661) | (2.003) | (2.024) |
| 3. House Damaged | 0.178 | 2.753*** | 0.233 | 0.0418 |
| | (0.236) | (0.875) | (1.977) | (2.000) |
| 4.House Destroyed | 0.213 | 2.869*** | 1.429 | 1.198 |
| | (0.224) | (0.782) | (1.864) | (1.884) |
| Death | 0.267** | 1.561 | 0.121 | -0.0156 |
| | (0.122) | (2.166) | (0.505) | (0.484) |
| Observations | 490 | 491 | 492 | 489 |
| R-squared | 0.076 | 0.102 | 0.090 | 0.096 |
| Number of village | 17 | 17 | 17 | 17 |

Notes: OLS coefficients are reported with robust standard errors in parentheses, bootstrapped at the village level. All regressions include village fixed effect. House subsidy measures the logged value of one plus the amount of housing subsidy received. "Subsidy Knowledge" is an ordinal variable recording the self-rated awareness of house rebuilding subsidy. "Money and Material" counts the number of people offering monetary and material support after the earthquake. ( *** p<0.01, **p<0.05, * p<0.1)

**Table 7: Social Capital and Building Temporary Housing, OLS**

| | (1) |
|---|---|
| VARIABLES | Temp House Building |
| | |
| Spring Festival Network | 0.00471*** |
| | (0.00108) |
| Government Officials | -0.000473 |
| | (0.0119) |
| Communist Party | 0.0543 |
| | (0.0732) |
| Schooling: Household Head | 0.00591 |
| | (0.00654) |
| License Holding | 0.0109 |
| | (0.0605) |
| Farmland | -0.0219 |
| | (0.0207) |
| Orchard Ownership | 0.0530 |
| | (0.0962) |
| Household Size | -0.0386** |
| | (0.0183) |
| Impoverished | 0.0435 |
| | (0.169) |
| Wubao/Dibao | 0.178* |
| | (0.0969) |
| Female Headed | 0.0664 |
| | (0.122) |
| 2.House Slightly Damaged | 0.0215 |
| | (0.214) |
| 3. House Damaged | 0.126 |
| | (0.209) |
| 4.House Destroyed | 0.0303 |
| | (0.195) |
| Death | 0.00571 |
| | (0.135) |
| | |
| Observations | 492 |
| R-squared | 0.079 |
| Number of village | 17 |

Notes: OLS coefficients are reported with robust standard errors in parentheses, bootstrapped at the village level. All regressions include village fixed effect. "Temp House Building" is a dummy variable: 1 = Household received help in building temporary housing. ( *** p<0.01, **p<0.05, * p<0.1)

**Table 8: Social Capital and Housing Reconstruction with Channel Variables Included, OLS**

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | House Reconstruct | House Reconstruct | House Reconstruct |
| Temp House Building | | 0.00386 | 0.00167 |
| | | (0.0312) | (0.0324) |
| Money and Material Support | | 0.00486 | 0.00349 |
| | | (0.00300) | (0.00243) |
| Knowledge on Subsidy | | 0.00699 | |
| | | (0.0232) | |
| House Subsidy Amount | | | 0.0278*** |
| | | | (0.00495) |
| Spring Festival Network | 0.00137** | 0.00107 | 0.000784 |
| | (0.000687) | (0.000792) | (0.000792) |
| Government Officials | 0.00288 | 0.00243 | 0.00437 |
| | (0.00925) | (0.00963) | (0.00964) |
| Communist Party | -0.0707 | -0.0714 | -0.0804 |
| | (0.0602) | (0.0636) | (0.0647) |
| Schooling: Household Head | -0.00753 | -0.00891 | -0.00875 |
| | (0.00695) | (0.00718) | (0.00641) |
| Farmland | 0.0426** | 0.0423** | 0.0432** |
| | (0.0180) | (0.0181) | (0.0174) |
| 2.House Slightly Damaged | 0.128 | 0.114 | 0.128 |
| | (0.304) | (0.308) | (0.337) |
| 3. House Damaged | 0.259 | 0.24 | 0.243 |
| | (0.325) | (0.332) | (0.356) |
| 4.House Destroyed | 0.426 | 0.408 | 0.376 |
| | (0.317) | (0.321) | (0.346) |
| Death | 0.0539 | 0.0450 | 0.0449 |
| | (0.0777) | (0.0769) | (0.0720) |
| Observations | 492 | 489 | 491 |
| R-squared | 0.122 | 0.126 | 0.165 |
| Number of village | 17 | 17 | 17 |

Notes: OLS coefficients are reported with robust standard errors in parentheses, bootstrapped at the village level. All regressions include village fixed effect. Column (1) reports the previous regression result, as in column (4) of Table (4). Columns (2) and (3) control for channel variables. ( *** p<0.01, **p<0.05, * p<0.1)

**Table 9: Vulnerability Analysis, OLS**

| | (1) | (2) |
|---|---|---|
| VARIABLES | Housing Damage | Death |
| | | |
| Spring Festival Network | 0.00315** | 0.000168 |
| | (0.00154) | (0.000354) |
| Government Officials | 0.0165 | -0.000260 |
| | (0.0184) | (0.00473) |
| Communist Party | 0.0887 | 0.0138 |
| | (0.117) | (0.0521) |
| Schooling: Household Head | -0.0226** | 0.00277 |
| | (0.0114) | (0.00354) |
| License Holding | -0.0809 | -0.0126 |
| | (0.0691) | (0.0212) |
| Farmland | 0.0154 | 0.0103* |
| | (0.0327) | (0.00583) |
| Orchard ownership | 0.0570 | 0.0566 |
| | (0.0814) | (0.0443) |
| Household Size | -0.0201 | -0.0165 |
| | (0.0422) | (0.0133) |
| Impoverished | -0.200 | 0.106 |
| | (0.179) | (0.129) |
| Wubao/Dibao | 0.366* | -0.0267 |
| | (0.206) | (0.0473) |
| Female headed | 0.189 | -0.189** |
| | (0.137) | (0.0933) |
| | | |
| Observations | 520 | 523 |
| R-squared | 0.056 | 0.138 |
| Number of village | 17 | 17 |

Notes: OLS coefficients are reported with robust standard errors in parentheses, bootstrapped at the village level. All regressions include village fixed effect. "Housing Damage" is an ordinal variable ranging from 1 to 4, which measures the degree of housing damage. A higher value represents greater damage. "Death" is a dummy: 1 = Household has a member deceased during the earthquake. ( *** p<0.01, **p<0.05, * p<0.1)