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and the dynamics of other-regarding preferences

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Formal insurance, risk sharing, and the dynamics of other-regarding preferences

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Abstract

In the absence of formal financial markets many poor households rely on the mutual exchange of transfers within informal risk sharing networks to protect themselves against adverse events. In this paper we present a model that explains the impact of formal insurance on informal risk sharing and, subsequently, the dynamics of other-regarding preferences. We test the predictions of the model using a solidarity game with rural households in Mexico. Consistent with the model predictions, we find that when shocks are collective, there is a crowding-out effect on transfers and a decrease in trust on insured participants. However, when shocks are idiosyncratic, we fail to confirm the predictions of the model. Transfers to non-insured members are significantly higher when insurance is available to some of the network members than in a control treatment when insurance is not available. This unexpected crowding-in effect on transfers leads to an increase in trust among non-insured participants. These findings suggest that there is a need to find optimal insurance designs that minimizes the crowding-out effect of formal insurance on informal risk sharing and other-regarding preferences.

1 Introduction

Providing formal insurance to previously uninsured households in developing countries is regarded as a promising instrument to decrease households vulnerability to poverty (World Bank, 2013). It has been

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argued that the risk reduction due to formal insurance could lead farmers to invest in riskier but higher yielding technologies (Giné and Yang, 2009; Fafchamps, 2010; Karlan et al., 2014), improve access to loans (Giné and Yang, 2009), and prevent the use of inefficient risk coping mechanisms (Dercon, 2002; Fafchamps and Lund, 2003; Fafchamps and Gubert, 2007; Barnett et al., 2008). Yet, the theoretical and empirical literature suggests that formal insurance can crowd-out transfers in informal risk sharing networks, potentially resulting in a net decrease in risk coverage (Lin et al., 2014). The aim of this paper is to investigate the interlink between formal insurance, risk sharing in informal solidarity networks, and the dynamics of other-regarding preferences. In particular, we consider whether access to formal insurance results in a crowding-out effect on transfers in informal solidarity networks and whether this has a subsequent negative effect on the development of other-regarding preferences (also referred to as social preferences), or the preferences that individuals give to the well-being of others (Kagel and Roth, 1995; Camerer et al., 2011).

Understanding the factors that affect the development of other-regarding preferences is important as other-regarding preferences can explain decisions in various circumstances ranging from charitable behavior, bequests, contributions to public goods and investment decisions (Cooper and Kagel, 2016). Furthermore, societies that manage to establish norms that curb individualistic interest in favor of social well-being have been found to experience higher economic growth (Zak and Knack, 2001; Cardenas and Carpenter, 2008).

We develop a model that explains the development of other-regarding preferences in informal risk sharing networks with imperfect commitment under a finite number of interactions. Similar to Foster and Rosenzweig (2001) and Lin et al. (2014), other-regarding preferences are conceptualized as the weight that individuals give to the utility of others. Yet, these weights are not constant over time but depend on the history of interactions. As individuals who are affected by negative shocks receive transfers from their risk sharing network, they increase the weight that they give to the utility of other network members. Therefore, even when there is no infinitely repeated interaction, our model predicts that positive levels of risk sharing can be achieved when individuals are sufficiently altruistic. We extend this model by taking into account the impact of formal insurance on risk sharing and on the development of other-regarding preferences. The model predicts that when shocks are idiosyncratic formal insurance decreases transfers in risk sharing networks which leads to a crowding-out effect on the development of other-regarding preferences. Three channels explain this effect. First, due to the availability of insurance the marginal benefit of sending a transfer to an insured network member is lower which decreases the optimal value of the transfers sent. Second, the insurance results in a mechanical reduction in transfers received by insured network members who do not experience an income loss. Third, the insurance reduces the value of participating in the risk sharing network as insured participants are less likely to send transfers to non-insured participants. In contrast, when shocks are covariate, the model gives ambiguous predictions regarding the impact of the insurance on transfers in the risk sharing network and on the development of other-regarding preferences. As before, the insurance would crowd-out transfers from non-insured members yet, the insurance payouts received by insured participants enable them to send transfers to other network members affected by a shock. Highly altruistic insured network members hit by a shock will still send transfers to other affected members of the network. If transfers are crowded-in by the insurance, there could be an increase in the importance that individuals give to other group members.

To test the predictions of our model, we implemented a lab-in-the-field experiment in rural Mexico where households relying on agricultural activities are particularly vulnerable to weather shocks and exposed to a large amount of uninsured risks. Natural disasters are a significant driver of poverty dynamics in Mexico (Rodriguez-Oreggia et al., 2013). In an effort to reduce this vulnerability, the Mexican government has invested in the development of a subsidized federal insurance program for farmers. Public expenses to promote coverage by formal, individual agricultural insurance have more than doubled between 2007 and 2012 Arias (2013). In 2013, 14.7 million hectares of agricultural land - mainly located though in the more developed regions - were covered by some type of insurance (Cabestany Noriega et al., 2013). By strengthening the insurance markets, many small-scale farmers will get access to formal insurance, which could have important implications for the dynamics of other-regarding preferences among communities. Moreover, this could have important implications for the poorest households, who are typically less likely to buy insurance and who consequently may need to rely on informal risk sharing networks (Eling et al., 2014).

Our experimental design is similar to van Dijk et al.'s (2002) three stage experiment. In the first stage we elicit experimental measures of social preferences using a three person dictator and trust game. Thereafter we form new groups and allow participants to interact in a three person repeated solidarity game based on Selten and Ockenfels (1998). After solving a real effort task, participants can suffer from a negative shock that results in zero earnings. Participants who are not affected by the shock and received a positive income can decide to send a transfer to affected participants. In this stage we exogenously modify a) the number of participants simultaneously affected by a shock and b) the availability of insurance. We allow that either one individual is affected by a shock at a time (individual shock) or that two individuals are affected simultaneously (collective shock). In the treatments with insurance two participants in the network are exogenously assigned to an insurance, while the third individual remains exposed to shocks. Insured participants receive a fixed payment independently of whether they are affected by a shock and therefore have the possibility to send a transfer to the member of the network who remains exposed to shocks. In the last stage we repeat the measures of social preferences using a three person dictator and trust game while keeping the groups constant. The comparison of the experimental measures before and after the solidarity game under different treatments allows us to trace the dynamics of other-regarding preferences.

We find partial support for the theoretical model. Contrary to the predictions of the model, we find that when shocks are individual and one member of the network is affected by a shock, insured participants are more likely to send a transfer to non-insured participants. This results in an increase in trust by non-insured participants compared with the control treatment with no insurance. This effect is consistent with a positive valuation of the interaction in the solidarity network. When shocks are collective, our results confirm the model predictions. Insured participants are less likely to send transfers to non-insured network members. This finding suggests that the predicted crowding-in effects of the insurance are relatively low and are lower than the disincentives to send a transfer. The decrease in transfers leads to a lower increase in trust in the insurance treatment compared with the control treatment without insurance.

Few theoretical models explained the existence of risk sharing agreements with imperfect commitment (Coate and Ravallion, 1993; Foster and Rosenzweig, 2001; Ligon et al., 2002; Charness and Genicot, 2009), yet, the only paper that considers the crowding-out effects of formal insurance on risk sharing is Lin et al. (2014). Following a similar approach to Foster and Rosenzweig (2001) and Lin et al. (2014), we propose a model of risk sharing with other-regarding preferences. Yet, we differ from these papers as we are the first ones to explicitly examine the impact of insurance on the development of other-regarding preferences. Previously, van Dijk and van Winden (1997) and van Dijk et al. (2002) examined the effect of interaction on public goods games on other-regarding preferences. We extend this research to consider income shocks and the role of formal insurances.

As documented by Lenel and Steiner (2016), there is a growing literature examining the interrelation between formal insurance and risk sharing networks. For example Mobarak and Rosenzweig (2013) consider how the existence of risk sharing agreements affects the demand of a formal insurance. On the one hand, Dercon et al. (2014) show theoretically and with a lab-in-the-field experiment that basis risk, the risk of suffering a loss that is not indemnified by an index insurance, crowds-in transfers in risk sharing networks in the context of a weather index insurance in Ethiopia. Lin et al. (2014) on the other hand show theoretically and empirically that formal insurances can crowd-out transfers in informal risk sharing networks as the value of autarky relative to participating in the network increases and as the formal insurance substitutes the need of support. Landmann et al. (2012) find that formal insurance crowds-out solidarity between network members in the case that incomes are observable and this effect even persists after removing the insurance. In contrast to these studies, our focus is on the impact of formal insurance on the dynamics of other-regarding preferences.

The closest to our paper is Cecchi et al. (2016) who analyze how the introduction of formal health insurance in Uganda affects public good contributions of experiment participants. The authors find that public good contributions were on average lower in areas where insurance was introduced, which is driven by lower contributions of individuals who did not adopt the insurance. Our work complements that research by analyzing the effects of formal insurance depending on the covariance structure of shocks. In particular, we consider separately the cases when shocks are individual and when two members are affected by a negative income shock. This is important as the dynamics of the exchange of help and other-regarding preferences can change significantly depending on the structure of shocks (Dietrich, Ibanez and Klasen, 2014)..

The rest of the paper is structured as follows. Section 2 presents the theoretical model explaining the crowding effects of insurance on transfers within risk sharing networks. Section 3 and 4 explain the experiment design, treatments, and experimental procedures. Section 5 describes the estimation strategy and results. The results summarized and potential limitations are discussed in Section 6. Conclusions are delivered in Section 7.

2 Theoretical model

2.1 Model set up

A risk sharing model in the spirit of well-established models of risk sharing under no or imperfect commitment is proposed (Coate and Ravallion, 1993; Foster and Rosenzweig, 2001; Ligon et al., 2002). We consider a solidarity network composed of three individuals, $I = i, j, k$ who live over two periods $t = 1, 2$. In each period individual i receives income $y_{i,t}(s_t)$, where s_t is the state of nature that individual i confronts in period t. There are two possible states of the world $s_{i,t} = 1$ or $s_{i,t} = 2$. The probabilities associated with each of these states are $(1 - p)$ and p, respectively. Similar to other risk sharing models, we consider that individuals cannot save across periods (Foster and Rosenzweig, 2001; Lin et al., 2014). Hence income for individual i in period t is given by:

$$y_{i,t} = \left\{ \begin{array}{cc} E_{i,t} + w_{i,t} & if\ s_{i,t} = 1 \\ \\ E_{i,t} & if\ s_{i,t} = 2 \end{array} \right) \tag{1}$$

Here E_i is a fixed income and w_i an additional positive income (i.e. wage) only attained if $s_{i,t} = 1$, while a bad state of the world, which we denominate income shock, occurs in $s_{i,t} = 2$ as the individual does not receive w_i. Individuals can send transfers to network members that are affected by a shock ($s_{i,t} = 2$). We denote by $t_{ij,t}$ the transfer sent by individual i to the affected individual(s) j in period t. We assume that only individuals who received a positive income (w_i) can send transfers and that transfers are sent only to network members affected by a shock. A transfer from i to j can occur if $s_{i,t} = 1$ and $s_{j,t} = 2$ for all $j \neq i$.

We assume that an individual's utility depends on two components: 1) the utility of own consumption and 2) utility of consumption of the other network members. To take into account that transfers might be motivated by an altruistic motive (Cox et al., 2008; Foster and Rosenzweig, 2001; Lin et al., 2014), we consider that in period t individual i attaches a welfare weight $\gamma_{ij,t}$ to their partner j's utility of consumption, $U(c_{j,t})$. The utility of consumption, $U(.)$ is assumed to be increasing and concave in c ($U'(c)$ >0 and $U"(c) < 0$). Following the standard assumptions we restrict $0 < \gamma_{ij,t} < 1$, thereby ruling out that i values j's utility of consumption more than her own.

