Group Lending without Joint Liability: Behavioral Insights from a Framed Field Experiment in Rural China

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Abstract

Joint liability group lending has been widely credited with reducing default rates among low-income borrowers in developing countries. However, recent research has shown that group lending without joint liability can achieve comparably high repayment rates, suggesting that joint liability clause may be less important than previously assumed. In this study, we disentangle the effects of group feature and joint liability clause, as well as various dimensions of social capital, on individual repayment behavior under different lending contracts. Specifically, we show theoretically that feelings of shame incentivize loan repayment under group lending and feelings of guilt discourage free-riding under joint liability. Based on results from a framed field experiment in rural China, we find that the group aspect reduces strategic default by 4.8 percentage points, and that the joint liability clause reduces strategic default by additional 3.8 percentage points. The positive effect of the group feature can be explained by feelings of shame and the degree of social ties. We further find that, in the absence of guilt, joint liability clause encourages free-riding; but in the presence of guilt and exposure to group members with high social status, joint liability increases repayment. Hence, our results demonstrate that joint liability is not universally effective at increasing repayment and its effectiveness depends on the level and the type of social capital within the borrowing population.

Keywords: Group Lending, Joint Liability, Social Capital, Field Experiments

1 Introduction

An extensive literature argues that joint liability, the requirement that borrowers within a group be jointly responsible for loan repayment, drives low default rates in microfinance relative to traditional individual liability (Besley and Coate, 1995; Cassar et al., 2007; Ghatak and Guinnane, 1999). However, recent empirical evidence is leading many to question the effectiveness of joint liability clause by demonstrating that repayment rates do not significantly change when the joint liability clause is removed from group loan contracts (Attanasio et al., 2015; Giné and Karlan, 2014)[1]. This raises the question of whether it is the group aspect or the joint liability clause of conventional group microfinance contracts that causes high repayment rates. In this paper, we seek to disentangle the impacts of group aspect and joint liability clause on individual repayment decisions. Furthermore, we investigate the role of social capital in group lending by presenting results from a framed field experiment combined with a social networks survey among Chinese agricultural borrowers.

Joint liability group loans are the predominant form of formal credit among low-income, asset-poor borrowers in developing countries. Joint liability mobilizes social collateral, in lieu of financial or physical collateral, in order to extent credit to these asset-poor borrowers. Mobilizing existing social ties with group credit schemes further allows microfinance institutions (MFIs) to solve information asymmetry problems that plague conventional credit contracts, such as adverse selection and moral hazard (Besley and Coate 1995; Ghatak 2000; Ghatak and Guinnane 1999; Gine et al. 2010; Stiglitz 1990; Van Tassel, 1999). Even without social collateral, joint liability can also provide a form of intra-group insurance to protect against idiosyncratic shocks and improve repayment (De Aghion et al, 2000). As a result, a large literature shows that joint liability group loans can lower default rates, help ensure the profitability of lenders, and lead to a higher community welfare relative to individual loans (Cassar et al., 2007; Ghatak, 1999). Based on this promise, MFIs utilizing joint liability group lending contracts have spread throughout the developing world and now provide formal credit to over

[1] Throughout the paper, we maintain an important distinction between "joint liability" and "group lending". Following Giné and Karlan (2014) and De Quidt et al. (2016), "joint liability" refers to the liability clause where all members of a group are held jointly liable for repaying the collective debt of the group. "Group lending" means there is some group feature to the lending or repaying process, such as the sharing of a regular group meeting time and place to disburse loans and collect payments.

150 million asset-poor borrowers (Perron 2016).

Despite the acclaimed success of joint liability, recent developments in microfinance practice and research are beginning to challenge the idea that joint liability loans are optimal relative to individual liability loans (Attanasio et al., 2015; Giné and Karlan, 2014). Institutionally, a number of leading MFIs, including the Grameen Bank and ASA in Bangladesh and BancoSol in Bolivia, are moving away from joint liability group lending to individual liability group lending (Dowla and Barua 2006). Furthermore, researchers have failed to uncover clear evidence of a positive impact of joint liability on loan repayment rates. In one of two field experiments by Giné and Karlan (2014), an MFI located in the Philippines removed joint liability clause from pre-existing group loan contracts while maintaining all other group loan features (e.g. weekly meetings); they found no increase in overall default rates after three years. They also found a heterogeneous effect of social capital on default behavior: borrowers with fewer social connections tend to default more often after being converted from joint to individual liability. These results suggest that joint liability may not be necessary to drive high loan repayment and that social capital may be a significant factor in determining borrower behavior in group lending schemes. In fact, social capital may be the critical factor that allows individual liability group lending to achieve comparable repayment rates to joint liability.

Peer pressure, an important mechanism through which social capital affects behavior, could provide an important explanation for borrowers' repayment behavior in group lending contexts. Peer pressure refers to the social pressure that an individual feels within a social network to conform to certain norms of behavior. Two conditions are necessary for peer pressure to motivate alterations in an individual's behavior: (1) an individual's behavior must affect the well-being of others in their social network and (2) the others must have the ability to affect the choices of the individual (Kandel and Lazear, 1992). Applied to behavior under group lending, peer pressure could incentivize loan repayment, even in the absence of actual social sanctions or group expulsion. Two important components of peer pressure are the social emotions of shame and guilt. Shame refers to the negative social emotions that an individual experiences when their behavior does not conform to social norms and guilt is the negative social emotions than an individual faces when their behavior has a direct negative impact on others' welfare. Failure to repay a group loan may cause a borrower to feel shame if others can observe

her default; failure to repay a joint liability group loan may further cause guilt as the default imposes additional costs on group members. Thus shame avoidance may discourage shirking and incentivize loan repayments in group loan contexts and guilt avoidance may drive behavior in joint liability loan contexts (Kandel and Lazear, 1992; Seiler et al., 2012; Dufhues et al., 2011).

Shame may also further explain another form of social capital, conformity. Individuals are susceptible to experience shame when one's behavior is seen as unacceptable relative to others' behavior. Consequently, if failure to repay is widespread in a group loan contract, perhaps due to some covariate negative shock, individuals may feel less shame from default and be less likely to repay. The social conditioning of shame can result in conformity behavior that may positively affect repayment (when repayment is the cultural norm, and shame is high) or negatively affect repayment (when default is normal and shame is low). This conformity behavior has been observed and widely studied in other fields (E.g. Asch, 1955; DeGroot, 1974; Deutsch and Gerard, 1955). There are a number of reasons behind such conformity behavior. For example, Guiso et al. (2013) proposes that social stigma associated with an action considered immoral decreases with the number of people doing it, which is consistent with our explanation on the potential effect of shame on repayment. In this study, we use experimental data to empirically test the existence of conformity and its implication in the group lending context.

