Natural Disasters and Social Capital

Evidence from the 2010 Chilean Earthquake

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Document prepared for presentation and discussion at the
2011 Belpasso International Summer School,
Belpasso, Italy, September 4-10, 2011

PRELIMINARY DRAFT, ***PLEASE DO NOT CITE***

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1. Introduction

The consequences of natural disasters over developing (and developed) economies have gained the attention of many scholars. In one hand, macroeconomic studies have focused on the effect of natural disaster on macroeconomic conditions, productivity and markets (see Cavallo & Noy, 2010, for a survey). On the other hand, micro level studies among other issues have analyzed the role of insurance and coping strategies on the aftermath of natural disasters. However, scarce economic literature has investigated the role of initial social capital for natural disasters' recovery or how the aftermath of a disaster can produce the destruction or appreciation of communities' social capital endowment. This topic becomes even more relevant when we analyze rural areas given that agriculture (and natural resources, in general) is perhaps the most sensitive industry to a range of external (and internal) shocks that may affect societies: climate change, natural disasters, economic crises, trade regulations, social conflicts, land policies, etc.

As noted by Cassar et al. (2011) the empirical literature proving the role that initial social capital can have on post-disaster environments is scarce. Adger et al. (2005) and Munansighe (2007) provide some insights for future research, while Nakagawa & Shaw (2004), Carter & Castillo (2005) and Mogues (2006) are interesting initial attempts. On the other hand, the effect that natural disaster can have *over* social capital, especially in the levels of trust and trustworthiness that characterize a community, has received even less attention of researchers so far, being the only exceptions, to our knowledge, Andrabi & Das (2010) and Cassar et al. (2011).

We explore on this research the role of social capital in post–disaster environments of rural areas in communities affected by the 2010 Chilean earthquake. One part of this research considered the use of experimental economics to evaluate how natural disasters affect the

[1] Part of this work (section 2) has been co-authored with Alberto Chong and Herrnán Bejarano, from the George Washington University and Penn State University, respectively.

endowment of social capital in rural villages. On the other hand, the second part of this research uses survey data to evaluate how initial endowments of social capital at household and community levels explain households' recovery from the earthquake. These different objectives and approaches are divided here into two different papers, denoted by sections 2 and 3, respectively.

The second section focuses on behavioral economics, where through the use of field experiments, trust and trustworthiness in villages affected by the 2010 earthquake and tsunami are evaluated and compared to a sample of rural households located in areas not affected by these disasters. In this way, the main purpose is to analyze how peoples' attitudes have been affected by these natural events. This is an important issue in economics given that potential changes in the behavior of people after natural disasters could affect the efficiency and final outcomes of policies and programs aimed to support communities in post–shock environments.

The third section of this document focuses on rural communities and households' responses to the 2010 Chilean earthquake, based on their levels of social capital. This issue is very relevant because many rural areas across developing countries face problems of sustainability and vulnerability, which can be heavily affected by natural disasters. I postulate that different coping strategies used by households and the economic recovery of these from the earthquake are function of the level of social capital in households and communities. This statement is supported by former empirical works that shown the importance of social capital on economic growth and development.

2. Trusting behavior in the aftermath of the 2010 Chilean Earthquake [2]

Peoples' behavior in the aftermath of any natural disaster may depend critically on various conditions. In this paper we postulate three such conditions that can adversely affect the trusting behavior of people affected by natural disasters: rivalry for scarce relief and recovery recourses, increment of information asymmetries between agents (what we call *aftermath moral hazard*) that provides excuses to break pre-established-social contracts, and migration or social displacement of people within communities.

To investigate this issue we address the effect of natural disaster on trust/trustworthiness by analyzing whether rural villager's trust and trustworthiness to their fellow villagers have been affected by the 2010 earthquake in Chile, or not. In specific, we conducted a series of trust games in villages affected by the 2010 Chilean earthquake, one the strongest earthquakes ever recorded (Madariaga et al., 2010). We also conducted trust games in a group of villages non-affected by the earthquake in order to use their outcomes as control and comparison with the experiments carried out in the villages affected by the earthquake. If the patterns of response vary between these groups, after controlling for other factors that may affect the behavior of people in the respective communities, we could infer whether a natural disaster aftermath affects people's trust and trustworthiness within communities, or not. Despite the growing body of empirical literature that has used the trust game format to evaluate different responses of people under diverse conditions, to our knowledge no study has addressed how the aftermath of a natural disaster may affect people's trust and/or trustworthiness.

2.1. Conditions provided by the aftermath of natural disasters to affect trust

Without doubt a community will not be the same once a natural disaster hits it. Besides all the material damage and economic losses that a region can suffer, the difficult conditions of the aftermath of a natural disaster may affect the endowment of communities' social capital. In particular, attitudes, perceptions and behavior of people such as trust and trustworthiness can be

[2] Coauthors of this research are Alberto Chong and Herrnán Bejarano from t the George Washington University and Penn State University, respectively. We thank Andrea Arratia for her support on the development of this research.

affected. Specially, we argue that three conditions provided by the aftermath of massive natural disasters may negatively affect trust and trustworthiness between people of a village/town: rivalry for scarce relief and recovery recourses, the excuse to break pre-established-social contracts induced by what we call *aftermath moral hazard*, and migration or social displacement of people within communities. Ideally policy and programs aimed to support affected communities should consider these conditions when assessing vulnerability and resilience of communities to natural disasters given the potential negative effect that they can have on villagers' trust and/or trustworthiness.

The first condition occurs when a natural disaster hampers the distribution of recovery resources because of availability and distribution constraints; a problem commonly observed in developing regions. This problem becomes even more dramatic when covariate natural disasters, such as earthquakes and floods, hit entire regions and the scale of damages go beyond a group of households.[3] Although many efforts have been focused into deliver aid resources more efficiently in terms of covering people's necessities (Kovács & Spens, 2007), not always aid ends at households that needed it the most (or not that urgently as others). The reasons for this situation may go from political affinity of the aid provider-receiver to inefficiencies at the moment of gauging damages. Cases of inadequate responses from local and international agencies of uneven (and unfair) distribution of help in natural disaster have been reported in the past (e.g. Brodie et al., 2006, for Katrina hurricane). In the immediate period after the natural disaster event this phenomenon may not be a problem for the trust of communities, given that households left behind have the hope of receiving aid in the near future. However, in the medium term, when people have not received support and realize that aid resources are not longer available, social conflicts may surge within communities. Trust to each other, and trustworthiness inside communities, may be compromised as some received help while other not.

The second condition that natural disasters may provide for the erosion of trusting behavior among villagers is influenced by what we call the *aftermath moral hazard*. Given that a covariate natural disaster is likely to affect a large population in a specific area, asymmetric information regarding suffered damages may facilitate the rupture of pre-established

[3] Distinctly, for idiosyncratic natural disasters (such as small tornados or localized floods) relief can be more efficiently delivered considering that the affected may just be a group of households.

compromises or contracts between parties. A natural disaster provides the excuse to not longer fulfill responsibilities, given that a party will not necessarily know how importantly damaged its counterpart was. We named this asymmetric information surged by the natural disaster damages, the *aftermath moral hazard*. Within communities this type of phenomenon may occur as disasters provide people with arguments needed to avoid responsibilities with others. Statements like "I can't pay you back now, because I have to rebuild my home" or "all my assets are gone due to the disaster" may become frequent arguments when is not necessarily the case. The asymmetry of information prevents the other party to demand the fulfillment of the contract, which enhances the possibility of decreasing trustworthiness. Given that when future expectations collapse for a given reason, the previously trusted party can suffer from radically changed circumstances, so there is less reasons to expect trustworthy behavior from the opposite party (Hardin, 1996). Clearly expectations of people can collapse after the traumatic event given by a natural disaster and the *aftermath moral hazard* conditions that may emerge, affecting negatively the trustworthiness among people of a community.

The third condition is produced by migration and/or displacement of people within communities. The former relates to the loss of trust that communities may face when people leave or arrive to a neighborhood. If, for instance, a small town gains population (from, for instance, a neighbor town that suffered considerably from a natural disaster) a new social structure may arise and trust may decrease. A similar effect on trust and trustworthiness may surge as part of social displacement due to the reallocation of people within communities, because of natural disasters' damages. A clear example is what happened in villages affected by the tsunami in Chile (after the 2010 earthquake), where many shantytowns made of emergency houses (*aldeas*) were created by the government, inside the same communities, aimed to shelter families that lost their homes. When these artificial neighborhoods last more than the expected (in Chile, one year after the earthquake they were still on place) feelings of mistrust to each other may arise as people are not voluntarily living with the people they have as neighbor. Related to this point, Barr (2003) finds that within resettled communities (artificially) created after the civil war in Zimbabwe there is less trust between people, compared to trust between people living in traditional communities.