We extend this model by considering that the welfare weight or altruism level $\gamma_{ij,t}$ is dynamic. Therefore we follow the notion of van Dijk and van Winden (1997), considering that the development of other-regarding preferences depends on the history of interactions. The assume that the weight $\gamma_{ij,t}$ changes over time with the history of previous transfers received by i from j, $t_{ji,t-1}$ and the previous level of altruism, $\gamma_{ij,t-1}$. The dynamics of other-regarding preferences are given by a function $\gamma_{ij,t+1} = f(t_{ji,t}, \gamma_{ij,t})$, where $\gamma_{ij,t+1}$ is increasing in transfers i received from j in the past, $\frac{d\gamma_{ij,t+1}}{dt_{ji,t}} > 0$, and increases more for initially less altruistic individuals $\frac{d\gamma_{ij,t+1}}{dt_{ji,t}d\gamma_{ij,t}} < 0$. A discount factor $\beta < 1$ takes into account that future utility of consumption is valued less than present consumption.

We consider two different scenarios which we refer to as individual and collective shocks. In the scenario with individual shocks, incomes of the network members are negatively correlated and therefore only one network member is affected by a negative income shock in a given period. Denoting the set of states for the world by $S = \{s_{i,t}, s_{j,t}, s_{k,t}\}$, the following states are possible under the individual shock scenario: $S_I = \{\{1,2,1\}, \{1,1,2\}, \{2,1,1\}\}$. Under this scenario, two network members can make transfers to the affected member at a given point in time. In the scenario with collective shocks, income within the network is positively correlated and two network members are affected by a negative income shock in a given period. Here, the following scenarios are possible: $S_c = \{\{1,2,2\}, \{2,1,2\}, \{2,2,1\}\}$. In this case, only one network member can make a transfer at a time. We assume that the value of the transfer will be equally divided by the two affected members. Finally, it can occur that either all individuals of the network are affected by a shock, $S_A = \{2,2,2\}$, or that no one in the network is affected by a shock, $S_N = \{1,1,1\}$. In those cases, no transfers are possible.

2.2 Individual shocks

We first consider the scenario with individual shocks, in which participant j suffers an income shock and individual i and k can make a transfer. Assuming that an individual's utility is separable in the two components - own consumption and weighted consumption of others - the optimization problem for individual i in $t = 1$ is to maximize the value function:

$$\underset{t_{ij,t}}{Max} \quad V_{i,t}\left(c_{i,t},\, c_{j,t},\, c_{k,t}\right) = U\left(c_{i,t}\right) + \gamma_{ij,t} U(c_{j,t}) + \gamma_{ik,t} U(c_{k,t}) \tag{2}$$

Subject to the budget constraint that the value of consumption is equal to the income after net transfers. In the case of idiosyncratic shocks, the budget restriction for individuals i, j and k, are given by:

$$c_{ij,t} = E_{i,t} + w_{i,t} - t_{ij,t} \tag{3}$$

$$c_{j,t} = E_{j,t} + t_{ij,t} + t_{kj,t} \tag{4}$$

$$c_{k,t} = E_{k,t} + w_{k,t} - t_{kj,t} \tag{5}$$

In addition, the optimization problem is subject to a participation constraint given in equation 6. This condition simply states that individual i would decide to participate in the risk sharing network and make a transfer in $t = 1$ if the discounted expected utility after the transfer is larger than the expected utility in autarky, i.e. without future exchange of transfers.

$$U_{i,t}\left(c_{i,t},\, c_{j,t},\, c_{k,t}\right) + \beta EU_{i,t+1}\left(c_{i,t+1},\, c_{j,t+1},\, c_{k,t+1}\right) \geq \begin{array}{c} U_{i,t}\left(y_{i,t},\, y_{j,t},\, y_{k,t}\right) + \\ \beta EU_{i,t+1}\left(y_{i,t+1},\, y_{j,t+1},\, y_{k,t+1}\right) \end{array} \tag{6}$$

The expected discounted utility of participating in the network, $EU_{i,t+1}(c_{i,t+1},\, c_{j,t+1},\, c_{k,t+1})$, depends on the probabilities of confronting a negative income shock and the value of future transfers received from other network members which is a function of the value of the transfer from i to j.[1] For a finite interaction over two periods, the problem can be solved recursively, finding first the optimal transfer in $t = 2$ and then finding the optimal transfer in $t = 1$. In $t = 2$, the participation constraint is not binding. Assuming that $t_{kj,t}$ is independent from $t_{ij,t}$, the first order condition for an interior solution implies that a transfer will be sent if:

$$\gamma_{ij,t} > \bar{\gamma}_{ij,t} = \frac{U'\left(c_{i,t}\right)}{V'\left(c_{j,t}\right)} \tag{7}$$

This implies that when the welfare weight, $\gamma_{ij,t}$, is higher than the threshold level $\bar{\gamma}_{ij,t}$, risk sharing can be achieved in the absence of repeated interaction. Positive transfers could then occur in $t = 2$ when altruism is above the threshold, $\bar{\gamma}$. However, in $t = 1$, transfers could occur even if the welfare weight is below the threshold level. This would happen when the participation constraint in the risk sharing network is binding. The participation constraint states that a participant's expected utility of participating in the risk sharing network and making a transfer today is larger than the expected utility under autarky. If this is the case, transfers are positive even when $\gamma_{ij,t} < \bar{\gamma}_{ij,t}$. As presented in Appendix A, the solution to the optimization problem, will be the optimal transfer, $t^*_{ij,t}$. Comparative statics around the optimum transfer $t^*_{ij,t}$, for $t = 1, 2$, lead to the following proposition:

Proposition 1. Optimal transfer

The optimal transfer increases with the level of altruism or welfare weight, $\gamma_{ij,t}$, i's income,

[1] To see the complete formulation look at Appendix A.

$E_{i,t} + w_{i,t}$ and the probability of reaching a state of the world in which a transfer is required from other members of the network.

Proof: See Appendix A.

Crowding-out of the insurance

We extend this model by introducing formal insurance. We consider a scenario in which only two members of the network j and k have access to the insurance. In this model we do not explain the decision to insure, but assume that insurance is exogenously assigned. This could for instance reflect a social protection program that just reaches some individuals within a community. Insured network members are insured for all two periods. We consider a fair insurance that costs ph each period and pays h when $s_{j,t} = 2$. We can distinguish two cases:

Case A: Non-insured participant i decides to send a transfer to an insured participant, j.

Compared with the scenario with no insurance, insurance induces two effects that crowd-out transfers from i to j in $t = 1$. First, there is a substitution effect. When j is insured and receives an insurance payout, h, the value of the marginal utility of a transfer is smaller. Second, the insurance generates a negative income effect for participant j. When the insured participant pays ph for the insurance in $t = 2$, she is relatively poorer compared to the scenario without insurance. This increases the future marginal cost of a transfer from j to i. As the expected value of future transfers is lower ($t_{ji,t+1}$), the expected value of participating in the insurance network falls. These two effects decrease the value of the optimal transfer, $t^*_{ij,t}$. This in turn generates a crowding-out effect in the dynamics of other-regarding preferences. As j receives lower transfers from i, the level of attachment towards i is also reduced in the case where insurance is available, compared to the case without insurance.

Case B: Insured participant i decides to send a transfer to a non-insured participant, j.

The effect of the insurance is threefold in this case. First, the disposable income of the insured participant i in $t = 1$ is lower which increases i's marginal cost of sending a transfer and results in lower transfers $t_{ij,t}$. Besides, the insurance changes the participation constraint. As i knows she is insured in case of a shock in $t+1$ and receives an insurance payout, the marginal utility of (additionally) receiving transfers from the network is lower compared with the scenario without insurance. When the insurance payout indemnifies the complete income loss, such that the insured participant does not receive transfers in $t+1$, then i's probability of a future transfer is zero ($q_3 = q_4 = 0$). These three effects reduce the incentive to participate in the risk sharing network today and crowds out the value of the transfer, $t_{ij,t}$. The dynamics of other-regarding preferences are hence negatively affected by the insurance.

In summary, in both cases we observe that introducing insurance to the risk sharing network results in a crowding-out effect on the value of the transfer in $t=1$. This generates an indirect effect on the dynamics of other-regarding preferences. The welfare weights, $\gamma_{ij,t+1}$, that individuals attach to the utility of the other network member's consumption in $t+1$ are therefore expected to be lower when some network members are insured compared with a scenario without insurance.

Proposition 2. Effect of the insurance on transfers when shocks are individual

Compared with a scenario without insurance, transfers are reduced when some network members have access to insurance. The crowding-out effect is larger, when: 1) the participation constraint is binding, 2) the fair premium of the insurance, $f = ph$, is higher, and 3) the insurance payout is higher.

2.3 Collective shocks

The model above can be modified in order to consider the scenario in which shocks are collective and therefore, two members of the network are affected simultaneously by a shock. In the scenario with collective shocks and no insurance, we assume that the network member who is not affected by a shock in $t=1$ decides on the optimal transfer level, $t^*_{ij,t}$. This transfer is equally shared among the two network members affected by a shock. Therefore each of the affected participants receives $t^*_{ij,t}/2$. We further consider that the welfare weight is the same for j and k, $\gamma_{ij,t} = \gamma_{ik,t}$. Under the scenario with collective shocks, the budget restriction for each network member is:

$$c^c_{i,t} = E_{i,t} + w_{i,t} - t_{ij,t} \tag{8}$$

$$c^c_{j,t} = E_{j,t} + {}^{t_{ij,t}}\!/_2 \tag{9}$$

$$c^c_{k,t} = E_{k,t} + {}^{t_{ij,t}}\!/_2 \tag{10}$$

The participation constraint and the future expected utility of participating in the network remain unchanged as in equations 6 and 14 in Appendix A. However, compared with the case of individual shocks and no insurance, the marginal utility of the transfer is larger when shocks are collective. First, the transfer benefits two individuals and second, for a given transfer shared among two affected individuals, the marginal utility of the transfer is higher. However, the future expected marginal cost of the transfers is also higher as two individuals benefit from the transfer. Therefore, when there is no insurance available, we would expect to observe larger transfers after collective than after individual shocks if the marginal utility of increasing consumption for j is larger than the discounted expected future benefit of the transfer.[2]

Crowding-out of the insurance

Regarding the impacts of the insurance on transfers, we focus on three main cases.

Case C: Non-insured participant i decides to send a transfer to two participants hit by a shock: j who is insured and k who is not insured.

The insurance crowds-out transfers, $t_{ij,t}$, through three channels. First, the marginal utility of the transfer for i is lower as the insured participant j, who is hit by a shock receives an insurance payout. Second, the insurance increases the disposable income for j, and enables her to send transfers to the non-insured participant, k. If the expected value of transfers from j to k is positive, the insurance generates a substitution effect and the optimal transfer from i to k is lower.[3] Lastly, with insurance the future disposable income of j is lower. This generates a higher cost for future transfers from j to i, and reduces the value of participating in the network for i. As i expects lower benefits from participating in the network, she sends less transfers in $t = 1$.[4]

Case D: Insured participant i not hit by a shock decides to send a transfer to two participants hit by a shock: j who is insured and k who is not insured.

This scenario combines Cases B and C. In this case, the insurance decreases the value of the transfer compared with the case of no insurance, for the same reasons as discussed in Case C (lower marginal utility of the transfer to i, higher cost of the transfer from j to i in the future, and substitution effect

[2]Or, $(1+\lambda)V'(E_{j,t} + t_{ij,t}/2) > \lambda\beta V'(E_{j,t} + w_{j,t+1} - t_{ji,t+1})$.