Social connectedness or social relationships, another aspect of social capital, also plays a critical role in determining borrowers' repayment behavior. Numerous authors have shown that increased social ties within borrowing groups can increase group loan repayment and individual contributions to the group (Abbink et al, 2006; Ahlin and Townsend, 2007; Cassar et al., 2007; De Quidt et al., 2016; Dufhues et al., 2011; Giné and Karlan, 2014; Van Bastelaer and Leathers, 2006; Wydick, 1999). Dufhues et al. (2011) distinguish two dimensions of social relationships, tie strength (measured by connectedness between borrowers) and social distance (measured by difference in prestige), and find that these diverse forms of social capital have different and important impacts on loan repayment. Giné and Karlan (2014) separate the social tie into knowledge (measured by relationship and contact frequency) and trust (measured by willingness to provide help or to ask for advice), and they show that only knowledge ties significantly reduce past due loans under the group lending with individual

liability in their sample.

Peer pressure and social connectedness constitute two important components of social capital in a group lending context. By separately addressing these two components, our analysis follows a social capital framework used in the sociology literature. In particular, Uphoff (2000) proposed a robust definition of social capital that includes both structural social capital and cognitive social capital. Uphoff (2000) defines structural social capital as the network of social relationships, social ties, and social standing that define an individual's social environment. Cognitive social capital refers to internal motivations that are conditioned by cultural expectations, social norms or social pressures. Social connectedness is a measure of structural social capital while peer pressure is a measure of cognitive social capital.

This paper builds on this literature by exploring two core issues. First, we investigate the relative repayment performance of individual and joint liability group lending contracts. Second, we conduct a deep exploration of the role of social capital in these contracts while specifically addressing both structural and cognitive social capital. To explore these issues, we first develop a theoretical model of repayment behavior in the context of group lending. We then investigate these issues experimentally by employing a framed field experiment in conjunction with a social network survey among 324 agricultural borrowers in northeastern China. We invited participants to play three microfinance games: individual lending without a group feature, group lending with individual liability, and group lending with joint liability. We also designed a modified dictator game to measure participants' shame proneness, and we conducted a social networks survey to measure guilt proneness and social relations among participants. Our results show that group lending improves individual repayment rates relative to individual loans, regardless of the liability clause. Furthermore, this positive effect can be explained by social capital. In particular, shame significantly reduces borrowers' strategic default rates, and individuals with a moderate level of closeness exhibit the highest repayment rates. Next, joint liability clause may evoke a free-rider problem in the absence of guilt, and feelings of guilt and exposure to authority figures can overcome this negative effect under the joint liability clause. Finally, we use an instrumental variable approach to show that conformity behavior exists within groups, implying that groups subject to random negative shocks could easily collapse, as group members' feeling of shame dissipates when

other group members also default.

This paper contributes to the existing literature on microcredit and social capital in three ways. First, we use a framed field experiment to cleanly identify the effectiveness of joint liability clause and group lending. Different from Giné and Karlan (2014) who conducted a random control trial to test the impact of removing joint liability clause from group lending, our lab-in-the-field experiment is able to cleanly identify the separate impacts of group feature and joint liability clause on repayment behavior. Second, social capital and its various components are notoriously hard to measure, and groups often self-select over different components of social capital, thus making it endogenous to loan repayment. With a carefully designed experiment and a social networks survey, we distinguish and empirically test the heterogeneous impacts of different dimensions of social capital on individual repayment behavior. Third, our theoretical model, which is an extension of Besley and Coate (1995)'s framework, makes it possible to distinguish different sources of peer pressure, specifically shame and guilt, and investigate their impacts on repayment behavior under different lending contracts.

The rest of the paper is structured as follows. Section 2 provides a theoretical framework incorporating shame and guilt into group lending with and without joint liability clause. Section 3 describes the design and data collection process of the framed field experiment in China. Section 4 presents the descriptive statistics of the sample, empirical strategy of individual strategic default behavior analysis, the estimated results on treatment effects and underlying behavioral mechanisms, and robustness check. Section 5 concludes.

2 Theoretical Model

In this section, we present a simple theoretical framework that analyzes the impacts of peer pressure on individual repayment incentives under individual and joint liability regimes. The framework mainly follows the theoretical mode from Besley and Coate (1995) with two important distinctions. First, we disentangle the "social collateral" in Besley and Coate into two specific sources, i.e. shame and guilt, and further explore their roles in different lending contracts. Second, our framework focuses on the repayment incentives under group lending. We compare between group lending with individual liability

and group lending with joint liability, and investigate how peer pressure affects them differently. Our model therefore is able to capture the way in which group lending with individual liability also leverages social collateral, while Besley and Coate (1995) assume that social collateral only exists in the joint liability lending.

2.1 Model Setup

Consider a two-borrower group in one borrowing cycle. The group is assigned to either an individual liability loan or a joint liability loan. Under individual liability, the two borrowers, 1 and 2, are responsible for their own debts; under joint liability, they are jointly liable for the group's debt. Under both liability clauses, two borrowers make their repayment decisions separately after their incomes are realized. Realized incomes (w_1, w_2) follow a joint distribution function. Loan obligation is L for a single borrower, and thus $2L$ for the group under joint liability. Also, we assume the upper bound of income $\overline{w_i} > 2L$, and the borrower is risk neutral.

2.1.1 Introduce Peer Pressure Functions

Within a group where borrowers' repayment behavior is observable, one may experience shame when defaulting. We define the cost of borrower i's shame as a function $S(s_i, x_{-i})$, where s_i is i's shame proneness or her sensitivity towards feeling shame and x_{-i} stands for other's behavior ($= 1$ if $-i$ defaults, $= 0$ if $-i$ repays). The cost of shame function $S()$ has several features: 1) there is no shame when i repays; 2) perceived shame increases with higher level of shame proneness, thus $\frac{\partial S(s_i, x_{-i})}{\partial s_i} > 0$; 3) i's shame decreases when the other borrower also defaults, thus $S(s_i, 0) > S(s_i, 1)$. For simplicity, we assume that $S(s_i, 1) = 0$ within the two-borrower group, and $S(s_i, 0)$ can be written as $S(s_i)$.

Under the joint liability regime, one's default would impose an extra loan burden on her partner, therefore borrowers may experience guilt when strategically defaulting. We define the cost of borrower i's guilt as a function $G(g_i, w_i)$, where g_i is i's guilt proneness or sensitivity towards guilt and w_i is her income level. The cost of guilt function $G()$ has several features: 1) there is no feeling of guilt when i is unable to repay or when i does not receive monetary help; 2) guilt increases with higher level of guilt proneness, thus $\frac{\partial G(g_i, w_i)}{\partial g_i} > 0$; 3) i's feeling of guilt increases with her income, thus $\frac{\partial G(g_i, w_i)}{\partial w_i} >= 0$.

In particular, $G(g_i, w_i) = 0$ when $w_i < L$; $G(g_i, w_i)$ could be positive when $w_i > L$, and the higher income w_i is, i is more likely to feel guilt.