Disasters and trust

As mentioned above, the conditions that people can face in the aftermath of a natural disaster may end negatively affecting the trust and/or trustworthiness inside communities, which may jeopardize the path of recovery and economic resurge. Abstracting from natural disasters, the study of Alesina & La Ferrara (2002) states that past traumatic events correlates negatively with trust levels reported by people in the GSS survey conducted across the US. However, their finding only proves statistical evidence when traumatic events occurred within a year from the survey, while traumatic events occurred after one year had not significant relation to trust perceptions.

Our argument that establishes the existence of a negative effect of natural disaster on trusting behavior is based on two main assumptions: 1) at least one of the three conditions described above (unequal/unfair distribution of aid, the *aftermath moral hazard*, and migration or social displacement) is present; and 2) the natural disaster is considerable important to affect most households in a region (covariate natural disaster). If neither of this assumption is true, probably the link natural disaster-trust is different. As a matter of fact, there are some studies that claim for a positive effect of natural disaster's aftermath over trust (Andrabi & Das, 2010; Cassar et al., 2011); however their evidence is not related to trust or reciprocity between people of the *same community*, as we attempt to analyze here. Someone's trusting behavior may increase in the aftermath of a disaster towards other agents (like donors or volunteers), but not necessarily towards his/her neighbors.[4]

Studying different villages after a civil war, Barr (2003) presents an interesting study where the trust game is conducted in resettled and original villages in Zimbabwe. Her study finds that resettled villagers present lower levels of trust while trustworthiness is unchanged between groups. Looking at natural disasters, Carter & Castillo (2005) use trust games' outcomes to measure households' recovery after the pass of hurricane Mitch in Honduras in 1998. They claim that trust is an important factor for household's recovery from the shocks of the hurricane (Carter & Castillo, 2005). However, one important issue with this study is that the authors performed the trust games years after the occurrence of the hurricane, assuming that the measured trust

[4] Trusting behavior is multidimensional, as it can be delivered to different types of agents (Morrone et al., 2009).

explained recovery of households. However, this is clearly a confounded measure given that trusting behavior of people after the hurricane may have changed by the aftermath conditions of this disaster. Thus, they ignore the implications that this study attempts to investigate: that trusting behavior can change in communities affected by natural disasters.

2.2. Research Methods

Hypothesis

Based on the proposed conditions that the aftermath of a natural disaster may provide to negatively affect trust and trustworthiness, this investigation seeks to test our argument via one main hypothesis: people that have been affected by a covariate natural disaster show different pattern of response over trusting decisions (trust and trustworthiness) than people that was not affected by the disaster. In concrete terms what we seek to investigate is the potential change in behavior of people. The null hypothesis would be that trust and trustworthiness do not show difference between people affected by a natural disaster and people that did not suffer a negative covariate shock during the last year.

Experimental Design

We based our experimental design on the well known trust game (Berg et al., 1995). The protocol that we used followed these guidelines:

a) Participants of the same community are invited and gathered in a room, two subgroups with equal number of people are randomly formed: group A and group B. Group A is designed to be the senders or "trustors". Group B is designated to be the receivers or "trustees".
b) The researcher explains that participants in group A (the trustors) can anonymously choose to send part of an endowment that will be given by the researcher (**p**), to some random participant in group B (the trustees). The money to be sent (**s**) can be any

amount in the range $0 \leq \mathbf{s} \leq \mathbf{p}$. It is clearly stated that the final amount sent by the trustor, **s**, will be converted to **3s** by the researcher.

c) Players of group B are moved to another room where they lose contact with participants of group A Then players of group A move one by one to a secret booth where they decide how much to send. The money to be sent (**s**) should be put inside an envelope provided to participants. All remaining money should be kept in the pocket or purse (or similar) of the participant before leaving the secret booth, so other players do not notice how much has been sent.

d) Once the trustee receives the envelope with the money multiplied by the researcher (3**s**), they are asked to opt to return any amount (**r**) to the trustor (who remains anonymous) in a secret booth. The trustee can return any amount in the range $0 \leq \mathbf{r} \leq 3\mathbf{s}$ –the remaining money should also be secretly kept by the participant. After this, the trustor receives the money returned by the trustee, **r**, and the game concludes.

The values of **s** and the ratio **r**/**3s** are considered to be metrics of trust and trustworthiness, respectively. For our case **p** corresponded to $6,000 Chilean pesos (approximately 14 U$ dollars). The endowment was given in $1,000 bills (the smallest currency bill), so each player A, the trustor, has the set choice {0, 1, 2, 3, 4, 5, 6} to decide how to play. The amount received by player B, the trustee, (**3s**) was also provided in $1,000 bills, so they set choice was given by {0, 1, 2, … 3s}.

We carried out one session of the trust games across 10 different rural villages in Chile. Given that our main objective is to evaluate whether trust and trustworthiness have been affected in the aftermath of the Chilean earthquake between people of the same community, we use two group of villages: 5 villages that were severely affected by the earthquake (treatment group), and 5 villages that were not (or much less severely) affected by this disaster (control group). The affected villages were selected from VII region of Chile, one of the most damaged regions of the country.

On every case, people of the same community were randomly selected and invited to participate in the game. Only one person, 18 years or older, per household was allowed to participate in the game. Initial and final remarks were conducted in a room with all participants

sitting together. In this same room at the begging of the session (before explaining the game to the participants), a raffle was conducted to randomly assign participants to group A and B. Thus, at the moment of explaining the game protocol people already knew their role. The game protocol was explained three times to the audience and questions were asked to check the understanding of participants.

All participants were asked to fill out a small survey where main socioeconomic and demographic data was collected. Additionally, one instrument was performed to elicit risk behavior –based on a simple lottery game– after the trust game was completed.[5]

Identification strategy

Five rural villages were selected based on their level of destruction from the earthquake, their population at year 2002 and main economic activity. Three villages were located in the coastal dry-land areas of the region (agricultural villages), and two were coastal towns (fishery villages).[6] We were concerned that across villages we would find people that were severely, modestly and barely affected by the earthquake, but we were more focused on selecting villages that shown an evident pattern of destruction one year after the earthquake.[7] Thus, we were not concerned about how importantly the earthquake hit a household in specific on a particular village, given that as covariate shock the earthquake did affect every subject on the area. We are more concerned on the aggregated village effect of the earthquake, given that the interaction of people in the aftermath of the disaster has common community conditions for every villager.

Undoubtedly our statistical inference could be subject to endogeneity concerns if, for instance, villagers in non-affected areas behave more (or less) trusty or trustworthily between them because of cultural patterns or community affinity instead of no-aftermath conditions, compared to communities in the earthquake area. Thus, in our case we were concerned to find

[5] The procedure used for this task is available upon request.
[6] These coastal towns were also affected by the tsunami that followed the 2010 earthquake.
[7] This evident pattern of destruction means that a considerable number of houses had structural damages, much debris was still observable, and emergency houses and shelters were predominantly settled across space. Our data show that 76% of participants in our games, on the earthquake area, suffered considerable damages on their houses.

five non affected communities that have close characteristics to the ones evaluated in the VII region. In order to have a similar pool of villages we first selected 2 coastal villages from the IV region, the closest region of Chile to the earthquake area that reported neither shaking activity nor tsunami. In general, between these regions of Chile (IV and VII) people of coastal communities are alike in terms of cultural patterns. For the agricultural communities, however, cultural patterns may differ more across villages of Chile, and someone can argue that people from the north (IV region) are different form people of the south (VII region). We addressed this potential issue by selecting dry-land communities located in the VI, V and IV regions. All five control communities were similar to the earthquake ones by population.[8] Finally, even though there is no such a thing as a village equal to another, we show below that most socio-economic and demographic characteristics of our participants did not differ statistically between groups, on average, providing a good degree of reliability to results and interpretations given below.