[3]This would occur if the weight that j gives to the utility of k is sufficiently high.

[4]This case can be easily extended to consider the case when a non-insured participant sends a transfer to two insured participants hit by a shock who are exposed to basis risk. Here the effect of the insurance would be to 1) decrease the marginal utility of a transfer from i to j (first channel discussed) and 2) decrease j's future disposable income, reducing the expected value of participating in the risk sharing network.

on transfers received by j). In addition, it decreases transfers further as the marginal cost of sending a transfer is higher for an insured participant. Apart from that, the marginal utility of future transfers is lower as the insured participant receives an insurance payout and the probability of receiving a transfer in the future is lower. These three effects result in additional crowding-out effects on the value of the transfers. For insured participants who are not hit by a shock in $t = 1$, the optimal value of the transfer is lower under the insurance than the non-insurance treatment. In consequence, other-regarding preferences increase less compared with the case without insurance.

Case E: Insured participant i hit by a shock decides to send a transfer to two non-insured participants (j, k) hit by a shock.

The impact of the insurance in this case is ambiguous. Similar to Case D, the insurance decreases the future value of participating in the network by decreasing the future marginal benefit of a transfer in case of a shock (due to the insurance payout) and by decreasing the probability of receiving a transfer in the future (as the insurance makes income more stable). Yet, the insurance can also crowd-in transfers as the insurance payout enables the insured participant to send transfers to the other members of the network affected by a shock. Even when the future expected value of participating in the network is zero for the insured participant, she would send a transfer when the weight that she gives to the utility of the other is sufficiently high: $\hat{\gamma}_{ij,t} > \frac{U'(E_{i,t}+w_{i,t}-t_{ij,t}+(1-p)h)}{V'(E_{j,t}+t_{ij,t}+t_{kj,t})}$.[5]

In summary, we show that when shocks are collective the insurance decreases the optimal value of the transfers for non-insured and insured participants not hit by a shock but increases the optimal value of the transfer for participants hit by a shock when the degree of other-regarding preferences is higher than a threshold level. Therefore under this case the impact of the insurance on transfers and other-regarding preferences is ambiguous.

Combining the above three cases, we can formulate the following proposition:

Proposition 3. Effect of the insurance on transfers

When shocks are collective, the effect of the insurance on transfers and other-regarding

[5] As more members of the network are affected by a shock, the marginal value of the transfer is higher and the threshold level $\hat{\gamma}_{ij,t}$ is lower. This would be reflected in a higher crowding-in effect.

preferences is ambiguous. The insurance generates a crowding-out effect for transfers by participants not hit by a shock (both non-insured and insured) but generates an ambiguous effect for insured participants hit by a shock who receive an insurance payout.

Proof: See Appendix A

3 Experiment design

We used a three stage experimental design similar to van Dijk and van Winden (1997) as displayed in Figure 1. In the first stage (baseline), participants were randomly and anonymously matched in groups of three. Using the strategy method we measured initial levels of other-regarding preferences using a three person dictator game (DG) and a three person trust game (TG). Participants did not receive feedback on the outcomes of the first stage. In the second stage, we randomly and anonymously re-matched participants in a three person solidarity network which we will refer to as NW. NW members participated in a repeated solidarity game over six rounds. Within this stage, we implemented a between-subject design with four treatments as explained in more detail below. In the third stage, we repeated the DG and TG, while the composition of the NW constant. The comparison between the first and third stage for a NW allows us to measure the causal effects of the treatments on changes in the level of altruism and trust.

Participants knew that the experiment consisted of a total of five parts (the first and the third stages consisted of two games each). Yet the exact procedures in each part were explained sequentially. Participants were also informed that only one of the five parts would be randomly selected for payment at the end of the experiment. In addition, participants received a show up fee of $20 Mexican Pesos (MXN)[6]irrespective of their performance in the experiment. To avoid strategic bias between stages, participants were informed that they would receive the instructions to each part of the experiment as the activity progressed. Below we explain in more detail the procedures of each stage of the experiment.

[6]The exchange rate at the time of the experiment was $18.87 MXN/$1 USD.

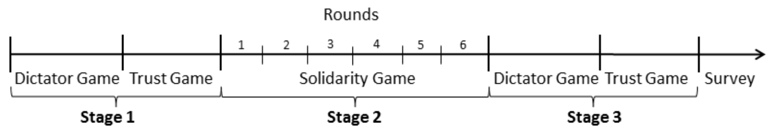

Figure 1: Sequence of the experiment

3.1 Stages

First Stage: baseline

In the first stage of the experiment subjects played two games: a one-shot dictator game (DG) with two dictators and one recipient based on Panchanathan et al. (2013) and an investment or trust game (TG) with two trustors and one trustee based on Berg et al. (1995); Cassar et al. (2013); Cassar and Rigdon (2011). The games were implemented using a strategy method similar to Fischbacher et al. (2001). For the DG, participants first decided on their transfer as if they were all playing the role of the dictator. All participants decided simultaneously and privately how much of an endowment of \$150 MXN they wanted to transfer to a recipient who did not receive any endowment. We used a neutral frame for the roles and referred to the dictator as player A and the recipient as player B. Participants were informed that if this activity were chosen for payment, two participants would be randomly assigned within the triad to take the roles of player A and one participant would assume the role of player B. To make the decision less abstract, participants received fake copies of bills (Myrseth et al., 2015): two bills of \$50 MXN, \$10 MXN and \$5 MXN, and one bill of \$20 MXN. To decrease concerns of experimental demand effects in social dilemmas (Zizzo, 2010), we implemented a double blind procedure. The value transferred was deposited in an envelope marked with the word “PASS” which was given to an enumerator who recorded the information privately, only knowing the number of the player.

The three-person TG used a similar structure and procedure as the DG. New groups of three players were randomly and anonymously formed. All players first took the role of the trustor (framed as player A). They received an endowment of seven experimental bills of \$10 MXN and decided simultaneously and privately how much they wanted to transfer to the trustee (framed as player B) by putting the respective amount of bills in an envelope marked with the word “PASS”. They knew that the amount passed would be tripled and passed on to the players in role B. Following the strategy method, players in role B decided for all possible amounts they could have received on how much to return to the players A ($30, $60,...,$210 MXN). They took this decision completing a decision table.[7]

In both experiments we used posters to explain the structure of the games and presented different examples to illustrate how payments would be calculated. Before participants made their decisions, they had to answer a set of control questions. If these were unclear, participants could raise their hands and one of the enumerators approached them individually to clarify. After verifying that all participants understood the games, the experiment started.

Second stage: solidarity game

In the second stage, participants were again matched randomly and anonymously into solidarity networks (NW). Each NW had three participants. We used a repeated solidarity game (in the following SG) based on Selten and Ockenfels (1998). To increase entitlement over the endowment (Reinstein and Riener, 2012), participants solved a real effort task where they earned a fixed payment of $150 MXN per round. Subjects were informed that they could lose their fixed payment if they were hit by a shock after solving the task. Yet, no further information was provided on the probability and structure of the shocks. As explained in more detail in the experimental design in Section 3.2., we varied the number of NW members who were affected simultaneously by a shock exogenously, as well as which NW members would be formally insured.

After the real effort task, each participant received a note indicating whether she experienced a shock and the earnings of the two other NW members. In case a shock was realized, members of the NW who had received a positive payment decided if they wanted to send a predefined amount of $30 MXN to affected NW participant(s). We kept the value of the transfers fixed to increase control over end game distributions of income. In cases where two participants suffered a shock, the transfer was equally divided between the two affected NW members. The solidarity game was repeated over six rounds and participants received feedback between rounds on the transfers sent and received.

Third stage: ex-post

In this stage we measured how the SG affected other-regarding preferences. Therefore, the DG and the TG were played again using the same procedures implemented in the baseline. To capture how participants behaved towards their NW members who they interacted with in the past, we used a pair matching procedure and kept the NW groups constant between the second and third stage. As the

[7]While we would have preferred to give them experimental units, we consider that would have been too confusing given the education level of our participants.

experimental design varies exogenously the possibilities of exchange in the solidarity game, we are also able to compare whether the treatment affected the differences in other-regarding preferences ex-post.

After completing the experiment, one of the five parts was chosen for payment by randomly selecting one of five numbered cards. In the case where a DG or TG part was chosen, additionally one of three numbered cards was randomly drawn to determine who assumed the role of person A or B for payments. In case where the SG was chosen, we randomly selected one of the six rounds for payment by drawing one of six numbered cards. After determining the payouts, participants were surveyed individually by the enumerators regarding their socio-demographic characteristics as they serve as important control variables when eliciting other-regarding preferences (e.g. Fehr, 2009; Houser et al., 2010; Karlan, 2005). Upon finishing the survey, participants were called one by one to the experimenter's table and received their payouts individually. Average payment was \$156 MXN (approx. \$9.20 USD at the time of the experiment). This corresponds to around 1.5 times the average daily wage of an agricultural laborer.

3.2 Treatments

The solidarity game involved four treatments in a 2x2 between-subject design as depicted in the upper table of Figure 2. The first dimension we varied was whether shocks are individual or collective. In the treatments with individual shocks, only one NW member was affected by a shock at a time, whereas in the collective shocks treatments two NW members were affected simultaneously. The second dimension we varied was whether insurance is exogenously available to some participants in the NW. In the treatments without insurance - Individual-Control and Collective-Control - none of the participants in the NW were insured. Hence in case of a negative income shock they received an income of \$0 MXN plus the transfer from the NW. In treatments with insurance, two NW members were assigned to and actuarial fair full insurance. To avoid self-selection concerns (i.e. less pro-social participants choose to insure), we always allocated the insurance to the randomly assigned participants in NW positions 2 and 3 for all six rounds of the SG. They received a fixed income of \$100 MXN for each round regardless of whether they were hit by a shock or not. Insured participants could still transfer \$30 MXN to their fellow affected NW members, but could not receive transfers from their NW. Similarly, participants who were not hit by a shock could not receive transfers from their NW.

In order to increase comparability across sessions and have control over the shock pattern, we predefined the timing of shocks for each member of the triad (see figure 2). In the case of individual shocks, for example, the first NW member was hit by a shock in round three and in round four. The position of each participants in the NW triad is however allocated randomly. Depending on the period and treatment, one, two or none of the NW members were affected simultaneously by a shock in a given period. Over the six rounds of the SG, all NW members were hit twice by a shock.

		No Insurance	Insurance*
Number of persons affected in NW	1	Individual-Control (Treatment 1)	Individual-Insurance (Treatment 2)
	2	Collective-Control (Treatment 3)	Collective-Insurance (Treatment 4)

*Insurance is mandatory for NW position 2 and 3 only

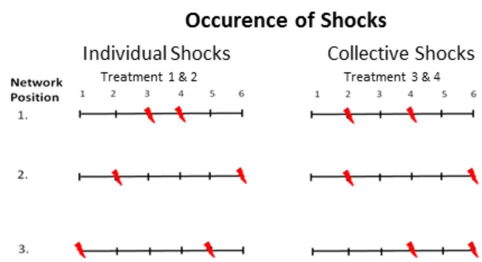

Figure 2: Structure of the shocks and treatments

4 Experimental procedures

We conducted lab-in-the-field experimental sessions in five different villages in the region La Frailesca of the Mexican State of Chiapas. The importance and history of social capital in village communities in Chiapas is well documented (Fox, 1996; Rico García-Amado et al., 2012). Our case study area is a commercially orientated maize growing environment dominated by smallholders. This region is very poor and 51.7% of the population live below the poverty line (CONEVAL, 2010). Climate risk poses a growing challenge for rural Mexico especially the frequency of drought shocks has increased and is endangering maize yields (Vermeulen, 2014). Chiapas has been one of the most affected regions over the past decade (Olivera Villarroel, S. M., 2013). In response to this situation, the Mexican government has invested in the development of a subsidized federal insurance program for farmers (Cabestany Noriega et al., 2013). However, as of 2011, in the poor south only around 8.6% of agricultural production units were covered on average (Arias, 2013). Before this background it is highly relevant to study the potential impacts that insurance could have on other-regarding preferences in the study region. Regarding health insurance, there has been a considerable increase in coverage since a free-of-charge, federal health insurance program (“Seguro popular”) was introduced in 2003 (Bonilla-

Chacín and Aguilera, 2013). It targets particularly the poor without access to other forms of social security and covers the most basic, cost-effective interventions.