2.2 Group Lending with Individual Liability

Under the individual liability, each borrower i is responsible for her own debt and both make their repayment decision simultaneously. As shown in Figure 1, if i chooses R - "repay", she repays L to the bank; if she chooses D - "default", she suffers a penalty which can be described by a function $P(w_i)$. The penalty may come from two sources: monetary loss due to seizure of income or assets by the bank, and non-pecuniary cost resulting from being hassled by the bank or simply from one's moral code. We assume that the default penalty is increasing in income as greater income implies greater seizable assets.

In the context of group lending with individual liability, i would suffer an additional default penalty from peer pressure, and the magnitude of this cost would depend on her partner $-i$'s behavior. That is, if $-i$ repays, i experiences shame $S(s_i)$ when her default behavior is observed by her partner; if $-i$ defaults, the feeling of shame would have been experienced by i reduces to 0.

To calculate the individual probability of repayment, we solve Nash equilibria of the game in Figure 1 (proof is in the Appendix A). Table 1 shows the conditions under which Borrower 1 repays her loan in different possible Nash equilibria. When Borrower 1 does not experience shame, the condition for her to repay is always $w_1 > L$ and $P(w_1) > L$ regardless of Borrower 2's choice, i.e. the default penalty needs to be larger than loan obligation given that Borrower 1 has the ability to repay. This mimics the individual loans without group feature as in Besley and Coate's model.

When Borrower 1 may experience shame within the group, the cost of default, given that Borrower 2 chooses to repay, increases from $P(w_1)$ to $S(s_1) + P(w_1)$, making Borrower 1 more likely to repay; while when Borrower 2 defaults, the cost of default, $P(w_1)$, is the same relative to the baseline scenario. Therefore, Borrower 1 has a higher incentive to repay in the group lending with individual liability compared with the individual loans without group feature. Also, the feeling of shame one may experience increases with her shame proneness, so higher shame proneness makes one more likely to

repay under the group lending with individual liability. These observations culminate in the following proposition:

Proposition 1: Under the group lending with individual liability, an individual borrower has a stronger motivation to repay than under the individual loans without group feature, because shame increases the default cost. Also, higher shame proneness leads to higher individual probability of repayment.

Figure 1: Group Lending with Individual Liability Incorporated with Peer Pressure

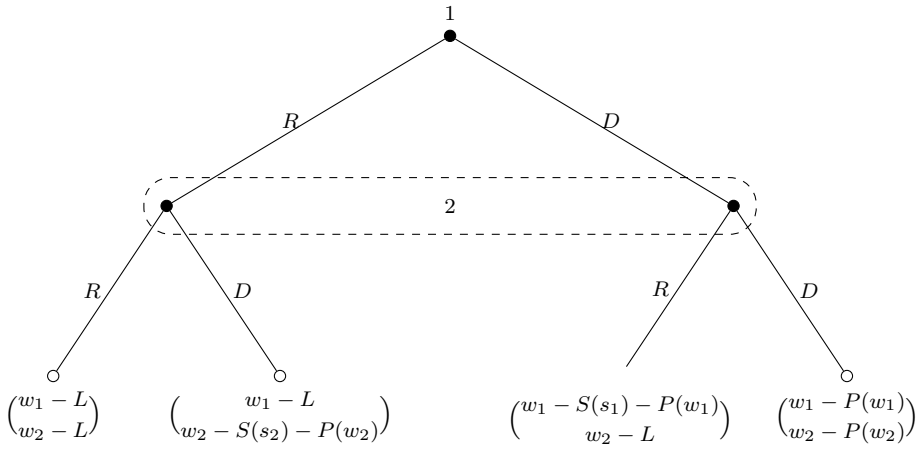


Table 1: Conditions for Borrower 1 to Repay-Individual Liability

Borrower 2's decision	Borrower 1 repays if and only if
Repay	$w_1 > L$ and $S(s_1) + P(w_1) > L$
Default	$w_1 > L$ and $P(w_1) > L$

2.3 Group Lending with Joint Liability

Under the joint liability lending, borrowers are responsible for the entire group's debt. Making their repayment decisions simultaneously, if both borrowers choose R - "repay", or both choose D - "default", the game ends. Specifically, when both repay (R, R), they each pay L to the bank; when both default (D, D), they both suffer the penalty $P(w_i)$. If one chooses R - "repay" and the other chooses D - "default", (R, D) or (D, R), whoever repays makes a second decision on whether to repay her partner's

loan by choosing H - 'help', or to not help by choosing NH - 'not help'. If she helps, she repays the group's debt $2L$; otherwise, she takes her initial money back, and both borrowers pay 0 to the bank and suffer the default penalty $P(w_i)$.

As Figure 2 describes, group members face the costs of peer pressure. In the situation where i defaults while $-i$ repays in their first decisions, the defaulter i would suffer the cost of shame $S(s_i)$ regardless of whether she receives help from the other. This is because first decisions are revealed before $-i$ making the second decision; regardless of whether $-i$ helps or not, i's default behavior is observable to $-i$, thus i suffers the cost of shame. When i is able to repay but chooses not to and when $-i$ repays on her half, i would suffer the cost of guilt $G(g_i, w_i)$.

We solve the game presented in Figure 2 for the sub-game perfect Nash equilibrium (proof is in the Appendix A). Table 2 shows the necessary conditions for Borrower 1 to repay her loan in the sub-game perfect Nash equilibrium. When Borrower 2's strategy is to repay her own loan and not to help regardless, the condition for Borrower 1 to repay is the same as in the individual liability. That is, the default penalty and the cost of shame must outweigh loan repayment. When Borrower 2's strategy is to repay both her own and Borrower 1's loan, Borrower 1 has the chance to free-ride under joint liability. In this case, Borrower 1 will only repay when the cost of shame and guilt outweigh the cost of loan repayment, i.e. $S(s_1) + G(g_1, w_1) > L$. When Borrower 2's strategy is to default or she simply could not repay due to low income, there may be two sub-game Nash equilibria where Borrower 1 chooses to repay her own loan in the first decision: Borrower 1 would not only repay her loan but also help cover Borrower 2's loan only if the default penalty outweighs the cost of repaying the group loan $2L$; Borrower 1 would only repay her loan but chooses not to help Borrower 2, when the default penalty is not large enough and Borrower 1's income exceeds her own cost of loan repayment, which implies she always repays in the first decision when able.

By observing the conditions for Borrower 1 repaying under joint liability, we are able to infer some implications of peer pressure on repayment behavior. First, we observe that shame increases loan repayment under group lending with joint liability as shame increases the incentive to repayment when Borrower 1 repays. Second, we find that guilt increases loan repayment by increasing the likelihood of repayment when Borrower 2 repays and helps, i.e. guilt reduces free-riding in joint liability. These

observations culminate in the following propositions:

Proposition 2 : Under group lending with joint liability, higher shame proneness leads to higher individual probability of repayment.