Regarding the trust games *per se*, all conditions of the experimental setting were replied as exactly as possible in every session across villages. Experiments were conducted during March 2011 in the earthquake villages, and during April–May 2011 in the control villages. Contamination problems between villages were completely avoided given that villages were not necessarily close to each other and nobody, besides the research team, knew what villages were going to be selected to conduct the games. Invitations to participate in each one of the ten different sessions were delivered by some member of the research team, who handed out invitations personally. With this practice we avoided self-selection of participants that potentially can occur when public announcements (posters, flyers, etc.) are used to invite participants to this type of games. Another important consideration is that invitations were given with no interference of local leaders, in order to maintain randomness in our sample.

2.3. Results

We first provide summary statistics for the main socioeconomic characteristics of our participants based on the group they belong to: treatment (earthquake) and control villages (table

[8] Population of villages were in the range 185-300 people to year 2002 (last National Census in Chile).

1). As can be seen 120 participants played as trustors (players A), and 116 as trustees (players B). The numbers are not matched because in 4 out of the 10 sessions we obtained an impair number of assistants, which was solved by adding one more participant to group A.[9]

We find no statistically evidence of differences between groups in most of the variables reported in table 1, being the exceptions *Marital_status* and *Trust_strangers*. Table 2 presents statistics and tests for our main variables of interest: *trust* and *trustworthiness*. Trust is defined by the metric ***s***, i.e., the amount of money sent form player A to B. The case of trustworthiness is given by the metric of ***r/3s***, i.e., the ratio formed by the amount of money returned by the trustee (**r**) over the amount received (**3s**). The dominant modes for ***s*** and ***r/3s*** are similar across groups. The mode of trustworthiness, 0.33, represents the ratio given by returning the same amount that the trustor sent. In other words, the mode signals that in several cases the trustees returned the same amount sent by the trustor (**s**), and kept for themselves the amount added by the researcher.

As can be observed in the bottom half of table 2, the pattern of behavior remarked by trust does not present statistical evidence of divergence. People in the earthquake area as well as people in the control area sent, on average, similar amount of money to trustees. On the other hand, observing differences in trustworthiness we get an opposite picture: the statistical tests provide evidence that people in the earthquake area present lower levels of trustworthiness to their fellow villagers than people in non-affected areas.

Regression analysis

Table 3 and 4 present OLS results of models that attempt to predict the observed levels of trust and trustworthiness across villages, respectively. As done in previous studies that model outcomes of the trust game (e.g. Croson & Buchan, 1999; Sutter & Kocher, 2007; Buchan et al., 2008), we include *Age*, *Education*, *Religion*, *Marital_status*, and *Gender* as basic controls in our

[9] Thus one player A was not matched with a player B. We returned to this unmatched player the same amount he trusted. Of course, given the anonymity of the game, no one knew whether they were left unmatched or not.

estimations. In addition we control for income reported by the player.[10] In column 2 and 4 we add the variable *Lottery* (variable that attempts to captures the willingness to take risks from the participants). The positive and significant correlation between ***s*** and *Lottery* provides evidence of what Karlan (2005) claims, and contradicts what Eckel & Wilson (2004) find.[11] The variable *Earthquake dummy* (treatment dummy: 1 if subject belongs to a village in the earthquake area, 0 otherwise) shows no significant effect, supporting the evidence of table 2.

The model of trustworthiness is based on the same covariates used to explain trust. One exception is that ***s*** is also added as control variable for predicting ***r/3s***. We exclude *Lottery*, as in this stage participants are not dealing with a risky decision and we include a squared value of *Age* –which proved to be statistically significant and improved the predictability of our models. An important variable that in this case showed to be important is *Trust_town*, which has a positive and significant coefficient across models (not included in the trust model results reported because it proved to be never significant). This result is in line to other studies that state that standard attitudinal questions about trust predict trustworthy behavior of people (e.g. Glaeser et al., 2000; Ashraf et al., 2006). The somehow puzzling coefficient of ***s*** can be explained by the ratio used as dependent variable: ***r/3s***. If we take elasticities on the sample means, it can be shown that the negative coefficient is just showing that player B tends to return amounts close to what Player A sent (close to ***s***). In models 5.1, 6 and 7 we exclude observations given by potential outliers that did not understand our game. These participants returned all the money that they received (***r/3s*** = 1), which may show that they were confused about the one-shot characteristic of the trust game, although their responses could have been explained also by high kindness of their part. Regardless this last possibility, we preferred to exclude them from our sample in results reported on models 5.1, 6 and 7.

In our different trustworthiness models *Earthquake dummy* is negative and significant. This shows that after controlling for players characteristics, people in the earthquake villages

[10] We used a categorical variable (*Inc_qtl*) based on the respective quintile that the player belonged within our sample. The use of this variable proved to be more informative across our models.

[11] Eckel & Wilson (2004) use the Holt & Laury (2002) lottery game. We tried a simple version of this game in our first session, and proved to be very confusing for people –fact that has been evidenced by results of other researches using this framework (e.g. Jacobson & Petrie, 2007). Given this confusion, we moved to a simpler lottery game in the remainder of our 9 game sessions.

behave less trustworthily than villagers in the control area. The models including village dummies (models 6 and 7) show that after controlling for the potential cultural heterogeneity or other unobserved village characteristics, the earthquake villages still present lower trustworthiness than the control group. To avoid perfect multicollinearity between *Earthquake dummy* and the village dummies in models 6 and 7, we manipulated our data by switching the value of *Earthquake dummy* from 1 to 0 in one player B (trustee) of every village in the earthquake area and, conversely, from 0 to 1 in one player B of every village in the control group. The observations that were subjected to this alteration were chosen randomly from participants of group B that played similarly in all villages: trustees that received $ 2,000 (from player A) and returned the same $ 2,000 (r/3s = 0.33).[12] In this way we do not change trustworthiness averages in our sample but impose a difference between the set of community dummies and the *Earthquake dummy*, avoiding perfect multicollinearity. Model 6 reports results excluding all personal characteristics of players, while model 7 includes them. In both cases our slightly modified *Earthquake dummy* variable is negative and significant.[13]

2.4. Discussion and implications of results for disaster resilience

Why has trustworthiness changed while trust has remained similar between village groups? Based on the expected trustworthiness theory (Barr, 2003) we should have expected lower trust levels in villages affected by the earthquake, if trustworthiness has decreased. However, we can postulate two points to explain why we do not observe differences in the trust responses between groups. First, we can recall evidence supported in past studies that trust measures are not reliably gauged with trust games (Karlan, 2005; Glaeser et al., 2000). The outcome that we observe can be biased by risk preferences of participants. Our data report that participants playing as trustors in both group of villages behaved similarly when facing the lottery game, which may explain why trust measures are not different between groups. Second, as evidenced by Ashraf et al. (2006), trustors "trust" even though they know that it does not pay monetarily, implying that

[12] In all villages we have at least one player that played in this way (these values are the sample mode for ***s*** and ***3r/s*** in both groups of villages).
[13] We are aware of the endogeneity problems of this procedure, but it is just performed to make more visible the results obtained. The potential endogeneity added to the model is unlikely to change our results, structurally.

there are other attitudes like unconditional kindness explaining player A decisions. As a matter of fact, we asked players A (trustors) if they thought they would make money or not with the game, and only 16% of our sample thought so. 82% and 86% thought that they would make less or no money from the amount sent to player B in the earthquake and non-affected villages, respectively –responses are not statistically different between groups (t –test, $p<0.57$, two tailed). In this way, suspecting of confounded trust–risk behavior and/or the influence of kindness in players' A decisions, and considering that both attitudes (risk behavior and kindness) shown to be statistically no different between players in both groups of villages, we can explain why we cannot reject the hypothesis that trust levels (differently from trustworthiness) are similar between groups.

The observed behavior of players of group B do not present the problems described above mainly because it has been widely empirically supported that the measures of trustworthiness from the trust games are reliable (e.g. Karlan, 2005). We claim that the earthquake has had an important effect on people's behavior regarding trustworthiness. In explaining this claim, we suggest that player B behaves differently in villages affected by the earthquake because the aftermath of the disaster provides them of excuses to no reciprocate, to no consider their neighbors (their potential matched player) in her actions. A covariate natural disaster provides excuses to break pre-established social-contracts, based on what we called *aftermath moral hazard*. This concept can be understood as information asymmetry arisen from the natural disaster damages that gives excuses to an agent to break such contracts and do not reciprocate. Another explanation relates the understanding that reciprocity can be determined by strategic behavior: player B does not face the financial risk than player A faced, but they face a decision that can affect future interactions within communities. In this argument our first described condition that an aftermath provides to alter trusting behavior enters: people in the aftermath of the earthquake may have perceived (or suffered of) unfair and unequal provision of aid resources, which may produce them to not consider their fellow villagers when deciding whether to reciprocate or not. Finally, another attitude that may explain behavior of players B in our sessions is that people in the aftermath may opt to kept more money for them given the uncertain conditions that they perceive after the disaster: as post-disaster conditions are not solved, people can have higher uncertainty about the future occurrence of new disasters or economic downturns.