Participants were selected based on a stratified random sampling procedure from villagers' lists provided by village heads ("comisariados"). We stratified the sample based on gender to obtain equal quota for men and women. Invitation to the session was given by the village heads. The selected household member was allowed to pass on their invitation to another household member or relative of the same gender if they could not attend the session.

It is possible that if there are strong pre-existing other-regarding preferences between participants, scope to generate changes in pro-sociality in the experiment is limited. Therefore, in order to increase social distance between participants and decrease the degree of pre-existing other-regarding preferences, we invited participants from 2 to 3 nearby villages to each session. The sessions took place in the village assembly room, usually in the largest and best accessible of those villages. Up to seven enumerators assisted in conducting the sessions. To guarantee understanding we illustrated all parts through posters and had participants answer control questions in every step. On average, participants correctly answered 92% of all control questions.

5 Results

5.1 Descriptive results

In total, 441 subjects from 12 villages participated in a total of 19 experimental sessions. Sessions were conducted with 17 to 38 persons depending on how many participants showed up to the session. Table 1 gives an overview of the socio-demographic data of the participants per treatment group. Wilcoxon rank-sum tests show that despite our randomization procedure, there are significant differences in the distribution of socio-demographic variables across treatments with and without insurance. In treatments with individual shocks there are significant differences in the proportion of females in the session, the number of people subjects could lend money from (proxy for a subject's social network), and the real life shock experiences. In treatments with collective shocks there are significant differences in the distribution of age, the number of friends in the session and the ownership of a house made of concrete (proxy for wealth) across treatments with and without insurance. We control for these unbalanced variables in the analysis. In our sample, we furthermore find that only 2 percent have had agricultural insurance before, while 54 percent have had some form of public social insurance ("Seguro popular").

In the baseline, participants passed on average 36% of their endowment in the DG and around 48% in the TG (see Table 2). Consistent with findings from Cox (2004) and Ashraf et al. (2006), we find a high correlation in the giving behavior in the DG and TG (Spearman correlation is 0.36) indicating that trust behavior can partly be explained by norms of altruism. For the amounts returned in the TG, our measure for trustworthiness, we find that for the average transfer of around $30 MXN, the share returned was 37% of the value received. We also find a significant correlation between giving in the DG and the amount returned in the TG (Spearman correlation is 0.26). Participants who passed a larger proportion of the endowment in the TG also returned a larger proportion, indicating that trust and trustworthiness are related (Spearman correlation is around 0.22 at expected transfer receipt of $90 MXN).

We find a fairly good level of balance in initial levels of altruism and trust across treatments with insurance and non-insurance once that we condition on the type of shocks (individual and collective; see Table 2). The treatment groups T1 and T2 (individual shocks with and without insurance) and T3 and T4 (collective shocks with and without insurance) do not differ significantly regarding their initial DG and TG transfers (Wilcoxon rank-sum test $p>0.05$). For baseline trustworthiness the baseline trustworthiness is balanced with one exception. At of $90 MXN, we find a small significant difference for T3 and T4. This suggests that we can compare the effect of insurance separately for individual and collective shock exposure without having to account for initial differences in other-regarding preferences.

There is consistency in TG and DG behavior across stages and the proportion of the endowment passed in the first and the third stages is highly correlated (Spearman correlation is 0.53 and 0.41 for the DG and TG, respectively). Yet, there is a decrease in the value of transfers between the baseline and the ex-post stage, although this difference is only significant for the TG in treatments T1 and T4 (Wilcoxon rank-sum test $p<0.05$) (see Table B.1 in the annex). This descriptive result however cannot be interpreted as causal as some socioeconomic characteristics of the participants across the treatments are unbalanced.

Figure 3 displays the transfers sent in the SG (second stage) by treatment, specifically showing the proportion of potential senders that made a fixed transfer of $30 MXN, separately for individual and collective shock treatments, as well as segregated and by NW positions. As intended by the experimental design, non-insured participants (NW1) did not have the opportunity to send transfers,

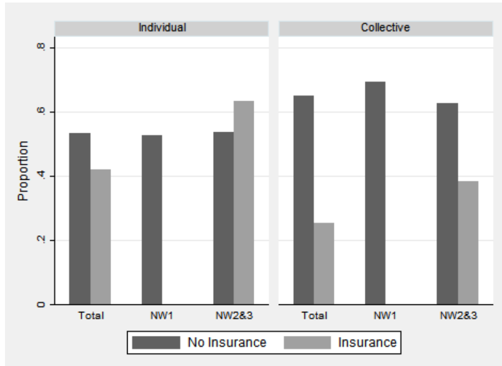

Figure 3: Proportion of potential senders that made transfers by treatment and NW position

since the other NW members (NW2 and NW3) were insured against shocks. Contrary to the predictions of the model, there was a significantly different increase in the share of insured participants (NW2 and NW3) who sent a transfer between the insurance and non-insurance treatment (Wilcoxon rank-sum test $p<0.10$). When shocks were collective, as predicted by the model, the proportion of insured participants (NW2 and NW3) who sent transfers was on average lower in the insurance than in the non-insurance treatment (Wilcoxon rank-sum test $p<0.01$). In total, the average effect of the insurance was a decrease in the proportion of participants who sent transfers when a shock occurred (Wilcoxon rank-sum test $p<0.00$).

In the case of collective shocks the insurance allows for more transfers as insured participants who were hit by a shock have the option to send transfers to non-insured participants after being hit by a shock. Figure 3 displays the transfers sent by insured participants and shock type. The results suggest that the insurance crowded-in transfers from insured participants when shocks were collective compared with the non-insurance treatment. Yet, as indicated in Figure 4, there are no significant differences in the distribution on transfers depending on whether insured participants were hit or not hit by a shock (Wilcoxon signed-rank test p-value=0.13). This implies that although non-insured participants are significantly less likely to receive a transfer in the insurance compared with the non insurance treatment (54% vs. 63%; Proportion test, one side test p-value=0.07), the average value of the transfer received is larger (23 vs 9, t-test p-value<0.01). This effect is partly due to the fact that in this case transfers are not shared among two affected participants. In the next steps we analyze the determinants of transfers in more detail and shed light on the effect on the evolution of other-regarding preferences.

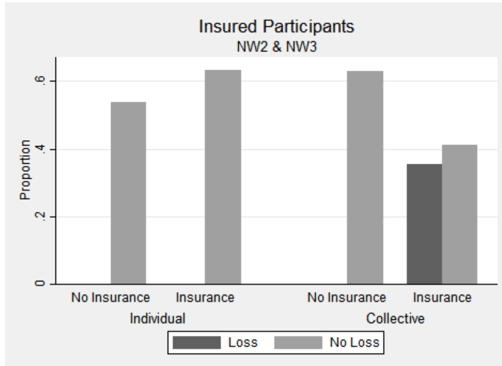

Figure 4: Proportion of potential senders that made transfers by treatment and loss status

5.2 Determinants of transfers sent

To control for initial differences in socio-economic characteristics of the participants, we estimate the following linear random effects probability model explaining the likelihood to send a transfer in the SG:

$$Y_{it} = \beta_0 + \beta_1 NW1_i + \beta_2 I_i + \beta_3 NW1_i \times I_i + \beta_4 \sum_{t=1}^{t-1} r_{it} + \beta_5 DG_{i1} + \beta' X_i + \sum_{t=2}^{6} \alpha_t P_t + u_i + e_{it} \quad (11)$$

In this model, the dependent variable Y_{it} takes a value equal to one if the individual i made a transfer in period t, when a shock occurred and zero otherwise. The variable $NW1_i$ is an indicator variable that takes a value of 1 if individual i is in NW position 1 indicating that in the insurance treatment this participant did not have access to the insurance and takes value equal to zero if individual i 's NW position is 2 or 3. If the randomization procedure worked, we expect that this variable will be equal to zero, so there would be no initial differences between individuals with access and without access to the insurance. I_i is a dummy variable that takes a value equal to one for treatments in which participants have access to insurance. We expect that this variable will be negative indicating a crowding-out effect of the insurance on transfers by individuals without access to the insurance. The term $I_i \times NW1_i$ is the interaction of the above variables and takes the value 1 if a subject belongs to those that are not insured within the insurance treatment. We expect that the crowding-out effect of the insurance will be complete for participants without access to the insurance and hence the estimated coefficient should be negative. The term $\sum_{t=1}^{t-1} r_i$ denotes the sum of transfers in \$MXN participant i has received from their network up to the previous round in the SG; it controls for the reciprocity motive of giving. Therefore, this term is expected to be positive. The variable DG_{i1} controls for initial levels of altruism. The vector X_i includes unbalanced socio-demographic variables: age, a dummy for female participants, the share of friends in the session (as a measure of pre-existing social ties), number of shocks experienced in the last three years, number of potential lenders (social network proxy), and a dummy variable for concrete house construction (wealth proxy). P_t is a dummy for the SG period, with $t = 2, ..., 6$. The time-invariant and time-variant random errors are expressed in u_i and e_{it}, respectively. We estimate the model separately for collective and individual shocks.

Table 3 displays the results of estimating equation 11 for individual and collective shocks. Models 1 and 3 include period dummies, while models 2 and 4 also include controls on socioeconomic characteristics of participants. The first two models indicate that between 38 and 42 percent of the participants in NW2 and NW3 send a transfer in the no Insurance treatment. Contrary to our expectations, the insurance does not crowd-out transfers of insured participants when shocks are individual, yet, by design the transfers of participants in NW1 are completely crowded-out. In the treatment with collective shocks, in columns 3 and 4, a larger fraction of participants in NW2 and NW3 send a transfer compared with the individual shocks treatment (65 vs 42 percent). This is consistent with the predictions of the theoretical model. For collective shocks we also observe that the insurance crowds-out transfers from participants with access to insurance. Participants with access to the insurance are 27 percentage points less likely to send a transfer than in the treatment without insurance. As expected, and given our design, the insurance completely crowds-out transfers from NW1. Supporting a reciprocity motive for sending transfers, we see that the likelihood to send a transfer is positively correlated with the value of transfers received in the previous round. However, this relation is only observed when shocks are idiosyncratic.

Result 1

When shocks are individual, the insurance does not reduce the likelihood that insured participants send a transfer to non-insured individuals. Yet, when shocks are collective the insurance reduces the likelihood that insured participants will send a transfer to the other NW members.

5.3 Change of other-regarding preferences

To analyze how the existence of a formal insurance affects the development of other-regarding preferences, we explore the differences in post- and baseline transfers in the DG and TG and estimate the following model:

$$\Delta Z_i = \beta_0 + \beta_1 I_i + \beta_2 DG_{i1} + \beta_3 TG_{i1} + \beta' X_i + u_i \tag{12}$$

Here, ΔZ_i refers to the difference between the ex-post and the baseline measure of other-regarding preferences for participant i (i.e. the difference in the proportions of endowment passed in DG and TG as well as returned in the TG), and DG_{i1} and TG_{i1} refer to the baseline transfers made/returned in the DG and TG by individual i. I_i is defined as before. The vector X_i contains socio-demographic controls; the terms u_i denotes unobserved effects.