Proposition 3 : Under group lending with joint liability, higher guilt proneness reduces the possibility of free-riding and increases individual probability of repayment.

Figure 2: Group Lending with Joint Liability Incorporated with Peer Pressure

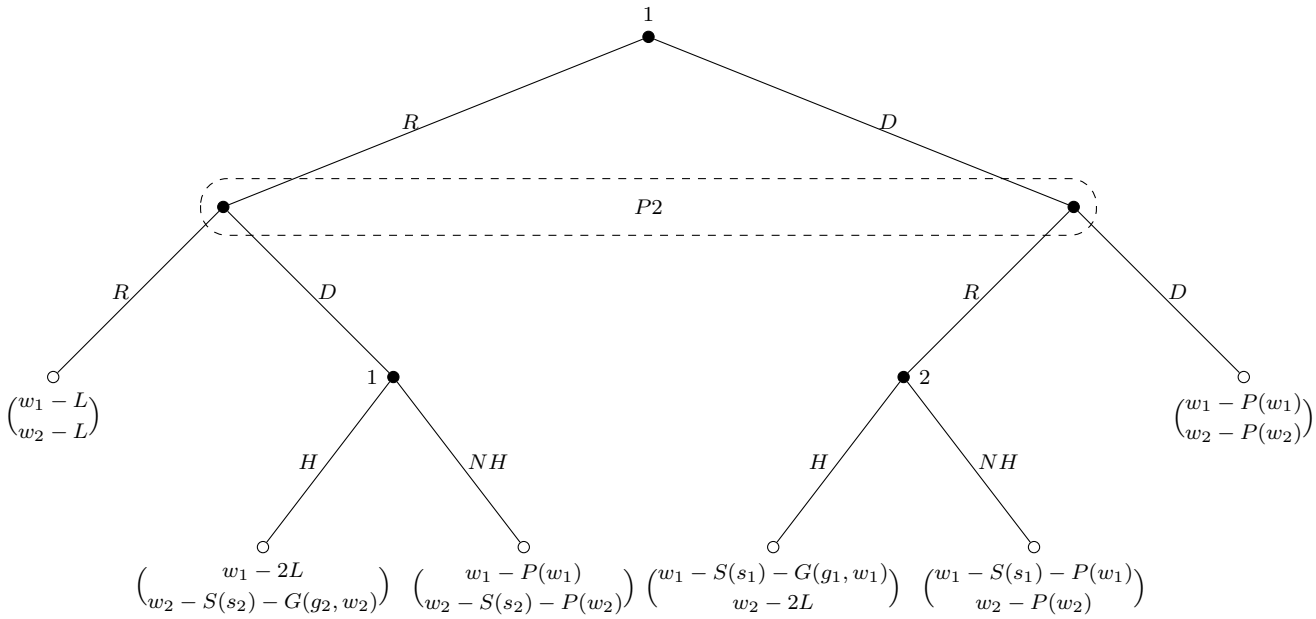


Table 2: Conditions for Borrower 1 to Repay-Joint Liability

Borrower 2's decision	Borrower 1 repays if and only if
Repay and Help	$w_1 > L$ and $S(s_1) + G(g_1, w_1) > L$
Repay, Not Help	$w_1 > L$ and $S(s_1) + P(w_1) > L$
Default	1 Help: $w_1 > 2L$ and $P(w_1) > 2L$
	1 Not Help: $w_1 > L$

2.4 Conformity Behavior

In this section, we explore how shame may drive conformity behavior in repayment decisions. In a

group loan contract, there are usually more than two borrowers in the group. Therefore, instead of observing the other's behavior, the borrower observes repayment behavior of the rest of group when making her own decision. Individuals are susceptible to experience shame when one's behavior is seen as unacceptable relative to others' behavior. If the larger proportion of the group defaults already, perhaps due to negative common shocks such as the catastrophic weather, the default behavior is less unacceptable in the group; the cost of shame the borrower may suffer when default thus decreases, making her more likely to strategically default in the future. Therefore, borrowers conform to the behavior of the group over time.

Literature on conformity behavior shows a number of reasons behind such behavior: a. externalities—actions taken by others may change returns that an individual receives from undertaking the same action, e.g. contribution to a public good; b. informational—an individual believes others are better informed about the optimal course of actions, thus others' behavior may provide a source of information regarding the course of actions she should take (Chamley, 2004; Guiso et al., 2013); c. social pressure—social interactions can influence an individual's preferences if individuals derive utility from minimizing the extent to which their actions deviate from the average behavior of others (Akerlof, 1997; Bernheim, 1994; Lindbeck et al., 1999); d. social stigma—social stigma associated with an action considered immoral decreases with the number of people doing it (Guiso et al., 2013). We provide one possible explanation for how reduced shame could be a driving factor behind conformity behavior under our framework of social capital, which is consistent with the story of social sigma by Guiso et al. (2013). Later on, we use empirical methods to demonstrate the existence of conformity behavior and its implication in group lending.

3 The Experiment and Data

To test the propositions proposed in the theoretical model as well as the impacts of social relations on repayment, we conducted a framed field experiment and a social networks survey among smallholder farmers in rural China. Framed field experiments are laboratory experiments conducted among a population relevant to the topic of interest and framed in terms of the topic (Harrison and List, 2004).

By conducting the experiment "in the field", we are able to improve the external validity of the results by utilizing a sample population with lending experiences and framing the experiment in terms of lending (Gneezy and Imas 2017). The framing would help participants understand the game and elicit behavior that is more likely to correlate with behavior in real loans.

We employ a framed field experiment to ensure that we are able to disentangle both the different impacts of group lending and joint liability as well as to create exogeneous variation in social capital. The framed field experiment is particularly well suited to this pursuit relative to observational studies or randomized controlled trials (RCTs). Observational studies are not able to cleanly disentangle the impacts of group feature and joint liability clause and are not able to identify the impact of variations in social capital due to self-selection. Although RCTs can experimentally vary the liability structure (as Gine and Karlan, 2014), it is difficult to experimentally vary social collateral, making it difficult to identify the impact of social capital on different contracts. Borrowers with certain personal characteristics, such as trustworthiness, could exhibit more social connections, and this may compound the impact of social capital with those personal characteristics when analyzing observational data or RCT results. Therefore, we adopt a framed field experiment in which we experimentally vary the liability structure and the group composition, which allows us to identify unbiased effects of both on loan repayment behavior. This section first describes the experimental procedures and treatments used in the experiment, and then the data collection process.

3.1 Experimental Procedures

We conducted the field experiment in Heilongjiang Province of China. Each experimental session included 12 participants and took roughly 3 hours to complete. At the beginning of each session, we collected oral consent from each participant followed by a thorough introduction to the microfinance games by enumerators.