Different researches have shown that trustworthiness is relevant for healthier economic systems (Hardin, 1996; Karlan, 2005). Moreover, it becomes even more relevant if we consider that the best device for creating trust is to establish and support trustworthiness (Hardin, 1996). Hence, in terms of policy it can be argued that enhancing trustworthiness will provide better environments to economic activity and the operation of relief programs. Trusting behavior can be enhanced by introducing regulations, such as the law of contracts, to improve relationships and to make parties more trustworthy (Hardin, 1996). Hence, the effect of institutional enforcement of trustworthiness may go well beyond making specific instances of trust reasonable. If trustworthiness can be harnessed and/or identified by planners in post-disaster conditions, the resilience of communities can be fortified as we solve failures observed in institutions aimed to support safety nets and recovery, especially for the poorer ones.

On the other hand, there may be additional benefits from ensuring that people receive adequate assistance after disasters and social displacements are planned with caution. A transparent and equal distribution of aid (that is based on people's real damage) can avoid the problems that we described above and that end on the erosion of trust and trustworthiness. Even such assistance may lead to greater trusting behavior if unfairness feelings are avoided from unequal distribution of aid. If policies are consistent and clear, planers can avoid higher deterioration of trusting behavior, promote more trustworthiness among villagers and therefore positive effect on trust and subsequent growth. Similar effect can happen by improving programs aimed to facilitate migration or social displacement. If these policies are well planned (ideally together to affected household leaders) and with clear future steps (periods, places of reallocation, etc.), the restructuration of communities can happen with less problems and thus avoid the surge of feelings of distrust among people.

Concluding, results provided here highlight an important aspect, given that a decrease of trustworthiness among fellow villagers can jeopardize the effectiveness of policy or programs aimed to relieve and support the resilience of communities affected by natural disasters. Even though with this empirical approach we do not clarify what of the three described conditions (provided by natural disaster aftermaths to affect trust) are taking place in Chilean villages, we do provide evidence and insights for future research about this important issue.

3. Economic recovery of rural households in the aftermath of natural disasters: how important is social capital? [14]

After the occurrence of natural disasters, households may opt for one of more coping strategies to recover pre–shock welfare levels. Although former economic researches have analyzed factors influencing households' coping strategies, few have analyzed the role that social capital (SC) may have in the decision of coping strategies to choose and in the subsequent recovery of households (HH) to natural disasters. This research, seeks to investigate in detail this issue by analyzing different measures of social capital, which is assessed based on household surveys, secondary data, and interviews with community key leaders and planners. SC variables are included in different econometric models to estimate if this asset affects the likelihood of using particular coping strategies and the recovery of rural HHs. Thus, if SC has a significant effect on average HH' responses, then it may be possible to identify which regions can economically recover faster than the average. With this information local and international authorities could more efficiently channel resources to either foment rapid economic growth in a region or provide more targeted support to communities likely to have a slow recovery.

This research seeks to contribute to the natural disaster literature by analyzing whether and how SC at community *and* HH levels is related to the choice of coping strategies and the final economic/productive recovery of rural HHs affected by the 2010 Chilean earthquake.

3.1 Social capital, coping strategies and recovery

SC has been a widely discussed topic in recent empirical economic literature, where many researchers argue that is an important asset for economic growth (e.g. Knack & Keefer, 1997; Narayan & Pritchett, 1999; Haddad & Maluccio, 2003; Rupasingha et al., 2006; Carter and Castillo, 2010); while some claim that its effect in the economy is null or even detrimental (e.g. Miguel et al. 2005; Di Falco & Bulte, 2010). SC can be defined as *the norms and social relations embedded in the social structures of societies that enable people to coordinate action to achieve*

[14] This research has been founded by a grant from the Latin American and Caribbean Environmental Economics Program (LACEEP).

desired goals (World Bank). In this context, the main arguments for a positive effect of SC on economic activity are based on the facilitation that share norms and cooperation can bring to the management of common resources, the diffusion of innovation, and to the establishments of contracts without major frictions (transaction costs can be reduced), among others. In this line, these effects of SC are expected also to occur in environments where people have suffered idiosyncratic or covariate shocks.

Considering that the occurrence of natural disasters is many times unpredictable and infrequent, the use of formal insurance systems is hardly an option in developing countries. However, HHs may be capable to recovering themselves by applying one or more coping strategies. To elaborate this point we consider a HH that maximizes its discounted lifetime utility subject to a intertemporal budget constraint; by the first order conditions we can derive a consumption Euler equation given by,

$$u'(c_{it}) = E_t\left[u'(c_{it+1})\left(\frac{1+r}{1+\delta}\right)\right], \quad (1)$$

where $\boldsymbol{u'(c_{it})}$ is the marginal utility of today's consumption for i^{th} HH, r is an interest rate and $\boldsymbol{\delta}$ is the discount factor of the HH. The key to explaining coping strategies is defining an extended inter–temporal budget constraint given by: $\boldsymbol{y_t + y_t^{pr} + y_t^{pb} + b_{it} - n_t = s_t + c_t}$, where the first three terms refer to regular income, and private and public transfers, respectively. $\boldsymbol{b_{it}}$ is borrowing or credits, $\boldsymbol{n_t}$ is the shock produced by natural disasters in the level of assets and $\boldsymbol{s_t}$ is the level of net savings. Assuming that the utility function of a HH exhibits constant absolute risk aversion, combining (1) with the budget constraints gives (Sawada & Shimizutani, 2005),

$$\boldsymbol{\Delta b_{it} + \Delta s_{it} + \Delta y_t^{pr} + \Delta y_t^{pb} = -\Delta y_{it} + \Delta n_{it} + \frac{1}{\alpha}\left[\ln\left(\frac{1+r}{1+\delta}\right)\right] + e_{it}}, \quad (2)$$

where $\boldsymbol{e_{it}}$ is a rational expectation error, and α is a constant. The left hand side variables of equation (2) show that a typical HH has four alternative coping strategies (changes in saving, borrowing, public transfers and private transfers) to mitigate the (absolute value of) negative shocks given by $\boldsymbol{-\Delta y_{it} + \Delta n_{it}}$. If these coping strategies are not enough to reach pre–shock welfare levels, the HH can try other alternatives such as reducing consumption, allocating more

time to work, migrate in search of off–farm job opportunities, and/or increasing child labor, among others.

Many microeconomic studies have analyzed how different socio–economic factors and initial endowments affect the HH decision of choosing different coping strategies to recover from natural disasters such as hurricanes, earthquakes and floods (Sawada & Shimizutani, 2005; Khandker, 2007; Sawada, 2007). However, to our knowledge, no research have paid attention on how SC may affect the election of these coping strategies and the subsequent recovery, even though it seems to be a crucial factor in post–disaster response (Adger et al., 2005; Munasinghe, 2007). The HH SC endowment may be relevant in a post–disaster environment because it may increase the likelihood of the HH to opt for one or more coping strategies. Looking at equation (2), HHs with high levels of SC may have more sources for obtaining $\boldsymbol{y^{pr}}$, given that with a larger network of contacts, more alternatives a HH will have to ask for private transfers –material gifts (productive or domestic implements) or financial assets. Similarly, borrowing from informal sources may also be affected: with higher SC transaction costs may be reduced, thus facilitating the access to loans from relatives, friends or neighbors.[15]

The community SC level will also be important for HHs' recovery, given that villages with more active leaders and organizations, as well with better communication flow and cooperation among its dwellers, may contribute to increase the likelihood of obtaining $\boldsymbol{y^{pb}}$.[16] More organized communities will likely be more successful when applying for public grants and therefore more likely to recover community infrastructure and to provide assistance to needed HHs.[17]

Considering these potential effects of community and HH SC, we may find a causality given by SC → Coping Strategies → HH Recovery: with higher levels of SC, HHs may have more options to choose more than one coping strategy and in this way have a quicker recovery

[15] Therefore, it could be postulated that $\frac{dy^{pr}}{d\mathrm{SC}} > 0$, and $\frac{db}{d\mathrm{SC}} > 0$.