The estimation results are presented in Table 4. Columns 1 to 5 show the result for the treatments with individual shocks, whereas columns 6 to 10 present the results for the treatments with collective shocks. Columns 1, 2, 6, and 7 present the results for changes in the DG, columns 3, 4, 8, and 9 present the effects for changes in the TG and columns 5 and 10 present the results for changes in the proportions returned in the TG.

We find, as can be observed in columns 1, 2, 6, and 7, that there is considerable stability in the proportion of the endowment transferred in the DG, our measure of altruism. We find no significant change in proportion of endowment transferred in the control and in the insurance treatment neither for individual nor for collective shocks. Yet, we observe some convergence in the value of the transfers as participants with high (low) baseline DG transfers decrease (increase) the value of transfers ex-post. In contrast, we find that transfers in the TG - which we refer to as trust - increased about 30% in the control treatment (both for individual and collective shocks). Whereas the insurance on average does not crowd-out other-regarding preferences in treatments with individual shocks, we find a crowding-out effect on trust in the treatments with collective shocks (columns 8 and 9). Results in columns 5 and 10 indicate that while in the control group there is an increase in trustworthiness , i.e. the proportion returned in the TG, no significant differences are observed for the change in trustworthiness between the insurance and the control treatment.

Result 2

On average, formal insurance does not crowd-out the development of other-regarding preferences when shocks are individual but has a crowding-out effect on trust when shocks are collective. Formal insurance has no effect on trustworthiness.

The results at the aggregated level then provide mixed evidence on the effects of insurance on the dynamics of other-regarding preferences. We find that the only dimension of other-regarding preferences that is affected is trust, i.e. the proportion of transfers sent in the TG, while there are no effects on altruism or trustworthiness. In addition, this effect is only observed for collective but not for individual shocks. The relative stability of the proportion of endowment transferred in the DG and the proportion returned in the TG could indicate that not all dimensions of other-regarding preferences are equally likely to be influenced by the insurance.

5.4 Heterogeneous effects

Given that the insurance has a different effect on the transfers that insured and non-insured participants receive, a relevant question is how this affects the dynamics of other-regarding preferences. To further explore the drivers of the change in DG and TG transfers, we disaggregate the effects by insured and non-insured NW members and estimate following equation:

$$\Delta Z_i = \beta_0 + \beta_1 I_i + \beta_2 I_i \times NW1_i + \beta_3 NW1_i + \beta_4 DG_{i1} + \beta_5 TG_{i1} + \beta' X_i + u_i \tag{13}$$

Here, NW1 refers to subjects in NW position 1 which are not insured within the insurance treatments. Table 5 presents the estimation results.[8] We find that there are no significant differences between the control and the insurance treatment on changes in altruism (columns 1, 2, 6, and 7) and trustworthiness (columns 5 and 10) by NW position neither for treatment with individual or collective shocks. However, we find that there are significant effects on changes in trust (columns 3, 4, 8, and 9). Interestingly, we find that the direction of the effect of the insurance on TG transfers depends on whether the shocks are individual or collective. While for individual shocks the insurance crowds-in trust for non-insured NW members (column 3), it crowds-out trust for insured NW members when shocks are collective (column 7). The positive effect of the insurance on changes in trust for non-insured network members is consistent with a perceived positive interaction. Non-insured members could have anticipated that insured members would have no incentive to send transfers. Yet, we find

[8]The effect for insured NW members corresponds to the coefficient β_1 in equation 1, while the effect for non-insured participants corresponds to the coefficient $\beta_1+\beta_2$ in equation 13.

that the insurance treatment does not crowd-out the transfer received in the SG by subjects in NW position one. In response to this positive surprise non-insured NW members may increase the degree of attachment towards other NW members. In contrast, in the treatment with collective shocks, we find that the insurance crowds-out the transfers received by non-insured participants. As they might have anticipated this effect, it is likely to result in a smaller effect on other-regarding preferences.[9]

The negative effect of the insurance treatment on trust levels of insured subjects in NW positions 2 and 3 is consistent with the hypothesis that reduced opportunities for positive interactions decrease the attachment towards NW members, as these NW members do not receive transfers because of the insurance. Yet, an open question remains why this effect is only observed in the case of collective shocks and not in the case of individual shocks. A possible interpretation is that there is a critical level of change in the relative value of the transfers above which the insurance crowds-out trust. This is consistent with the finding that the decrease in transfers made by insured members - NW positions 2 and 3 - is larger in the collective than in the individual shocks (on average, 65% of participants made a transfer when shocks were collective and no insurance was available compared with 53% who did so when shocks were individual). Another potential explanation could have to do with differences induced by the introduction of insurance in the collective compared to the individual shock treatment. When shocks are collective insured subjects experiencing a shock (framed as an income loss) are still asked to provide a transfer to affected NW members. With individual shocks, this is not possible as there is only one NW member affected by a shock per period. If an insured participant experiencing and income loss under collective shocks had expected to receive transfers from the NW instead - which is not possible in this treatment - they might feel disappointed from having been left out by their network. This could cause a subsequent reduction in trust levels towards NW members.

Result 3

> Formal insurance crowds-in the development of trust for non-insured participants when shocks are individual. When shocks are collective formal insurance crowds out trust for insured participants.

All in all, we can only partly confirm the theoretical predictions of our model stating that other-

[9] To address the hypothesis explicitly that fulfilled expectations matter in the dynamics of other-regarding preferences (Bault et al., 2016), we would need information on participants' expectations of receiving a transfer for each round. While we attempted to do so, this exercise was rather cognitively demanding for our participants and is further complicated by the three-person structure of our game. As a results, we are not convinced of the accurateness of our measure which is why we do not present it. Future studies should consider expectations more rigorously in a less complex framework.

regarding preferences are crowded-out by formal insurance. While the development of trust is crowded-out by insurance, we do not find similar effects for altruism or trustworthiness. Moreover, these crowding effects seem to be context specific as we only observe negative effects in treatments with collective shocks but positive effects for treatments with individual shocks. Also, we find different effects of insurance on the dynamics of trust of insured and uninsured subjects.

6 Limitations

Several limitations of our study must be addressed. First of all, our experiment only considers a very specific case of full and fair insurance that is randomly allocated to some members of a social network. The implications of partial insurance and/or loaded premiums are likely to be very different. Similarly, taking into account the decision to become insured will probably induce different effects. On the one hand, solidarity networks might forego helping those who decided not take up formal insurance, as suggested by Lenel and Steiner (2016). On the other hand, those without well functioning social networks could benefit relatively more from formal insurance. Also, the shock structure we address in our paper is quite specific. First of all, shocks lead to a full income loss, as opposed to real life, where losses are rather partial. Secondly, the study considers only two specific cases of negatively correlated (i.e., individual) and positively correlated (i.e., collective) income shocks and does not further vary the degree of covariance, or consider cases where shocks are completely random. This is also an abstraction from reality where the distinction is not so clear cut and varies by geographical region and/or the type of shock. Apart from this, we are unable to disentangle with our experiment the different effects of insurance on transfers that we derive in the model (income and substitution), as the income of insured subjects is always different from the non-insured. While this reflects reality, it does not allow us to analyze income and substitution effects separately. Another point we could not take into account is whether familiarity with insurance schemes would induce differential effects, as very few subjects in our sample have had agricultural insurance (which most closely resembles the insurance scheme tested in this experiment) at some point in their life. Lastly, we are not able to satisfactorily explain why we find effects of insurance on trust, but not on other measures of other-regarding preferences as altruism or trustworthiness.

The practical relevance of the results presented here hinge on the assumption of external validity, i.e. being able to generalize the found relationships to other persons, times and settings (Roe and Just, 2009). The generalizability towards the group of interest is improved by applying lab-in-the-field experiments with non-standard subjects, namely farmers, as compared to standard lab experiments (Levitt and List, 2007). However, with respect to the external validity of dictator games it has been criticized that subjects might behave more generously when they deal with "windfall gains", than outside the lab where they deal with their earned money (Cherry et al., 2002). Furthermore, dictator games that were modified from the standard version to put them into an arguably more realistic context show a substantial reduction in giving and thereby challenge its meaningfulness as a measure for altruism. This occurred when the possibility to withdraw money (List, 2007; Bardsley, 2008), income uncertainty (Dana et al., 2007; Andreoni and Bernheim, 2009), or full anonymity (Franzen and Pointner, 2012) were introduced. Differences in experimental protocols and geographic location have also been found to affect outcomes in trust games (Johnson and Mislin, 2011). When comparing lab with field settings, however, reviews find in majority positive correlations of contributions in the dictator and trust game and field behavior (Camerer 2015; Galizzi et al. 2015). These findings underline the practical relevance of our results regarding potential effects of formal insurance on other-regarding preferences in communities engaged in informal risk sharing.

7 Conclusion

Poor households are often restricted in their access to formal capital markets and thus rely on informal insurance networks. The exchange of transfers in these networks could foster the development of other-regarding preferences within the network. In this paper we analyzed how the introduction of a formal insurance affects the exchange of transfers in informal solidarity networks and the effect that this has on the development of other-regarding preferences. We develop a simple theoretical model that allows explaining how interaction in an insurance network can affect the dynamics of other-regarding preferences and the impact of insurance on those dynamics. To test the predictions of the model, we use a lab-in-the-field experiment with baseline- and ex-post measures of other-regarding preferences (altruism, trust and trustworthiness). We compare how these preferences evolve after individuals interact in a solidarity game with different treatments that vary (1) whether insurance is exogenously assigned to some network members, and (2) the covariance structure of shocks.

Our results provide only partial support for the theoretical model. As predicted, the development of other-regarding preferences depends on the interactions in the risk sharing network. Interactions that are valued negatively (i.e. decrease in the transfers received) result in lower levels of trust, while interactions that are valued positively (i.e. an increase in the transfers received) result in an increase in trust. However, this effect is found to occur only in some contexts and not in others and in only one of the measures of other-regarding preferences (trust). The experimental results however do not support the predicted crowding-out effect of the insurance on transfers to non-insured network members. When shocks are individual, formal insurance has a positive effect on the transfers sent by insured members, while in the case of collective shocks, we find that the insurance results in lower transfers to non-insured members.

Furthermore, our results illustrate that it is important to take into account heterogeneous effects of introducing insurance to informal risk sharing networks and consider separately the effect on those left uninsured and those with access to the insurance. Moreover, it is important to consider the structure of shocks and the degree of covariance of the shocks.

All in all, the results suggest that formal insurance has negative effects on network transfers and trust especially when shocks are positively correlated. This is particularly problematic as informal risk sharing is only efficient in indemnifying negatively correlated, idiosyncratic shocks (e.g. Mobarak and Rosenzweig, 2012). The potential benefit of insurance is most salient when shocks are covariate, or positively correlated within informal risk sharing groups, which may be weakened as a consequence of the introduction of insurance. Special attention should be given to those left uncovered by formal insurance, as they might not only receive less transfers, but possibly also be perceived as less trustworthy by their networks. Further research is needed to find optimal insurance designs that decrease the potential crowding-out effects of formal insurance on risk sharing networks. Group-based insurance could for example be a promising alternative.