During the introduction, participants were told to imagine that they owned one Mu [2]of land for rice cultivation and needed a loan at the beginning of planting season to purchase the required inputs, such as seeds and fertilizer. In each game, the local microfinance institution pre-approved them for a

[2]Mu is a Chinese unit of land measurement, which is about the size of 0.165 acre.

loan and this loan may come in the form of an individual loan, a group loan with individual liability or a group loan with joint liability, where joint liability contract had two borrowers [3]. Each round in the games stood for a borrowing cycle, i.e. a year. Thus, participants had access to the loan in Round 1 of any microfinance game. The amount of the loan for one participant under both liability clauses was fixed at 833 Yuan (about $126) with interest rate 20%, so repayment was equal to 1,000 Yuan (about $151).

In any microfinance game, the final outcome was decided by a) systemic risk, i.e. the weather, and b) idiosyncratic risk, i.e. one's own outcome level. The systemic and idiosyncratic risks were realized separately by drawing different colored balls from a bag. As Table 3 shows, after the weather was determined, there were three possible outcomes, 0, 1,400 Yuan (about $211), and 2,100 Yuan ($317); each occurring with a predetermined probability[4] [5]. Then the participant was asked to make her own repayment decision [6]. Her repayment decision was limited by the realized outcome as Table 4 displays.

Table 3: Outcomes in Microfinance Games

Outcome	0	1,400 Yuan	2,100 Yuan
Good Weather (70%)	10%	30%	60%
Bad Weather (30%)	30%	30%	40%
Unconditional Probability of Outcome	16%	30%	54%

[3] Local banks began to implement joint liability lending in 2003, the initial required group size under joint liability lending was five. Then the group size was switched to three and was finally set at two. In the game, we kept the same size for joint liability group as the reality.

[4] Numbers of balls standing for the weather and individual outcomes were predetermined. Before drawing, participants verified the numbers of corresponding color of balls in the bag and thus are aware of the probabilities. Moreover, to ensure that decisions were not driven by a preference for a short playing time, we required all participants, including those who defaulted in previous rounds, to draw an outcome anyway.

[5] In all three microfinance games, weather condition was announced to all those who were present, while the outcome information was private during the experiment. To protect the privacy of participants' outcomes, we used a privacy box behind which each individual realizes outcomes and makes her own repayment decisions before any information was announced.

[6] In the game, participants could only use the outcome from the current round to repay their loans, i.e. no money from previous periods was allowed. One who received 0 outcome had no choice both under individual lending and in the first repayment decision under joint liability lending, but to default automatically.

Table 4: Available Choices in Microfinance Games

	Individual Liability	Joint Liability	
	Repayment Decision	1st Repayment Decision	2nd Help Decision
0	Default	Default	Not Help
1,400 Yuan	Default or Repay	Default or Repay	Not Help
2,100 Yuan	Default or Repay	Default or Repay	Help or Not Help

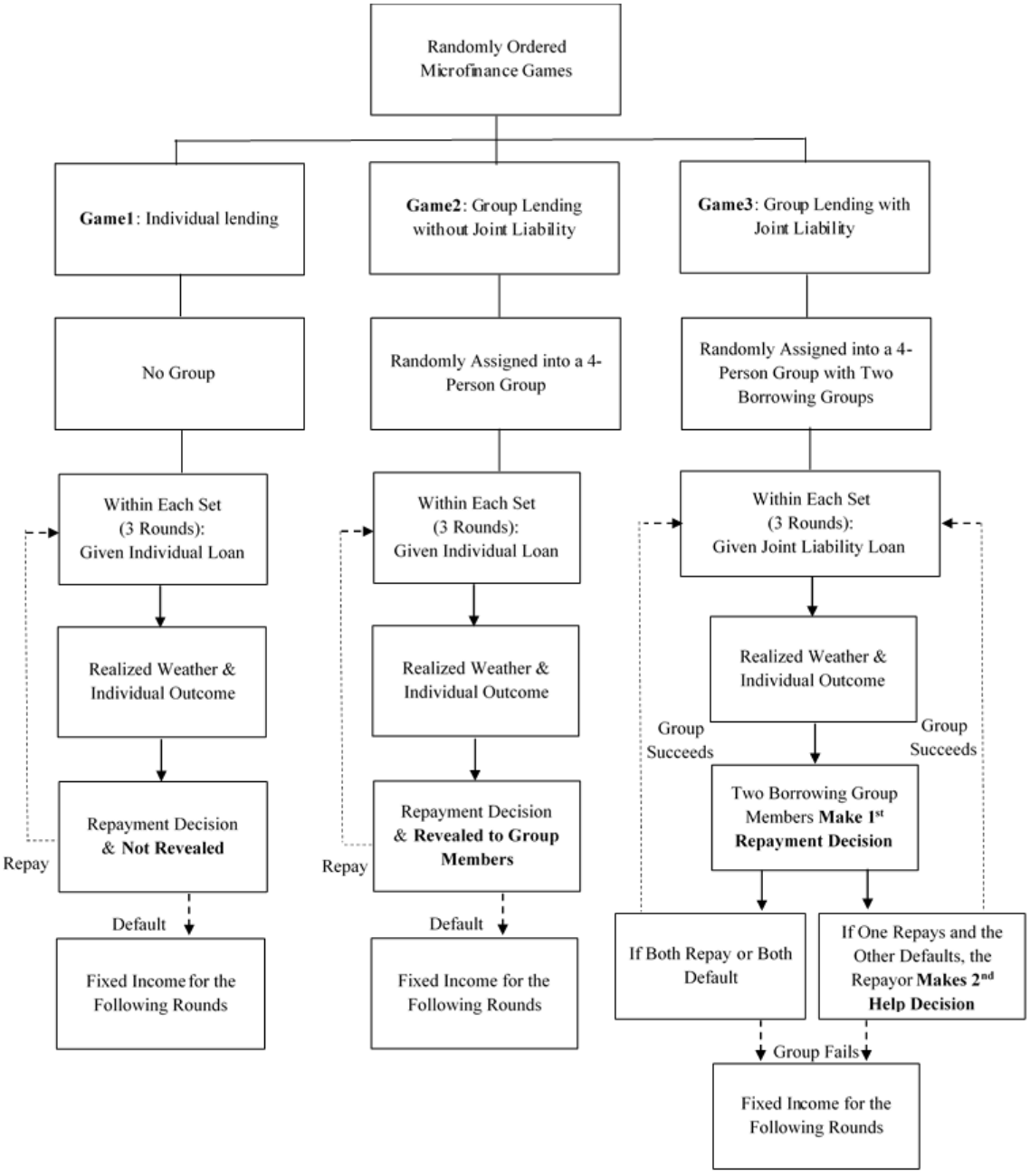
Each participant's decision in Round 1 would affect her loan access in the next round. Under individual liability, each participant made one decision on whether to repay her loan, 1,000 Yuan, or to default. If she repaid in Round 1, she could get the same loan the next round; if she defaulted, she would be banned from getting the loan the next round and received a fixed 700 Yuan. This fixed income mimics the situation where participants do not have access to loan products and have to earn income from other non-agricultural activities, such as selling vegetables. Under joint liability, the two members in the same borrowing group made the 1st repayment decision simultaneously on whether to default or to repay her own loan of 1,000 Yuan with one of the following consequences: a) if both defaulted, the group failed; b) if both repaid, the group succeeded; c) if one decided to repay, while the other defaulted, then whoever decided to repay made the 2nd help decision on whether to help her partner repay. For the 2nd decision, if a participant agreed to help her partner out, she had to repay 2,000 Yuan for the whole group, then the group succeeded; if a participant refused or was unable to help, she could take her 1,000 Yuan (which she had initially indicated she would be willing to repay) back and the group failed [7]. Only the successful borrowing groups had access to the same joint liability loan in the following round; both members in failing borrowing group would be banned from future loan, each receiving 700 Yuan per period.