[16] That is $\frac{dy^{pb}}{d\mathrm{SC}} > 0$

[17] This is not limited to only public transfers if private corporations or firms hand out assistance for disaster recovery. However, this other potential outcome of community SC (higher likelihood to opt and receive y^{pr}) will depend on the availability of private funds, which may vary considerably more from one region to other than public funds, regardless the level of SC of the community.

than the average HH (assuming that more options for coping strategies translates in more efficient use of these for final recovery). To our knowledge, only Nakagawa & Shaw (2004), Carter & Castillo (2005) and Mogues (2004) have sought to understand the influence of SC in HHs' recovery after natural disasters, although no deep analysis about the different coping strategies used by HHs is implemented. This research seeks to investigate the influence of SC in the recovery efforts of communities and HHs after a covariate shock, based on the coping strategies used by different HHs. *The option to and the decision to use one or different coping strategies made by a particular HH, and its subsequent economic recovery, is postulated to be a function of the endowment of SC that the HH, and the community where it is located, has.*

3.2. Research objectives and methods

The general objective of this research is *to investigate how the SC endowment of rural HHs and communities affects the economic recovery of HHs after natural disasters*. The SC measures used in this study are defined below. For the specific objectives, this study addresses the following points:

1) To estimate communities' and HHs' SC levels and evaluate how these have influenced the decision to use coping strategies by rural HHs in Chile, to mitigate the damages produced by the 2010 earthquake.

2) To analyze factors (including SC and coping strategies) affecting the recovery of Chilean rural HHs located in the areas hit by the earthquake.

Based on the previous discussion and objectives, this investigation seeks to test three main hypotheses: after a natural disaster, (1) HH SC facilitates the use of borrowing and/or transfers, as coping strategies, by HHs; (2) rural HHs located in communities with high SC levels experience faster economic/productive recovery than average HHs, other things equal; and (3) HHs endowed with high levels of SC experience a faster economic recovery than the average rural HH, other things equal.

To address these hypotheses and the project's objectives, this study analyzes a panel with information on a sample of rural HHs in areas where the Chilean earthquake presented severe shaking intensity (see figure 1), and the SC levels of their respective communities. The research methodology can be divided into three main steps: (a) gathering of secondary data for assessments of communities' SC, (b) collection of primary HH data from a survey, and (c) quantitative and econometric analyses of the data using different empirical models. More details of each data collection process and quantitative analyses are provided below.

Household Panel Data

In order to create the mentioned panel, this study interviewed 367 HHs. The HHs were selected from a set of 7 comunas[18] located in the VII and VIII regions –the two regions that were more severely affected by the earthquake (see figure 1). The comunas where the study was conducted are (from north to south): *San Javier*, *Cauquenes*, *Yerbas Buenas*, *Quirihue*, *Ninhue*, *Portezuelo* and *Ranquil* (see figure 2). These comunas have been selected mainly because are the closest rural non–coastal comunas to the earthquake's epicenter.[19] Heterogeneity among these comunas does not seem a major concern for the creation of the HHs' sample given that, besides their geographical clustering, these comunas present low population density, high poverty rates, and the prevalence of traditional agriculture. From these 7 comunas, 13 villages (communities) were randomly selected. The surveys were carried out during February and May 2011.

In addition to the levels of income and assets, the survey included a set of questions that addressed the damages and shocks that HHs suffered from the earthquake. The survey incorporated also retrospective questions to obtain information (recall data) about assets and income –as well as socioeconomic condition– levels before the earthquake.[20]

[18] Comunas (districts) are the lowest level administrative division in Chile. They are governed by a municipality and encompass, generally, different towns, villages, and unsettled areas –see figure 1 and 2 for their spatial distribution.
[19] I have excluded coastal comunas from this study, in order to evaluate only communities' responses to the *earthquake* disaster.
[20] The use of retrospective questions is a common approach in social sciences. For instance, Haddad and Maluccio (2003) argue that particular important past events that affected people's history, such as presidential elections (or earthquakes), are occasions that contribute to recall more accurate data from people.

Social Capital Data and Variables

Generally, in the literature SC is disaggregated in two types: *bonding* and *bridging* SC. The former refers to interconnection between socially homogeneous groups, while the latter refers to networks that cut across geographic and socioeconomic distance (Flora & Flora, 2008). Given that an earthquake is a covariate shock, the role of both types of SC may differ in the final coping strategies and recovery of HHs. Bonding SC may become less effective since local networks of support would be strained in poor regions, while bridging SC becomes important as networks beyond social classes and geographic areas may support HH's resilience. The role of each type of SC in the decision to use coping strategies and final recovery of HHs is an issue that is addressed with the results.

Given these concepts of SC, and considering previous empirical economic literature, I assessed different SC metrics in this research: number and participation in different associations; trust levels based on standard attitudinal survey questions from the General Social Survey (GSS); non–standard attitudinal question (used in other studies to asses cooperation and trust); and social diversity measures based on family networks inside and outside the village. Each measure is explained below.

To measure SC in the villages, three main associations' variables at pre–earthquake levels were assessed: the number of local productive (business) organizations, the number of local non–business associations, and the number of participants in the neighborhood council[21] (these three variables will be normalized by adult village population). The data for these variables were collected from the 2010 National Census, municipal records, and from interviews with community leaders. With this information we have information that differs across communities and that will measure the degree of horizontal integration in each community. In the HH survey it was also inquired whether and how much time the HH members participated in the associations.

[21] Neighborhood councils are typical in rural communities across Chile, in which people gather to apply for community grants and projects, and to organize political demands to local authorities.

On the other hand, trust is a major component of SC. Following the approach used by Glaeser et al. (2000) and others, this study considers the estimation of trust indicators for HH members implementing retrospective questions of trust in different people (based on the structure of GSS questions). Non–standard question as the ones suggested by Schmid (2000) were also included to measure trust and other factors like cooperation and risk aversion. Generally, the concept of trust relates more to the bonding type of SC, as has been demonstrated that levels of trust is higher in more homogeneous communities. However, a high level of trust can also be presented in communities with more heterogeneous groups, where it is expectable to observe more effective social engagement given that is more likely to observe business–like actions happening beyond familiar ties (Fukuyama, 1995).

Empirical Models and Preliminary Results

Given that the collection of surveys concluded the past May, results at the moment of submitting this paper are still not available. By September it is expected to have preliminary results to share with the participants of the summer school. However, the empirical analyses and potential models that will be considered to evaluate the data, based on the discussion addressed above, are described in the following.

The first empirical analysis to perform will be to estimate the likelihood of the selection of different coping strategies from HHs. If we assume that dissaving (d_{it})[22] and informal borrowing (b_{it}) are constrained and only transfers ($y_t^{pr} + y_t^{pb}$) are available in equation (2), and, alternatively, we assume the restriction of the transfers and borrowing with only the availability of dissaving, and the restriction of dissaving and transfers making only borrowing available, we end up with a three dependent variable model, where the left hand side variables correspond to the respective coping strategy. However, giving that it is more achievable to obtain information of whether or not a HH has employed one coping strategy (discrete event) than the intensity of the strategy, a three *binary* dependent variable (three equations) model is considered. Thus, for each equation, let the adoption of a coping strategy C_s (S = 1: borrowing, 2: dissaving, 3:

[22] I use dissaving, instead to changes in savings, hereafter.