Acknowledgement

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Table 1: Characteristics of participants by treatment

	T1 Individual Control		T2 Individual Insurance		T3 Collective Control		T4 Collective Insurance		T1=T2	T3=T4
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p^1	p^1
Age (years)	33.56	11.99	35.92	16.14	38.26	14.16	34.29	13.63	0.55	0.02**
Agriculture Main Inc.[2] (d)	0.93	0.26	0.88	0.33	0.91	0.29	0.86	0.35	0.21	0.32
Education (years)	7.59	4.14	7.26	4.67	7.97	3.99	8.17	4.43	0.45	0.40
Female (d)	0.60	0.49	0.44	0.50	0.58	0.50	0.47	0.50	0.02**	0.10
Friends in Session (share)	0.23	0.30	0.20	0.24	0.19	0.22	0.14	0.16	0.56	0.07*
HH has concrete house (d)	0.28	0.45	0.26	0.44	0.25	0.43	0.28	0.45	0.72	0.54
HH owns cellphone (d)	0.31	0.46	0.31	0.47	0.43	0.50	0.52	0.50	0.90	0.17
No. of Festivities 2014[3]	4.64	3.35	5.75	5.37	7.41	6.59	6.82	6.14	0.16	0.56
No. of Potential Lenders[4]	4.60	5.45	5.72	6.21	5.65	3.61	5.33	3.55	0.03**	0.57
Shock Experience[6] (d)	0.20	0.40	0.45	0.50	0.46	0.50	0.25	0.43	0.00***	0.00***
Observations	114		108		117		102			

d=dummy variable.

[1] p-values. Categorical variables: Two-sample test of proportions. H_0: Treatment group populations have equal proportions. Continuous variables: Wilcoxon rank-sum test. H_0: Treatment group populations have same distribution.

[2] Takes the value 1 if subject's household's main income source is agriculture.

excessive rain, storm, pests, livestock illness, erosion, sales price decrease, input price increase, low sales, severe illness,

[3] Festivities, such as weddings, religious events, birthdays, baptisms etc. attended in 2014 (Social Network Proxy).

[4] Answer to the question: 'If you urgently needed MXN500, how many people outside your household would be willing to lend you that amount?' (Social Network Proxy)

[6] Takes the value 1 if subject has suffered from one or more of the following shock events in the last 3 years: Drought, death of family member, loss of income source, robbery, fire.

Table 2: Summary table of DG/TG transfers by treatment

	T1 Individual Control		T2 Individual Insurance		T3 Collective Control		T4 Collective Insurance		T1=T2	T3=T4
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p^1	p
Dictator Game										
Transfers										
Baseline	0.30	0.28	0.33	0.26	0.39	0.24	0.42	0.26	0.32	0.24
Ex-post	0.30	0.24	0.30	0.24	0.37	0.24	0.41	0.30	0.98	0.48
Trust Game										
Transfers										
Baseline	0.47	0.25	0.42	0.22	0.52	0.24	0.51	0.24	0.21	0.89
Ex-post	0.39	0.22	0.40	0.18	0.49	0.23	0.43	0.23	0.36	0.11
Cond. Returns										
Baseline, MXN90	0.37	0.20	0.37	0.20	0.37	0.16	0.43	0.22	0.68	0.03
Ex-post, MXN90	0.32	0.20	0.31	0.16	0.36	0.18	0.37	0.22	0.84	0.69
Observations	114		108		117		102			

All values expressed as a share of the endowment.

[1] Ranksum test. H_0: Treatment group population have same distribution.

Table 3: Effects of insurance on SG transfers sent by shock type

	Individual		Collective	
	(1)	(2)	(3)	(4)
	Base	Controls	Base	Controls
Ins.=1	0.077	0.073	-0.248***	-0.271***
	(0.066)	(0.066)	(0.078)	(0.080)
Ins.=1×NW1=1	-0.629***	-0.648***	-0.433***	-0.414***
	(0.086)	(0.088)	(0.102)	(0.101)
NW1=1	0.003	0.013	0.074	
	(0.056)	(0.056)	(0.088)	
Lagged amount received (MXN)	0.002***	0.001**	-0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
DG1 Transfer (share)		0.123		0.126
		(0.084)		(0.117)
Constant	0.376***	0.417***	0.627***	0.646***
	(0.060)	(0.088)	(0.051)	(0.133)
Period Dummies	Yes	Yes	Yes	Yes
Socioeconomics	No	Yes	No	Yes
Observations	852	852	287	287

Random effects regressions. Standard errors clustered at NW level in parenthesis.

Dep. Var.: Proportion of potential senders that made a transfer of MXN30.

d denotes dummy variable.

Ins.=1 if participant belongs to NW with insurance.

Coll.=1 for collective shocks treatments.

NW1=1 if participant is in NW position 1, i.e. is not insured in insurance treatments.

Table 4: Effect of insurance on altruism, trust and trustworthiness by shock type

	INDIVIDUAL					COLLECTIVE				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	ΔDG	ΔDG	ΔTG	ΔTG	$\Delta TGret$	ΔDG	ΔDG	ΔTG	ΔTG	$\Delta TGret$
Ins.=1	0.01	-0.01	0.02	0.02	0.01	0.04	0.02	-0.06**	-0.08**	-0.02
	(0.03)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.04)	(0.03)	(0.03)	(0.02)
DG1 (share)	-0.63***	-0.64***	0.16**	0.17***	-0.03	-0.54***	-0.55***	0.18***	0.18***	0.03
	(0.08)	(0.08)	(0.06)	(0.06)	(0.03)	(0.07)	(0.07)	(0.06)	(0.06)	(0.04)
TG1 (share)	0.32***	0.34***	-0.78***	-0.75***	-0.63***	0.38***	0.36***	-0.63***	-0.64***	-0.62***
	(0.07)	(0.07)	(0.08)	(0.07)	(0.04)	(0.07)	(0.07)	(0.06)	(0.06)	(0.05)
TG amt. (MXN)					-0.00**					-0.00***
					(0.00)					(0.00)
TG amt.ˆ2 (MXN)					0.00*					0.00**
					(0.00)					(0.00)
Constant	0.03	0.05	0.24***	0.30***	0.24***	-0.01	0.13	0.22***	0.32***	0.31***
	(0.03)	(0.06)	(0.03)	(0.05)	(0.04)	(0.04)	(0.08)	(0.03)	(0.07)	(0.05)
Socio-Econ	No	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes
Observations	222	222	222	222	222	219	219	219	219	219

Dependent Variable=Difference of post- and pre-test DG/TG transfer shares.

Ins.=1 if participant belongs to NW with insurance.

DG1/TG1 (share) refers to share of endowment passed in pre-test of DG/TG.

Socio-economic control variables include: age (years), female (d), friends in session (share), concrete house (d), no. of pot. lenders, no. of shocks experienced 2014.

TG1 and DG1 refer to share of endowment passed (for columns 5 and 10: returned) in baseline DG/TG.

TG amt.=Amount received in TG, with 0 MXN$\leq TGamount \leq 210MXN$.

Table 5: Effect of insurance on altruism, trust and trustworthiness by shock type, heterogeneous effects

	INDIVIDUAL					COLLECTIVE				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	ΔDG	ΔDG	ΔTG	ΔTG	$\Delta TGret$	ΔDG	ΔDG	ΔTG	ΔTG	$\Delta TGret$
Ins.=1	0.00	0.05	-0.02	0.02	0.00	-0.01	-0.10**	-0.10***	-0.09	-0.02
	(0.03)	(0.05)	(0.03)	(0.02)	(0.05)	(0.04)	(0.05)	(0.04)	(0.06)	(0.02)
NW1=1	-0.01	-0.01	-0.10***	-0.10***	-0.04	-0.06	-0.05	-0.03	-0.03	-0.03
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)
Ins.=1×NW1=1	-0.04	-0.04	0.12**	0.12**	0.04	0.08	0.07	0.08	0.08	0.01
	(0.06)	(0.06)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.06)	(0.06)	(0.04)
DG1 (share)	-0.64***	-0.57***	0.17***	0.22***	-0.03	-0.54***	-0.66***	0.18***	0.20**	0.03
	(0.08)	(0.09)	(0.05)	(0.07)	(0.03)	(0.08)	(0.11)	(0.06)	(0.08)	(0.05)
TG1 (share)	0.33***	0.34***	-0.75***	-0.74***	-0.63***	0.37***	0.35***	-0.64***	-0.64***	-0.62***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.04)	(0.08)	(0.08)	(0.06)	(0.07)	(0.05)
Ins.=1×DG1 (share)		-0.15		-0.11	0.00		0.24*		-0.03	-0.02
		(0.14)		(0.09)	(0.02)		(0.13)		(0.12)	(0.04)
TG amt. (MXN)					-0.00**					-0.00***
					(0.00)					(0.00)
TG amt.ˆ2 (MXN)					0.00*					0.00**
					(0.00)					(0.00)
Constant	0.06	0.04	0.33***	0.32***	0.25***	0.15*	0.21***	0.33***	0.32***	0.33***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.04)	(0.08)	(0.08)	(0.08)	(0.08)	(0.05)
Socio-Econ	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	222	222	222	222	222	219	219	219	219	219

Dependent Variable=Difference of post- and pre-test DG/TG transfer shares.

Ins.=1 if participant belongs to NW with insurance.

NW1=1 if participant is in NW position 1, i.e. is not insured in insurance treatments.

Socio-economic control variables include: age (years), female (d), friends in session (share), concrete house (d), no. of pot. lenders, no. of shocks experienced 2014.

TG1 and DG1 refer to share of endowment passed (for columns 5 and 10: returned) in pre-test DG/TG.

TG amt.=amount received in TG, with 0 MXN$\leq TGamount \leq 210MXN$.

Table 6: Heterogeneous effects of insurance by network position

		INDIVIDUAL			COLLECTIVE		
		DG	TG	TG Ret	DG	TG	TG Ret
@NW Position 1	=1	-0.04	0.10**	0.04	0.07	-0.02	-0.01
		(0.05)	(0.04)	(0.03)	(0.05)	(0.05)	(0.03)
	=0	0.04	-0.02	-0.01	0.00	-0.10***	-0.02
		(0.03)	(0.03)	(0.02)	(0.04)	(0.04)	(0.02)

Coefficients are contrast estimates based on regressions in Table 5.
Standard errors clustered at NW level in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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A Risk sharing model

The model considers a risk sharing model with three individuals ($i,\ j,\ k$) who interact over two periods ($t = 1, 2$). Income is stochastic and two states of the world are possible, $s_i = 1, 2$. With probability p, individuals receive a low income ($s_i = 2$) and with probability $(1 - p)$ they receive a high income ($s_i = 1$). Individual's income is given by Equation 1. We first consider an scenario in with individual i decides to make a transfer to individual j, solving the optimization problem presented in Equations 2 to 6.