There were three microfinance games in the experiment to mimic three different lending contracts: individual lending (Game 1, Control), group lending with individual liability (Game 2), and group lending with joint liability (Game 3). The income realization and decisions outlined above were common across the three microfinance games and only the group aspect and liability clause were varied. We

[7] Different from Kono's (2013) design where participants who chose to repay were required a sunk cost when the group defaulted, we allowed the participant to not pay her loan once she found out her partner would not repay in the 2nd decision. In this sense, who initially indicated to repay her own loan, yet choosing not to help her partner, would not receive an extra punishment compared with her partner who chose to default. This is consistent with the reality.

randomized the order of the three microfinance games in different experimental sessions to avoid any order bias. For each microfinance game, participants' repayment behavior was collected in multiple rounds. Each microfinance game was played in 3 sets, and each set contained 3 rounds. Within each set, we simulated a dynamic incentive penalty by not allowing an individual participant or a borrowing group to borrow in rounds following default. They each received a fixed 700 Yuan. However, at the beginning of each set, an individual participant or a borrowing group regained access to loan, regardless of whether they defaulted in previous sets. Two practice rounds were played at the beginning of each game to make sure that participants fully understood the rules. Figure 3 below shows procedures for the three games.

Figure 3: Procedure of Three Microfinance Games



Game 1 (Control) was designed to mimic conventional individual loans. Participants sat sepa-

rately from one another without knowing others' outcomes or repayment decisions during the game. In this way, we limited the effect that social relations and informational elements may have on one's repayment behavior.

Game 2 was designed to mimic group lending with individual liability. Participants were randomly assigned into a 4-person group. Each group member's repayment decision was revealed to the three other group members at the end of each round. Since each participant's outcome information was private, one could observe whether other group members defaulted without knowing their actual outcomes.

Game 3 was designed to simulate group lending with joint liability. Participants were randomly assigned into a 4-person group. Each group contained two 2-participant borrowing groups. The two borrowing group partners make the 1st repayment decision simultaneously; only when a participant repaid while the other defaulted, would the person who repaid be asked to make the 2nd help decision. Participant's repayment decision and helping decision (if applicable) would be revealed to her group members at the end of each round.

After finishing the microfinance games, participants played a revised dictator game that revealed individual shame proneness. In the game, participants were required to send out money with or without her ID revealed (game details are included in the Appendix B). Shame proneness elicited from the revised dictator game is calculated as the average amount of money one sent out when her ID was observable minus the average money sent out without her ID. The more one sent out under the former scenario relative to the latter scenario, the more she cares about how others view her, i.e. the participant has higher level of shame proneness.

At the end of the experimental session, we also conducted a social networks survey to measure the social relations within randomly assigned groups. Enumerators took pictures of each participant at the beginning of the experimental session and uploaded these pictures into the computer-based survey. Following Dufhues et al. (2011) and Giné and Karlan (2014), we disentangle three dimensions of social relations—closeness (or knowledge), trust, and authority (or social distance). During the survey (see the Appendix C), enumerators asked nine questions in which respondents would indicate the other

members of the session (by pointing to their picture on the screen) for whom the question applied. The nine questions included four questions intended to measure the level of closeness or knowledge (e.g. whether are friends or family, whether getting involved in common activities etc.), four questions to measure the level of trust between participants (e.g. whether would borrow money if needed, whether there was mutual help before), and one question to measure authority (who are village leaders or local dentists etc.). In the survey, we also included the standardized Guilt and Shame Proneness Scale developed by Cohen et al. (2011) to measure individual guilt proneness, which is the average score of four guilt questions. The questions can be found in the Appendix D. Finally, participants received monetary payouts that served as compensation for their time and ensure their game decisions were incentive compatible. The rules for compensation calculation are included in the Appendix E.

3.2 Data Collection

The data for the empirical analysis was collected through the above framed field experiment and a social networks survey on a sample population of smallholder farmers in rural China. The data collection occurred in 6 villages of Mulan County in Heilongjiang province of China from July through September 2017. We chose this region because joint liability lending has been implemented there for years, thus a) it would be easier for local borrowers to understand the microfinance games in the experiment, and b) the study conclusion would be beneficial for local microfinance institutions. We used all farmers who are current borrowers or had borrowing experiences in the past 10 years as the sample frame; the sample frame included 37,000 farmers in the county. To identify the final sample, we randomly selected 6 out of 12 villages and 2-3 sub-villages in each chosen village, and collected information from local village leaders on the ratios of potential eligible farmers in each sub-village. Next, we randomly chose farmers from the name list based on the size of eligible farmers in each sub-village, and hired local village leaders to help enumerators identify farmers from the name list. The total number of participants in the experiment was 600 farmers. Excluding experiment sessions for preliminary test (for the purpose of calibrating parameters, training and re-training enumerators in order to standardize their behaviors during the data collection process), the final sample that enters the empirical analysis included 324 borrowers. Table 5 shows the specific sample size in each sub-village of the final sample.