transfers) be a dichotomous choice, where HH *i* decides to use the respective coping strategy ($C_{s\,i}$ = 1) if they have access and perceive a net positive benefit ($C^*_{s\,i}$) and does not use it otherwise ($C_{s\,i}$ = 0). This decision–making criterion can be represented by a probit model. Assuming dependence of the three coping strategies through the correlation of the respective jointly normal distributed error terms, the final model can be represented by a multivariate (trivariate) probit model given by,

$$
\begin{aligned}
C^*_{1\,i} &= \alpha_1 \boldsymbol{Q}_i + \theta_1 \boldsymbol{X}_i + \gamma_1 SK_i + \delta_1 SK_j + \varepsilon_{1\,i} \ , \\
C^*_{2\,i} &= \alpha_2 \boldsymbol{Q}_i + \theta_2 \boldsymbol{X}_i + \gamma_2 SK_i + \delta_2 SK_j + \varepsilon_{2\,i} \ , \qquad (4) \\
C^*_{3\,i} &= \alpha_3 \boldsymbol{Q}_i + \theta_3 \boldsymbol{X}_i + \gamma_3 SK_i + \delta_3 SK_j + \varepsilon_{3\,i} \ ,
\end{aligned}
$$

where ε_1 , ε_2 and ε_3 correspond to the error terms of the three coping equations, assumed also to have variances equal 1 for identification purposes. $\boldsymbol{Q}$ represents a matrix of HH specific shock variables from the earthquake, *SK* is SC in HH *i* and also in community *j*, and $\boldsymbol{X}$ is a set of HH socioeconomic and education variables at 2010 levels. This last set will include variables representing the income sources of HHs from direct (farm revenues and wages) and non–direct sources (remittances, heritage, others) that may affect the coping decision. α_S , θ_s , γ_S and δ_S are coefficients to be estimated –for each coping equation– following Capellari and Jenkins (2003). The sign of the coefficients given by γ_S and δ_S will test hypothesis (1), which we expect to be positive and significant for the borrowing and transfers coping equations (as suggested in section 1). Given that initial levels of SC are used as covariates (SC levels before the earthquake), potential endogeneity problems will be avoided, although endogeneity tests will be carefully considered to check this issue.

The second analysis considers a regression model to estimate HH recovery using a simple growth (change) model. The model is described by the following equation:

$$
\Delta y_i = \beta_0 + \beta_y y_{i0} + \beta_x \boldsymbol{X}_i + \beta_A A_i + \beta_I I_i + \beta_Z Z_i + \beta_{SKi} SK_i + \beta_{SKj} SK_j + \beta_C \boldsymbol{C}_i + e_i \ , \qquad (5)
$$

where Δy_i is either asset or income change of the i^{th} HH between January 2010 and 2011. y_0 is either the respective initial level of assets or of income (at 2010 levels), and $\boldsymbol{X}$ is the set of HH's socioeconomic and education variables. The variables *A* and *I* are the HH's asset and income shocks (damages from the earthquake), respectively, and the vector *Z* represents other shock

variables such as housing and health damages.[23] ***C*** represents a set of dummy variables for the use of the different coping strategies described in (4). Interaction terms of *SK* (and *C*) with *A* and *I* will show if a HH endowed with SC (or using particular *C*) recovers more rapidly or slower than the average, if SC and/or particular coping strategies dampens the impact of the earthquake shocks. Thus, the coefficients of these interaction terms are the tests of the hypotheses (2) and (3) described above.

For the estimation of parameters in (5), some caveats should be considered from the simple OLS estimation (that will also be used to test results). First, multicollinearity could be an issue, especially the one arising from the potential correlation between SC variables (*SK*) and the coping strategy dummies (*C*). We expect a high correlation between, for example, HH SC and informal borrowing. In the multivariate probit model (equation 4) this is not an issue because we claim the causality SC → Coping Strategies, but with both variables in the same side of the equation there could be problems of collinearity. A second issue in the estimation is the potential endogeneity problem of the coping strategies variable: coping strategies explain wealth change, but the change in wealth over time may also explain why to opt for one type of coping strategy over the other. Given these two caveats, the empirical approach proposed includes a two stage least square, where the first stage corresponds to a probit model that predicts the coping strategy variable to use in the second estimation. In this way we could use the SC variables to explain the use of coping strategies in stage one (similarly to what is to be done in (4)), and include only the instrument for the coping strategy in stage 2. In this way we could avoid the endogeneity and the collinearity problems.

Considering that, in general, the government is the main actor providing aid and creating programs for reconstruction after a natural disaster, it is important to carefully analyze the effect of public transfers received by HHs. In order to address how public transfers differently affect a HH recovery, I will construct two subgroups: HHs that received no public transfers, and HH receiving public transfers. Giving this subdivision, an econometric analysis can be performed to analyze if SC affects these subgroups to a similar or different degree. The question arises whether HHs that receive public transfers also have a greater (or lower) average recovery over

[23] ***Z***, *A* and *I* are elements of matrix ***Q*** in (4).

the entire sample. If there are concerns that the SC and other factors indeed have differential effects on the recovery of HHs with and without public transfers, separate growth models for each HH group must be specified. Hence if equation (5) is considered for each HH group without taking into account the potential differential effects, the resulting OLS (or 2SLS) estimates could be biased due to a sample selection problem. As a way of dealing with these problems I will use an *endogenous switching regression model*, which accounts for both sample selection and endogeneity problems. The first step of the switching regression model will employ a probit model to estimate the likelihood of the discrete event: HH receives public transfer v/s HH with no public transfer (dummy variable). In this equation the community SC level will be a crucial determinant as pointed in section 1. From results of this estimation the *inverse Mills ratio* is to be calculated and used as identification in the second step, where either the OLS or the 2SLS second stage (including the instrument for coping strategies) will be conducted.

In all the models described in this section a set of dummies for each comuna will be considered in order to control for unobserved characteristics (especially political) or mayor earthquake damages at comuna levels (such as service shortages). Finally, although the described methodology follows what it is expected in theory, important to mention is that all the quantitative approaches here described have to be reconsidered once the data are analyzed, especially given that the final models will depend on what types of coping strategies have been used in Chile since the last February earthquake.

At the moment of preparing this draft data are being analyzed. I expect to have preliminary results by the end of August, so they can be discussed at the Belpasso Summer School.

References

Adger, N.W., Hughes, T.P., Folke, C., Carpenter, S.R., & Rockstrom, J. (2005). Social-Ecological resilience to coastal disasters. *Science* 309(5737), 1036–1039.

Alesina, A., & La Ferrara, E. (2002). Who trusts others? *Journal of Public Economics, 85*(2), 207–234.

Andrabi, T. & Das, J. (2010). In aid we trust: Hearts and minds and the Pakistan Earthquake of 2005. Policy Research Working Paper Nº WPS 5440. The World Bank.

Ashraf, N., Bohnet, I. & Piankov, N. (2006). Decomposing Trust and Trustworthiness. *Experimental Economic* 9, 193–208.

Barr. A. (2003). Trust and expected trustworthiness: experimental evidence from Zimbabwean villages. *The Economic Journal* 113, 614–630.

Berg, J., Dickhaut, J., & McCabe, K. (1995). Trust, reciprocity, and social history. *Games and Economic Behavior, 10*(1), 122–142.

Brodie, M., Weltzien, E., Altman, D., Blendon, R., & Benson, J. (2006). Experiences of Hurricane Katrina evacuees in Houston shelters: Implications for future planning. *American Journal of Public Health* 96(8), 1402–1408.

Buchan, N. R., Croson, R. T. A., & Solnick, S. (2008). Trust and gender: An examination of behavior and beliefs in the investment game. *Journal of Economic Behavior & Organization, 68*(3–4), 466–476.

Capellari, L., & Jenkins, S. (2003). Multivariate probit regression using simulated maximum likelihood. STATA Journal 3(3), 278–294.

Carter, M. R., & Castillo, M. (2005). Morals, markets and mutual insurance: Using economic experiments to study recovery from hurricane Mitch. In C. B. Barrett (Ed.), *Exploring the moral dimensions of economic behavio*r. Oxon, UK: Routledge.

Carter, M., & Castillo, M. (2010). Trustworthiness and SC in South Africa: Analysis of actual living standards data and artefactual field experiments. *Economic Development and Cultural Change* (forthcoming).

Cassar, A., Healy, A. & von Kessler, C. (2011). Trust, risk, and time preferences after natural disasters: Experimental evidence from Thailand. Working paper available at https://sites.google.com/site/cassar/research

Cavallo, E. & Noy, I. (2010). *The economics of natural disasters, a survey*. Inter–American Development Bank Working Paper Series No. IDB–WP–124. Washington, DC.

Croson, R. & Buchan, N. (1999). Gender and culture: International experimental evidence from trust games. *The American Economic Review* 89(2), 386–391.

Di Falco, S., & Bulte, E. (2010). A dark side of social capital? Kinship, consumption, and savings. *Journal of Development Studies* (forthcoming).