Denoting the set of states for the world by $S = \{s_{i,t}, s_{j,t}, s_{k,t}\}$, the following states are possible: $S_1 = \{1, 2, 1\} + \{1, 1, 2\}$; $S_2 = 1, 2, 2$; $S_3 = \{2, 1, 1\}$; $S_4 = \{2, 2, 1\} + \{2, 1, 2\}$; and $S_5 = \{2, 2, 2\}$ and $S_6 = \{1, 1, 1\}$. Let q_1 to q_6 represent the expected probabilities of the different states of the world.[10] the expected utility of consumption in $t = 2$ is given by the expected utility of different states of the world:

$$
\begin{aligned}
EU\left(c_{i,t+1}\right) = & q_1\left(U\left(c_{i,t+1}\right) + \gamma_{ij,t+1}V\left(c_{j,t+1}\right) + \gamma_{ik,t+1}V\left(c_{k,t+1}\right)\right) + \\
& q_2\left(U\left(c_{i,t+1}\right) + 2\gamma_{ij,t+1}V(c^c_{j,t+1})\right) + \\
& q_3\left(U\left(c^b_{i,t+1}\right) + \gamma_{ij,t+1}V\left(c^b_{j,t+1}\right) + \gamma_{ik,t+1}V\left(c^b_{k,t+1}\right)\right) + \\
& q_4\left(U\left(c^{cb}_{i,t+1}\right) + \gamma_{ij,t+1}V(c^{cb}_{j,t+1}) + \gamma_{ij,t+1}V(c^{cb}_{k,t+1})\right) + \\
& q_5\left(U(E_{i,t+1}) + \gamma_{ij,t+1}V(E_{j,t+1}) + \gamma_{ik,t+1}V(E_{k,t+1})\right) + \\
& q_6\left(U\left(E_{i,t+1} + w_{i,t+1}\right) + \gamma_{ij,t+1}V(E_{j,t+1} + w_{j,t+1}) + \gamma_{ik,t+1}V(E_{k,t+1} + w_{k,t+1})\right)
\end{aligned} \tag{14}
$$

where $n = i, j, k$ and:

$$
\begin{aligned}
c^c_{j,t+1} = & E_{j,t+1} + t_{ij,t+1}/2 \\
c^b_{i,t+1} = & E_{i,t+1} + t_{ji,t+1} + t_{ki,t+1} \\
c^b_{m,t+1} = & E_{m,t+1} + w_{m,t+1} - t_{mi,t+1} \\
c^{cb}_{o,t+1} = & E_{o,t+1} + t_{jo,t+1}/2 \\
c^{cb}_{j,t+1} = & E_{j,t+1} + w_{j,t+1} - t_{ji,t+1}
\end{aligned}
$$

for $m = j, k$ and $o = \{i, k\}$.

The first order condition for an interior solution in $t = 1$ implies that the optimal transfer $t^*_{ij,t}$,

[10] Assuming that the probability, p_i, is the same for all i, then $q_1 = 2p_i(1 - p_i)^2$, $q_2 = (1 - p_i)p_i^2$, $q_3 = (1 - p_i)^2 p_i$, $q_4 = 2p_i^2(1 - p_i)$, and $q_5 = p^3$. Hence, $q_6 = (1 - q_1 - q_2 - q_3 - q_4 - q_5) = (1 - p_i)^{3\cdot}$.

solves:

$$\frac{dL}{dt_{ij,t}} = (1+\lambda)A + \lambda\left(B+C\right)\left(\frac{dt_{ji,t+1}}{d\gamma_{ji,t+1}}\frac{d\gamma_{ji,t+1}}{dt^*_{ij,t}}\right) = 0 \tag{15}$$

where λ is the Lagrangian multiplier which is assumed to be larger than zero when the participation constraint is binding and equal to zero otherwise.

$$\begin{aligned} A =& -U'\left(E_{i,t} + w_{i,t} - t^*_{ij,t}\right) + \gamma_{ij,t}V'(E_{j,t} + t^*_{ij,t} + t_{kj,t}) \\ B =& q_3\beta\left(U'\left(E_{i,t+1} + t_{ji,t+1} + t_{ki,t+1}\right) - \gamma_{ij,t+1}V'(E_{j,t+1} + w_{j,t+1} - t_{ji,t+1})\right) \\ C =& q_4\beta\left(\frac{1}{2}U'\left(E_{i,t+1} + \frac{t_{ji,t+1}}{2}\right) - \gamma_{ij,t+1}V'(E_{j,t+1} + w_{j,t+1} - t_{ji,t+1})\right) \end{aligned} \tag{16}$$

Hence, A captures the net marginal utility of a transfer from i to j in t, whereas B and C refer to i's expected future marginal utility of consumption that would result from receiving transfers from j. B denotes the value of the transfer in case of idiosyncratic shocks, whereas C refers to the value of the transfer when shocks are covariate and the transfer is shared by two members of the network affected by a shock. The last term on Equation 15, $\frac{dt_{ji,t+1}}{d\gamma_{ji,t+1}}\frac{d\gamma_{ji,t+1}}{dt^*_{ij,t}}$, captures the dynamics of other-regarding preferences. As i sends a transfer to j in $t = 1$, this the weight that j gives to i's utility increases, $\frac{d\gamma_{ji,t+1}}{dt^*_{ij,t}}$>0. In turn as $\gamma_{ji,t}$ is larger, the value of the transfers that j sends to i in $t = 2$ is higher, $\frac{dt_{ji,t+1}}{d\gamma_{ji,t+1}}$>0. For a maximum, the second order condition implies $\frac{d^2L}{dt^2_{ij,t}} < 0$.

Proof proposition 1

Now we consider how the optimal value of the transfer changes according to the weight that individual i gives to the utility of j, $\gamma_{ij,t}$, the expected probability of receiving a transfer in the future (q_3 and q_4) and i's wealth ($E_{i,t}$). When the participation constraint in the network is binding, $\lambda > 0$, comparative statics around optimal value of the transfer $t^*_{ij,t}$ imply:

$$\begin{aligned}
\frac{dt_{ij,t}}{d\gamma_{ij,t}} &= -\frac{\frac{d^2L}{dt_{ij,t}d\gamma_{ij,t}}}{\frac{d^2L}{dt^2_{ij,t}}} = -\frac{(1+\lambda)V'(E_{j,t}+t^*_{ij,t}+t_{kj,t})}{\frac{d^2L}{dt^2_{ij,t}}} && > 0 \\
\frac{dt_{ij,t}}{dq_3} &= -\frac{\frac{d^2L}{dt_{ij,t}dq_3}}{\frac{d^2L}{dt^2_{ij,t}}} = -\frac{\lambda\beta\left(U'\left(c^b_{i,t+1}\right)-\gamma_{ij,t+1}V'(c^b_{j,t+1})\right)}{\frac{d^2L}{dt^2_{ij,t}}}\left(\frac{dt_{ji,t+1}}{d\gamma_{ji,t+1}}\frac{d\gamma_{ji,t+1}}{dt^*_{ij,t}}\right) && > 0 \\
\frac{dt_{ij,t}}{dE_{i,t}} &= -\frac{\frac{d^2L}{dt_{ij,t}dE_{i,t}}}{\frac{d^2L}{dt^2_{ij,t}}} = \frac{(1+\lambda)U''(c^*_{i,t})}{\frac{d^2L}{dt^2_{ij,t}}} && > 0
\end{aligned} \tag{17}$$

Assuming that $U'\left(c^b_{i,t+1}\right)-\gamma_{ij,t+1}V'(c^b_{j,t+1})>0$in $t=2$, the participation constraint is not binding, $\lambda=0$. The optimal transfer from i to j increases with $\gamma_{ij,t}$ and $E_{i,t}$.

Proof proposition 2

Case A: Non-Insured participant i decides to send a transfer to an insured participant j.

Under this scenario, the first order condition for a maximum is given by Equation 15 where:

$$\begin{aligned}
A =& -U'\left(E_{i,t}+w_{i,t}-t^*_{ij,t}\right)+\gamma_{ij,t}V'\left(E_{j,t}+(1-p)h+t^*_{ij,t}+t_{kj,t}\right) \\
B =& q_3\beta\left(U'\left(E_{i,t+1}+t_{ji,t+1}+t_{ki,t+1}\right)-\gamma_{ij,t+1}V'\left(E_{j,t+1}+w_{j,t+1}-ph-t_{ji,t+1}\right)\right) \\
C =& q_4\beta\left(\frac{1}{2}U'\left(E_{i,t+1}+\frac{t_{ji,t+1}}{2}\right)-\gamma_{ij,t+1}V'\left(E_{j,t+1}+w_{j,t+1}-ph-t_{ji,t+1}\right)\right)
\end{aligned} \tag{18}$$

Compared with the scenario without insurance (Equation 16), income for j is higher in Case A as $(1-p)h>0$. Under the assumption that $V''<0$, the net marginal utility of the transfer, A, in this case. Hence, this generates a substitution effect that decreases the transfer that j receives in t. Defining the net indemnification payment that j receives in t as $m=(1-p)h$, where $m>0$, and taking partial equilibrium analysis around the optimum implies:

$$\frac{dt_{ij,t}}{dm} = -\frac{\frac{d^2L}{dt_{ij,t}dm}}{\frac{d^2L}{dt^2_{ij,t}}} < 0$$

Given that:

$$\frac{d^2L}{dt_{ij,t}dm} = (1+\lambda)\gamma_{ij,t}V''\left(E_{j,t}+(1-p)h+t^*_{ij,t}+t_{kj,t}\right) < 0$$

This implies that the larger the indemnification payment (the lower the deductible), the lower the value of the transfer, $t_{ij,t}$.

The second effect of the insurance is to decrease B and C compared with the case without insurance. In $t+1$, j would send a transfer to i if the net marginal utility of the transfer is positive:

$$-U'\left(E_{j,t+1}+w_{j,t+1}-ph-t_{ji,t+1}\right)+\gamma_{ji,t+1}V'(E_{i,t+1}+t_{ji,t+1}+t_{ki,t+1})>0$$

Hence transfers would occur only when j is sufficiently altruistic, $\gamma_{ji,t+1}>\overline{\gamma}_{ji,t+1}=\frac{V'(E_{i,t+1}+t_{ji,t+1}+t_{ki,t+1})}{U'(E_{j,t+1}+w_{j,t+1}-ph-t_{ji,t+1})}$. Under the assumption that the utility function is concave, it easy to show that the value of the expected transfer decreases as the cost of the insurance $f=ph$ increases:

$$\frac{dt_{ji,t+1}}{df}=-\frac{\frac{d^2L}{dt_{ji,t+1}df}}{\frac{d^2L}{dt^2_{ji,t+1}}}=-\frac{U''\left(.\right)}{\frac{d^2L}{dt^2_{ji,t+1}}}<0$$

Compared with the case with no insurance, j income is lower. This implies that j's marginal cost of at transfer is higher in Case A than in the no-insurance case. This income effect lowers $t_{ji,t+1}$, decreasing the future expected benefit of participating in the network. In the limit, when the expected transfer is zero, the participation constraint given in Equation 6 does not bind, $\lambda=0$, and the expected benefit of a transfer is lower. In this extreme case, only sufficiently altruistic individuals will send a transfer.

Case B: Insured participant i decides to send a transfer to a non-insured participant j. The first order condition remains as in Equation 16. Equation 16 transforms to:

$$\begin{aligned}
A=&-U'\left(E_{i,t}+w_{i,t}-ph-t^*_{ij,t}\right)+\gamma_{ij,t}V'(E_{j,t}+t^*_{ij,t}+t_{kj,t})\\
B=&q_3\beta\left(U'\left(E_{i,t+1}+(1-p)h+t_{ji,t+1}+t_{ki,t+1}\right)-\gamma_{ij,t+1}V'(E_{j,t+1}+w_{j,t+1}-t_{ji,t+1})\right)\\
C=&q_4\beta\left(\frac{1}{2}U'\left(E_{i,t+1}+(1-p)h+t_{ji,t+1}/2\right)-\gamma_{ij,t+1}V'(E_{j,t+1}+w_{j,t+1}-t_{ji,t+1})\right)
\end{aligned}\tag{19}$$

Compared with the no-insurance case, we see A is lower. After paying the cost of the insurance, i has a lower disposable income. This increases the marginal cost of a transfer and decreases the value sent $\left(\frac{dA}{df}<0\right)$.