Table 5: Participation Rates in Sampled Villages

Village	Sub-village	# of Farmers	% of Borrowers in Sub-village	Realized Participation	Realized Participation Rate
WenYa	Jixiang Tun	257	47.9	12	63.5
	Baogang Tun	675	36.1	36	87.4
SanXing	Wangjia Dian	890	44.7	48	78.9
	Yujia Gou	378	31.2	12	80.1
	Zhoujia Gang	415	50.0	36	77.6
LinJiang	Jiangjia Tun	329	75.1	24	65.2
	Xinfa Tun	164	60.0	12	85.5
SanHe	Tongchang Tun	225	60.0	12	82.2
	Dongbang Tun	468	41.9	24	76.9
XingShan	Pailou Dian	489	36.4	24	84.5
	Majia Tun	356	42.7	24	82.1
ShiHe	Maojia Tun	422	60.1	36	73.9
	Hedong Tun	409	57.5	24	76.6
6	13	5477	49.51	324	78.0

4 Empirical Strategy and Results

4.1 Participant Characteristics

Table 6 presents descriptive statistics for the 324 borrowers in the final sample. Individual and household characteristics include age, household role, gender, marital status, education level, religious status, household size, source of income, number of Mu of land owned and planted etc. We also include participants' current or previous borrowing experiences from local banks. Since marriage certificates are required for loan screening at local banks, our sample is mainly married (98%) and middle-aged participants (with average age 45.5 years old). The average participant has 7 years of education, comes from a household of four members, owns 26 Mu of land, and plants 65 Mu by renting in land, of which

41.5 Mu was dedicated to corn during the previous planting season. Note that the household role and the gender balance are fairly even (with 40% household heads and 42% males). Agricultural loans are mainly provided in the form of joint liability rather than individual liability lending, therefore we find 99% of the sample are agricultural farmers who have joint liability lending experience only. The sample has experience with a variety of group sizes. Around 19% of participants have defaulted on or rescheduled their loans.

Three social relation ties reported in Table 6, i.e. closeness tie, trust tie, and authority tie, are calculated as a participant's number of each network link towards other group members (in the 4-person group) from the social networks survey. We transform closeness tie and trust tie into indices using principal component analysis (PCA) from multiple survey questions. We then normalize the indices into z-scores by subtracting its mean and dividing its standard error. Authority tie is a discrete variable standing for the number of authoritative members for the participant in the 4-person group, with average 0.14. Shame proneness calculated from the revised dictator game is scaled between 0 and 1, i.e. the higher shame proneness is, one is more likely to have the feeling of shame, and the average is 0.78 within the sample. Guilt proneness calculated from the survey questions is also scaled between 0 and 1, i.e. the higher guilt proneness is, one is more likely to have the feeling of guilt, and the average is 0.96 within the sample. The conformity behavior measurement in the game is calculated as the ratio of uncreditworthy borrowers among the rest of the group each participant observes before making her repayment decision. We then normalize it as a z-score measurement; the higher this measurement is, the larger proportion one observes default behavior happening in the group.

Table 6: Sample Statistics (N=324)

Variable	Mean	St.Dev	Min	Max
Demographics				
Age	45.50	12.11	18.00	71.00
Head	0.40	0.49	0.00	1.00
Male	0.42	0.49	0.00	1.00
Married	0.98	0.12	0.00	1.00
Education (Year)	7.32	2.86	0.00	16.00
Non-Religion	0.83	0.38	0.00	1.00
Communist	0.02	0.15	0.00	1.00
# of Household Member	4.05	1.43	1.00	8.00
Agricultural Production				
Agricultural	0.97	0.17	0.00	1.00
Non-Agricultural	0.26	0.44	0.00	1.00
Self-owned Land(Mu)	26.12	16.88	0.00	100.00
Self-planted Land(Mu)	64.44	68.29	0.00	600.00
Rice(Mu)	14.54	41.83	0.00	600.00
Corn(Mu)	41.45	45.61	0.00	330.00
Soy Bean(Mu)	8.57	17.78	0.00	130.00
Real-Life Borrowing Experience				
Joint Liability(JL)	0.99	0.10	0.00	1.00
Individual Liability(IL)	0.02	0.16	0.00	1.00
Have Defaulted	0.19	0.40	0.00	1.00
JL Group Size: 2	0.26	0.44	0.00	1.00
JL Group Size: 3	0.33	0.47	0.00	1.00
JL Group Size: 5	0.40	0.49	0.00	1.00
Experiment Social Capital Indixes				
Closeness Tie (z-score)	0	1	-1.75	5.65
Trust Tie (z-score)	0	1	-2.64	3.14
Authority Tie	0.14	0.36	0	2
Shame Proneness	0.78	0.26	0	1
Guilt Proneness	0.96	0.12	0.25	1
Conformity in Default (z-score)	0	1	-2.07	0.71

4.2 Statistics of Outcome Variables

Table 7 shows the average repayment and strategic default decisions from each game. We conduct mean

t-test comparisons to elicit the statistical impacts of group status and joint liability at the means in the sample. Panel A reports the results for individual repayment rate (=1 repay, =0 default) in each round of each game, and Panel B and C report the mean of strategic default decision (=1 strategic default, = 0 repay). Here, we differentiate strategic default (when the participant receives positive income and has the ability to repay her own loan but chooses to default) from mechanic default (when the participant receives zero income and must default): repayment rate in Panel A is the overall repayment rate, excluding both mechanic and strategic default; Panel B focuses on the strategic default behavior by excluding the mechanic default. Since participants or borrowing groups who default are not allowed to borrow in subsequent rounds, the sample is truncated by defaults in Rounds 2 and 3. In Panel B, we provide the average decisions while dropping the missing values. In Panel C, we impute these missing values and report the updated strategic default rates. Calculation in Panel C can also prevent the bias arising from the fact that repayers are over-represented in Panel B.

A few noticeable trends appear in the data. First, it shows that participants respond to dynamic incentive: all panels show that repayment rates decrease (strategic default rates increase) from Round 1 to Round 3. In the games, participants do not have incentive to repay in Round 3 unless they have strong moral or social cost [8]. Second, there is a clear positive impact of the group feature (Game 2 and Game 2 relative to Game 1) and joint liability (Game 3 relative to Game 2). Excluding Round 3 where the dynamic incentive vanishes, the last row of both Panel B and C show that group feature significantly reduces strategic default behavior in the individual lending, and joint liability clause further reduces strategic default relative to the individual liability. It is necessary to confirm these treatment effects using empirical methods and further explore potential roles of social capital in the next section.

[8] Comprehension questions in the survey also show that 95% of participants understood the rules of games very well.

Table 7: Mean Outcome Variables

	Individual Lending (Game 1)	Group Lending with Individual Liability (Game 2)	Group Lending with Joint Liability (Game 3)	G2-G1	G3-G1	G3-G2
Panel A: Repayment Rate (%)						
Round 1	65.59	70.30	69.47	4.71**	3.88*	-0.83
				(0.027)	(0.069)	(0.691)
Round 2	58.39	58.10	66.57	-0.29	8.18***	8.47***
				(0.916)	(0.002)	(0.001)
Round 3	15.72	13.81	22.79	-1.91	7.07**	8.98***
				(0.459)	(0.012)	(0.001)
Round 1&2	62.74	65.28	68.29	2.54	5.55***	3.01*
				(0.132)	(0.001)	(0.068)
Panel B: Strategic Default Rate (%)						
Round 1	22.48	16.63	18.01	-5.85***	-4.47**	1.38
				(0.003)	(0.025)	(0.459)
Round 2	31.92	31.04	20.80	-0.88	-11.12***	-10.24***
				(0.753)	(0.000)	(0.000)
Round 3	81.41	83.39	73.00	1.98	-8.41***	-10.39***
				(0.515)	(0.010)	(0.001)
Round 1&2	26.25	22.55	19.14	-3.7**	-7.11***	-3.41**
				(0.024)	(0.000)	(0.028)
Panel C: Recalculated Strategic Default Rate (%)						
Round 1	22.48	16.63	18.01	-5.85***	-4.47**	1.38
				(0.003)	(0.025)	(0.459)
Round 2	49.10	44.30	34.14	-4.8*	-14.96***	-10.16***
				(0.069)	(0.000)	(0.000)
Round 3	88.04	89.29	78.03	1.25	-10.01***	-11.26***
				(0.537)	(0.000)	(0.000)
Round 1&2	35.02	29.46	25.25	-5.56***	-9.77***	-4.21***
				(0.001)	(0.000)	(0.010)