Eckel, C. C., & Wilson, R. K. (2004). Is trust a risky decision*? Journal of Economic Behavior & Organization, 5*5(4), 447–465.

Flora, C.B., & Flora, J. L. (2008). *Rural communities: legacy and change*. Third Edition, Westview Press: Boulder, CO.

Fukuyama, F. (1995). *Trust : Social virtues and the creation of prosperity* (first ed.). New York: Free Press.

Glaeser, E. L., Laibson, D. I., Scheinkman, J. A., & Soutter, C. L. (2000). Measuring trust. *Quarterly Journal of Economics* 115(3), 811–846.

Haddad, L., & Maluccio, J. (2003). Trust, membership in groups and household welfare: evidence from KwaZulu–Natal, South Africa. *Economic Development and Cultural Change*, 51(3), 573–601.

Hardin, R. (1996). Trustworthiness. *Ethic* 107(1), 26–42.

Holt, C. A., & Laury, S. K. (2002). Risk aversion and incentive effects. *The American Economic Review, 9*2(5), pp. 1644–1655.

Jacobson, S. & Petrie, R., 2007. *Inconsistent Choices in Lottery Experiments: Evidence from Rwanda*. Experimental Economics Center Working Paper No. 2007–03. Georgia State University.

Johnson, N. D., & Mislin, A. A. (2010). *Trust games: A meta–analysis.* George Mason University Working Paper in Economics No. 10–38.

Karlan, D. S. (2005). Using experimental economics to measure social capital and predict financial decisions. *The American Economic Review, 9*5(5), pp. 1688–1699.

Khandker, S. (2007). Coping with flood: role of institutions in Bangladesh. *Agricultural Economics*, 36(2), 169–180.

Knack, S., & Keefer, P. (1997). Does social capital have an economic payoff? A cross–country investigation. *Quarterly Journal of Economics, 112*(4), 1251–1288.

Kovács, G. & Spens, K.M. (2007). Humanitarian logistics in disaster relief operations. *International Journal of Physical Distribution & Logistics Management* 37(2), 99 – 114.

Madariaga, R., Metois, M., Vigny, C. & Campos, J. (2010). Central Chile finally breaks. *Science* 328(5975), 181–182.

Miguel, E., Gertler, P., & Levine, D. (2005). Does social capital promote industrialization? Evidence from a rapid industrializer. *Review of Economics and Statistics*, 87, 754–762.

Mogues, T. (2006). *Shocks, livestock asset dynamics and social capital in Ethiopia*. DSGD Discussion Paper Nº 38. International Food Policy Research Institute, Washington , DC.

Morrone, A., Tontoranelli, N. & Ranuzzi, G. (2009). *How good is trust? Measuring trust and its role for the progress of societies*. OECD Statistics Working Papers, No. 2009/03.

Munasinghe, M. (2007). The importance of social capital: comparing the impacts of the 2004 Asian Tsunami on Sri Lanka, and Hurricane Katrina 2005 on New Orleans. *Ecological Economics* 64(1), 9–11.

Nakagawa, Y. & Shaw, R. (2004). Social capital: A missing link to disaster recovery. *International Journal of Mass Emergencies and Disasters* 22(1), 5–234.

Narayan, D., & Pritchett, L. (1999). Cents and sociability: Household income and social capital in rural Tanzania. *Economic Development and Cultural Change*, 47, 871–897.

Rupasingha, A., Goetz, S., & Freshwater, D. (2006). The production of social capital in US counties. *The Journal of Socio–Economics*, 35(1), 83–101.

Sawada, Y. (2007). The impact of natural and manmade disasters on household welfare. *Agricultural Economics*, 37(1), 59–73.

Sawada, Y., & Shimizutani, S. (2005). Are people insured against natural disasters? Evidence from the Great Hanshin–Awaji (Kobe) Earthquake in 1995. CIRJEN Discussion Paper No F–314, available at: http://www.e.u–tokyo.ac.jp/cirje/research/dp/2005/2005cf314.pdf.

Schmid, A. (2000). Sources of social capital. Department of Agricultural, Food, and Resource Economics Staff Papers No. 11781, Michigan State University.

Sutter, M. & Kocher, M. G. (2007). Trust and trustworthiness across different age groups. *Games and Economic Behavior* 59(2), 364–382.

Table 1. Main statistics of survey data. Mean (median) [standard deviation].

Variable	Description	Earthquake villages	Control Villages
Gender	Dummy variable, 1 if female	0.73	0.69
Marital_status	Dummy variable, 1 if married	0.61	0.67
Religion	Dummy variable, 1 if Catholic	0.80	0.83
Age	Age of the player	48.37 (51) [17.1]	49.37 (48) [15.2]
Education	Level of education, scale 0 (no education) to 5 (12 years or more)	2.20 (2) [1.3]	2.40 (2) [1.2]
People_household	Number of persons living in household	3.24 (3) [1.5]	3.25 (3) [1.6]
Income_pc	Household per capita income (thousands of Chilean pesos)	53.63 (37.5) [6.4]	60.97 (50.0) [4.1]
Trust_town	Reported trust to people of village, scale 1 (no trust) to 4 (high trust)	2.07 (2) [0.9]	2.10 (2) [0.9]
Trust_strangers	Reported trust to strangers, scale 1 (no trust) to 4 (high trust)	1.66 (1) [0.9]	1.37 (1) [0.9]
Nº of Participants [a]		121	115
Trustors (group A)		61	59
Trustees (group B)		60	56

Notes: We find no significant difference on average participants' characteristics between groups (earthquake vs control villages), with the exception of marital status and trust to strangers. See text for more details.
[a] Number of participant do not match between trustors and trustees because in 4 out of 10 sessions we had an uneven number of participants. See text for more details.

Table 2. Main statistics of game outcomes and statistical tests. [a]

	Trust (*s*)		**Trustworthiness (*r/3s*)**	
	Earthquake	Control	Earthquake	Control
Dominant Mode	2	2	0.33	0.33
Mean (median)	2.31 (2)	2.24 (2)	0.28 (0.22)	0.38 (0.33)
Standard deviation	1.56	1.25	0.24	0.22
	Statistical tests for differences between groups [b]			
t–test for equality of mean, equal variance assumed	0.82		**0.03**** [**0.00***]	
t–test for equality of mean, equal variance not assumed	0.82		**0.02**** [**0.00***]	
Mann–Whitney U test for equality of distributions	0.78		**0.00***** [**0.00***]	
Levene's tests for equality of variance	0.29		0.60 (0.90)	

[a] Six players of group B (4 in the earthquake area and 2 in the control villages) could not play because they received $0 from the trustor. These six cases are neither included in the results reported here nor in the regression estimations.
[b] Test values correspond to two–tailed p–values. Squared brackets show p–values of sample excluding outliers given by $r/3s = 1$ (six observations in total, three on each group).

Table 3. Results of trust models [dependent variable: ***s***].

	Model 1	Model 2	Model 3	Model 4
Constant	0.109 (0.803)	0.017 (0.883)	0.633 (0.766)	0.487 (0.791)
Gender	0.321 (0.287)	**0.637** (0.299)**	0.220 (0.291)	**0.673** (0.291)**
Marital_status	–0.318 (0.267)	–0.331 (0.286)	–0.422 (0.267)	**–0.450** (0.287)*
Religion	**0.475** (0.264)*	0.415 (0.292)	0.444 (0.297)	0.343 (0.308)
Age	**0.025** (0.011)**	**0.022** (0.012)*	**0.025** (0.011)**	**0.021** (0.011)*
Education	0.126 (0.132)	0.049 (0.146)	**0.253** (0.131)*	0.210 (0.136)
Inc_qtl	0.054 (0.102)	0.042 (0.120)	–0.013 (0.104)	–0.085 (0.114)
Lottery		**0.138** (0.076)*		**0.289** **(**0.090)***
Earthquake dummy	0.097 (0.282)	0.005 (0.291)		
Community dummies	*no*	*no*	*yes*	*yes*
Nº Observations	120	111	120	111
R^2	0.119	0.1311	0.24	0.31

Notes: Robust standard errors in parenthesis. Not reported town dummies are included in models 3 and 4. Number of observations varies because *Lottery* was not assessed in one village (see footnote 11).
*p < .10. **p < .05. ***p < .01.

Table 4. Results of trustworthiness models [dependent variable: ***r/3s***].