In addition, the insurance decreases B and C. Given that the participant i expects to receive an indemnification in t+1, the marginal benefit of future transfers is lower, $U'\left(E_{i,t+1}+(1-p)h+t_{ji,t+1}+t_{ki,t+1}\right)<U'\left(E_{i,t+1}+\right.$

for a given level of expected transfers from j and k. As the value of the indemnification is higher, the expected marginal benefit of a transfer is lower as $\left(\frac{dB}{dm} < 0 \quad and \quad \frac{dC}{dm} < 0\right)$. In the case that the insurance eliminates the need for a transfer in the future, $q_3 = q_4 = 0$, this reduces the expected benefits of participating in the risk sharing network to zero and decreases the incentive to send a transfer in t. In that case, only sufficiently altruistic individuals would send a transfer as participation constraint would not bind, the first order condition would be $A = 0$. In this case:

$$\frac{dt_{ij,t}}{dq_3} = -\frac{\frac{d^2 L}{dt_{ij,t}dq_3}}{\frac{d^2 L}{dt_{ij,t}^2}} > 0$$

as: $\frac{d^2 L}{dt_{ij,t}dq_3} = \lambda \left(U'(E_{j,t+1} + (1-p)h + t_{ji,t+1} + t_{ki,t+1}) - \gamma_{ij,t+1}V'(E_{j,t+1} + w_{j,t+1} - t_{ji,t+1})\right) \left(\frac{dt_{ji,t+1}}{d\gamma_{ji,t+1}} \frac{d\gamma_{ji,t+1}}{dt_{ij,t}}\right) > 0$

Similar condition applies for changes in q_4.

Collective shocks

When no insurance is available, the first order condition in Equation 15 implies:

$$\begin{aligned}
A =& -U'\left(E_{i,t} + w_{i,t} - t^*_{ij,t}\right) + 2\gamma_{ij,t}V'(E_{j,t} + t^*_{ij,t}/2) \\
B =& q_3\beta\left(U'\left(E_{i,t+1} + t_{ji,t+1}/2\right) - \gamma_{ij,t+1}V'(E_{j,t+1} + w_{j,t+1} - t_{ji,t+1})\right) \\
C =& q_4\beta\left(\frac{1}{2}U'\left(E_{i,t+1} + \frac{t_{ji,t+1}}{2}\right) - \gamma_{ij,t+1}V'(E_{j,t+1} + w_{j,t+1} - t_{ji,t+1})\right)
\end{aligned} \tag{20}$$

Proof proposition 3

Case C: Non-Insured participant i decides to send a transfer given that two participants are hit by a shock: j, who is insured and k, who is not insured.

Under this scenario, Equation 20 transforms to:

$$
\begin{aligned}
A =& -U'\left(E_{i,t} + w_{i,t} - t^{*}_{ij,t}\right) + \gamma_{ij,t}V'(E_{j,t} + (1-p)h - t_{jk,t} + \frac{t^{*}_{ij,t}}{2}) + \gamma_{ik,t}V'(E_{k,t} + \frac{t^{*}_{ij,t}}{2} + t_{jk,t}) \\
B =& q_3\beta\left(U'\left(E_{i,t+1} + t_{ji,t+1} + t_{ki,t+1}\right) - \gamma_{ij,t+1}V'(E_{j,t+1} + w_{j,t+1} - ph - t_{ji,t+1}) - \gamma_{ik,t+1}V'\left(E_{j,t+1} + w_{j,t+1} - t_{ki,t+1}\right)\right) \\
C =& q_4\beta\left(\frac{1}{2}U'\left(E_{i,t+1} + \frac{t_{ji,t+1}}{2}\right) - \gamma_{ij,t+1}V'(E_{j,t+1} + w_{j,t+1} - ph - t_{ji,t+1}) - \gamma_{ij,t+1}V'(E_{j,t+1} + \frac{t_{ji,t+1}}{2})\right)
\end{aligned}
\tag{21}
$$

Compared with the no-insurance case, the value of the marginal transfer, A, is lower. The higher the value of the loss covered h, and the higher the value of the transfer from j to k, the lower the value of the transfers that i sends as these conditions hold:

$$
\begin{aligned}
\frac{dA}{dh} &= \gamma_{ij,t}V''(E_{j,t} + (1-p)h - t_{jk,t}) < 0 \\
\frac{dA}{dt_{jk,t}} &= \gamma_{ik,t}V''(E_{k,t} + t_{ij,t} + t_{jk,t}) < 0
\end{aligned}
$$

In addition, similar to Case A, the cost of the insurance decreases the disposable income for j in the future increasing the value of participating in the network. For participant j, the first order condition for a maximum is given by: $-U'\left(E_{j,t+1} + w_{j,t+1} - ph - t_{ji,t+1}\right) + 2\gamma_{ji,t+1}V'(E_{i,t+1} + t_{ji,t+1}/2) > 0$. Where $\frac{dt_{ji,t+1}}{df} < 0$ under the usual assumption of concavity of the utility function.

Case D: Insured participant i, not hit by a shock, decides to send a transfer to two participants hit by a shock: j, who is insured and k, who is not insured.

In this case, Equation 20 transforms to:

$$
\begin{aligned}
A =& -U'\left(E_{i,t} + w_{i,t} - ph - t^{*}_{ij,t}\right) + \gamma_{ij,t}V'(E_{j,t} + (1-p)h + \frac{t^{*}_{ij,t}}{2}) + \gamma_{ik,t}V'(E_{k,t} + \frac{t^{*}_{ij,t}}{2}) \\
B =& q_3\beta\left(U'\left(E_{i,t+1} + (1-p)h + t_{ji,t+1} + t_{ki,t+1}\right) - \gamma_{ij,t+1}V'(E_{j,t+1} + w_{j,t+1} - ph - t_{ji,t+1}) - \gamma_{ik,t+1}V'(E_{k,t+1} + w_{k,t+1} - \right. \\
C =& q_4\beta\left(\frac{1}{2}U'\left(E_{i,t+1} + \frac{t_{ji,t+1}}{2}\right) - \gamma_{ij,t+1}V'(E_{j,t+1} + w_{j,t+1} - t_{ji,t+1}) + \gamma_{ik,t+1}V'(E_{k,t+1} + \frac{t_{ji,t+1}}{2})\right)
\end{aligned}
\tag{22}
$$

In comparison with the no-insurance case, A is lower. The insurance decreases disposable income for i, increasing the marginal cost of sending a transfer $\left(\frac{dA}{df} < 0\right)$. The second effect of the insurance is to indemnify j when affected by a shock. Therefore the marginal benefit of the transfer is lower. Transfers decrease more as the indemnification payment is higher $\left(\frac{dA}{dm} < 0\right)$. The insurance also generates an indirect effect. As participant j receives an indemnification payment, she is also able to send transfers to k. This generates a substitution effect that crowds-out transfers from i to k. The higher the expected transfer from j to i, the larger the crowding-out effect $\left(\frac{dA}{dt_{jk,t}} < 0\right)$. Finally, the insurance decreases the expected value of participating in the social network as shown in Case B, $\left(\frac{dB}{dm} < 0 \quad and \quad \frac{dC}{dm} < 0\right)$.

Case E: Insured participant i, hit by a shock, decides to send a transfer to one non-insured participant j hit by a shock.

Assuming that the third participant is not insured and also not hit by a shock, Equation 20 transforms to:

$$\begin{aligned}
A =& -U'\left(E_{i,t} + (1-p)h - t_{ij,t}\right) + \gamma_{ij,t}V'(E_{j,t} + t_{ij,t} + t_{kj,t}) \\
B =& q_3\beta\left(U'\left(E_{i,t+1} + (1-p)h + t_{ji,t+1} + t_{ki,t+1}\right) - \gamma_{ij,t+1}V'(E_{j,t+1} + w_{j,t+1} - t_{ji,t+1})\right) \\
C =& q_4\beta\left(\frac{1}{2}U'\left(E_{i,t+1} + (1-p)h + \frac{t_{ji,t+1}}{2}\right) - \gamma_{ij,t+1}V'(E_{j,t+1} + w_{j,t+1} - t_{ji,t+1})\right)
\end{aligned} \tag{23}$$

Compared with previous cases, the impact of the insurance is positive in this case. The participant who is insured receives an indemnification payment which enables her to make a transfer to the other participant j affected by a shock in t. The value of the transfer sent increases with the value of the indemnification and the decreases with the value of the expected transfer from k to i.

The marginal cost of a transfer is lower the higher the indemnity payment $m = (1-p)h$, which increases the transfer from i to j. However, the larger transfer from i to j the lower the marginal benefit of the transfer andthe increase in the net marginal utility of a transfer. In this case:

$$\frac{dA}{dm} = -U\text{"}\left(E_{i,t} + (1-p)h\right) > 0$$

$$\frac{dA}{dt_{ki,j}} = -\gamma_{ij,t}V''(E_{j,t} + t_{ij,t} + t_{kj,t}) > 0$$

However, as presented in Case D, the insurance has a negative effect on B and C, the expected future benefit of participating in the insurance network. The larger the indemnification payment, the larger the crowding-out effect. In consequence the net effect of the insurance is undetermined in this case.

B Tables

Table B.1: Summary Table of DG/TG Transfers

	(1) Individual Control		(2) Individual Insurance		(3) Collective Control		(4) Collective Insurance	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Dictator Game								
Transfers								
Baseline	0.30	0.28	0.33	0.26	0.39	0.24	0.42	0.26
Ex-post	0.30	0.24	0.30	0.24	0.37	0.24	0.41	0.30
p^1	0.55		0.58		0.43		0.52	
Trust Game								
Transfers								
Baseline	0.47	0.25	0.42	0.22	0.52	0.24	0.51	0.24
Ex-post	0.39	0.22	0.40	0.18	0.49	0.23	0.43	0.23
p	0.01**		0.66		0.12		0.01**	
Cond. Returns								
Baseline, MXN90	0.37	0.20	0.37	0.20	0.37	0.16	0.43	0.22
Ex-post, MXN90	0.32	0.20	0.31	0.16	0.36	0.18	0.37	0.22
p	0.07*		0.08*		0.60		0.01**	
Pre-Stage, MXN120	0.36	0.22	0.34	0.20	0.39	0.17	0.43	0.23
Post-Stage, MXN120	0.31	0.21	0.31	0.19	0.35	0.20	0.36	0.23
p	0.16		0.29		0.07*		0.01**	
Pre-Stage, MXN150	0.35	0.19	0.30	0.19	0.38	0.20	0.40	0.21
Post-Stage, MXN150	0.29	0.21	0.30	0.18	0.35	0.19	0.35	0.22
p	0.06*		0.75		0.32		0.05*	
Pre-Stage, MXN180	0.35	0.22	0.29	0.18	0.34	0.17	0.37	0.21
Post-Stage, MXN180	0.32	0.20	0.28	0.18	0.35	0.19	0.34	0.22
p	0.37		0.85		0.99		0.29	
Pre-Stage, MXN210	0.34	0.25	0.29	0.21	0.35	0.21	0.39	0.25
Post-Stage, MXN210	0.29	0.22	0.28	0.20	0.34	0.22	0.35	0.26
p	0.17		0.90		0.66		0.36	
Observations	114		108		117		102	

Transfers (Return amounts) as share of endowment (maximum)

[1] p-values from Ranksum Test by stage

Table B.1: Transfers Sent in Solidarity Game

	T1 Ind_NoIns		T2 Ind_Ins		T3 Coll_NoIns		T4 Coll_Ins		T1=T2	T3=T4
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p	p
Proportion of transfers made										
Total	0.53	0.38	0.63	0.39	0.65	0.48	0.38	0.43	0.07*	0.00***
NW1	0.52	0.34	.	.	0.69	0.47	.	.	.	.
NW2&3	0.54	0.40	0.63	0.39	0.63	0.49	0.38	0.43	0.12	0.00***
Diff. NW1-NW2&3	-0.02				0.06					
p^1	0.78				0.50					
Observations	114		108		117		102			

[1] p-values from Wilcoxon rank-sum test. H^0: Groups are from populations with the same distribution.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$