	Model 5	Model 5.1	Model 6	Model 7
Constant	0.173 (0.226)	–0.083 (0.146)	**0.345** (0.050)***	–0.089 (0.148)
*Trust (**s**)*	**–0.050** (0.013)***	**–0.031** (0.010)***	**–0.042** (0.010)***	**–0.04** (0.010)***
Gender	0.012 (0.041)	0.008 (0.032)		–0.008 (0.035)
Marital_status	0.037 (0.050)	0.037 (0.030)		0.041 (0.032)
Religion	–0.044 (0.070)	0.009 (0.043)		0.035 (0.043)
Age	0.004 (0.007)	**0.009** (0.005)**		**0.009** (0.004)**
Age^2	–0.000 (0.000)	**–0.000** (0.000)*		**–0.000** (0.000)*
Education	0.002 (0.018)	**0.022** (0.013)*		**0.020** (0.012)*
Inc_qtl	0.029 (0.018)	**0.020** (0.011)*		0.011 (0.011)
Trust_town	**0.069** (0.028)**	**0.051** (0.014)***		**0.051** (0.014)***
Earthquake dummy [a]	**–0.09** (0.044)**	**–0.091** (0.029)***	**–0.058** (0.029)**	**–0.065** (0.039)*
Community dummies	*no*	*no*	*yes*	*yes*
Nº Observations	110	104	104	104
R^2	0.18	0.33	0.31	0.44

Notes: Robust standard errors in parenthesis. Not reported community dummies are included in models 6 and 7. All models exclude participants receiving $0 from trustors and models 5.1–7 exclude outliers that played ***r/3s*** = 1 (see notes to table 2). Results including outliers in columns 3 and 4 give similar structural results but lower values of R^2. *p < .10. **p < .05. ***p < .01.

[a] We avoid perfect multicollinearity between *Earthquake dummy* and the community dummies, in models 6 and 7, by procedure described in text.

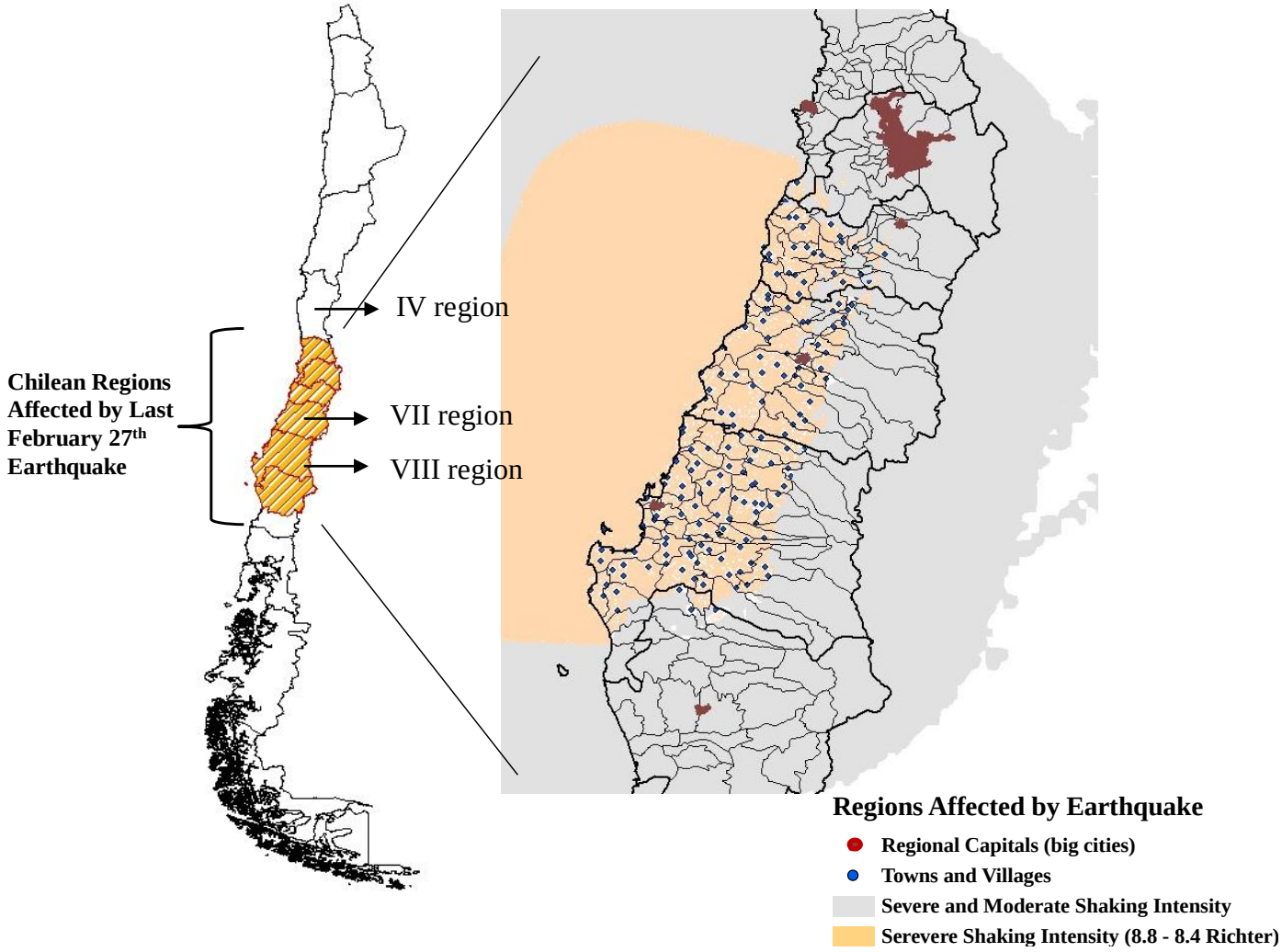

Figure 1. Chilean earthquake location and intensities.

Source: Own elaboration with data provided by the "Earthquake Geospatial Research Portal" at Harvard University.

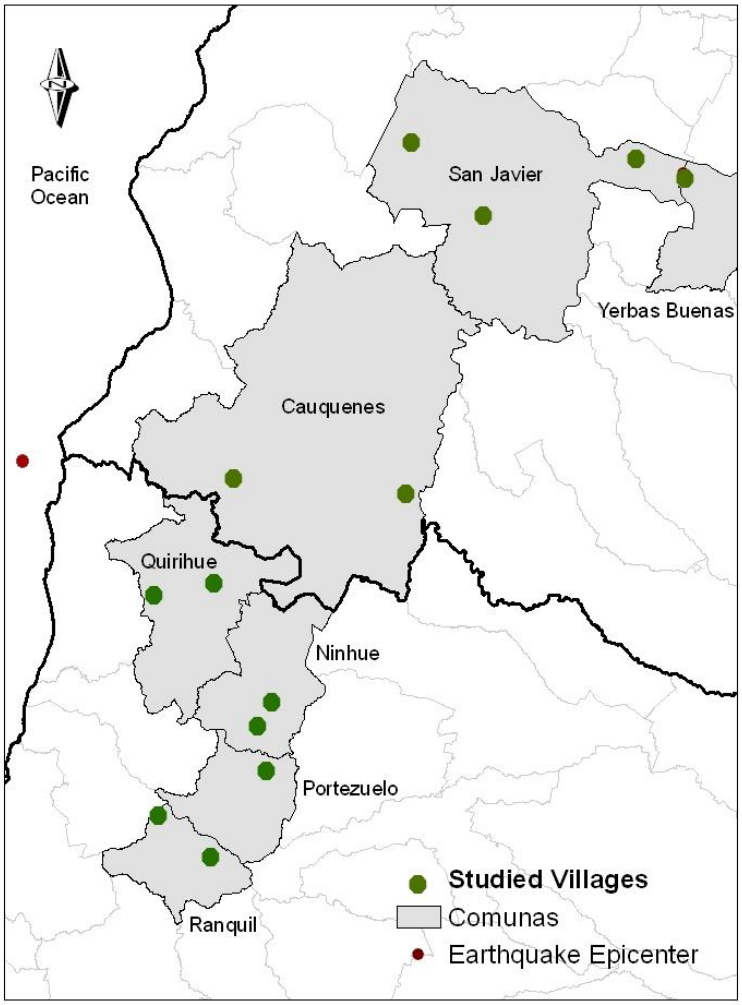

Figure 2. Chilean *comunas* and villages (communities) where surveys were conducted.

Source: Own elaboration.