P-values are in the parenthesis. p<0.1 *, p<0.05 **, p<0.01 ***

Note: Panel C shows the recalculated strategic default rate with imputation based on Panel B. We impute missing values (where participants strategically defaulted and were not allowed to make borrowing decisions in subsequent rounds) in Panel B with value 1 with the idea that one would make the same strategic default choice under the same or even decreased dynamic incentive, and then calculate the average strategic default rate.

4.3 Empirical Specification and Results

4.3.1 Econometric Model

In this section, we develop an empirical approach to estimate the effects of group feature and joint liability clause, as well as the impacts of different types of social capital, on borrowers' repayment decisions. Since borrowers have no choice but to default when receiving zero income, we focus on strategic default behavior only. Also, we restrict the analysis to borrowers' decisions in Round 1 and Round 2 because borrowers' incentive to repay in Round 3 vanishes. The main empirical strategy is Multilevel Mixed-Effect Model following Guo and Zhao (2000). Mixed models are particularly useful when repeated measurements are made on the same statistical units, or when measurements are made on clusters of related statistical units. In the experiment, repayment decisions made in different rounds by the same participant tend to be correlated due to common individual characteristics. Also, since individuals are randomly selected from the whole population of eligible farmers to which we want to generalize, we include individual level random effects in the analysis.

There could be correlations at more than one level. Other than observations within individuals, individuals nested within the same session could be correlated on their repayment choices due to the common atmosphere or the way instructor guided throughout the session. One advantage of the mixed model is to allow residual components to be at more than one level to address the situations where correlation comes from grouping. For example, a two-level model allows for grouping of repayment decisions within individuals. Thus, the residual variance is partitioned into a within-individual component and a between-individual component. The individual residuals (individual effects) represent unobserved individual characteristics that affect their repayment choices. It is these unobserved variables which lead to correlation between outcomes for each participant. A three-level model would allow for grouping of the repayment decisions of individuals within sessions. The intraclass correlation coefficient (ICC) test for the three-level models shows that conditional on the fixed-effect covariates, individual random effect composes approximately 29% of the total residual variance, yet session random effect is only 4%. Therefore, we choose the simplest two-level model instead of three-level model,

and we model individual random effect as the random intercept. Furthermore, mixed models apply log-likelihood methods to estimate the coefficients and this method has the advantage of permitting likelihood-ratio tests for comparing different models. Generated likelihood ratio test (LR=237.52, p-value=0.000) justifies that mixed effect Probit model is significantly better than the ordinary Probit model for the experiment data.

We consider the following Multilevel Mixed-Effect Probit Model of the strategic default decision variable regressed on treatments, social relations, and peer pressure, and a vector of control variables as follows:

$$SD_{igr} = I(\alpha_0 + \alpha_1 Group_g + \alpha_2 JL_g + \alpha_3 Group_g * SR_{ig} + \alpha_4 JL_g * SR_{ig} + \alpha_5 Group_g * Shame_i + \alpha_6 JL_g * Guilt_i + \alpha_7 Group_g * Conformity_{igr} + u_i + \Gamma + \epsilon_{igr} > 0) \quad (1)$$

Where SD_{igr} is the repayment decision when individual borrower receives positive income ($SD_{igr} \in (0,1)$, with 1 indicating strategic default, which comes from Panel B in Table 7), i indicates individuals, g indicates games, and $r \in (1,2)$ indicates rounds. Two treatment variables are $Group_g$, a dummy variable indicating the presence of group feature regardless of liability clause, and JL_g, a dummy variable indicating the presence of the joint liability clause.

$Group_g * SR_{ig}$ represents social relations in the group lending, as indicated by participant i in game g. It has three specific measurements, i.e. i's closeness tie, trust tie, and authority tie within groups. We also have $JL_g * SR_{ig}$ to test whether there are heterogeneous effects of social relations in group lending with joint liability relative to individual liability. $Shame_i$ measures i's shame proneness. We anticipate that the estimated effect for shame proneness will be negative, indicating that a higher level of shame proneness i leads to less strategic default. $Guilt_i$ is i's guilt proneness. We anticipate that higher levels guilt proneness will result in less strategic default under joint liability. According to our theoretical model, we have the group-shame and joint liability-guilt interaction terms.

Conformity is measured as the ratio of uncreditworthy borrowers among the rest of the group i observes before she makes her repayment decision under the game g in the round r. We expect a

significant positive effect, which will indicate higher tendency of strategic default when observing more defaults within the group. Since conformity behavior exists in the group lending where repayment behavior is public information, we only include conformity interacted with group lending, i.e. there is no conformity when $Group_g = 0$. However, a potential endogeneity issue arises from the conformity measurement $Conformity_{igr}$. In the conformity behavior, a participant's behavior depends on what she observes others, and it is possible that decisions of the rest of the group would also depend on observed repayments of participant i in previous rounds. That is, participant i's strategic default decision reflects her own previous strategic default decisions (i.e. the "reflection" problem). In an attempt to avoid this potential endogeneity problem, we use an exogenous variable to instrument the original measurement. One candidate instrument variable is the mean of idiosyncratic risks among the rest of the group in round $r-1$. This IV candidate is theoretically valid for two reasons: 1) The IV is highly correlated with the original conformity measurement, because bad idiosyncratic shock leads to mechanic default and increase ratio of uncreditworthy members in the group in round r; 2) other participants' idiosyncratic risks are exogenous and completely unobserved by participant i, thus it would not affect i's decision in the next round [9]. We then employ two-stage least squares to estimate the coefficients.

Lastly, u_i is the individual random effect, and Γ is a group of fixed effects, including session fixed effect and round fixed effect. Error term ϵ_{igr} are distributed as a standard normal with mean 0 and variance 1 and are independent of u_i. In the main regression, we regress SD_{igr} on $Group_g$ and JL_g to test the main treatment effects. Later on, we extend the regression to include social relations, peer pressure, and conformity behavior, in order to investigate the impact of social capital in the context of group lending.

4.3.2 Main Results

Table 8 shows the regression results of estimating Equation (1). Model 1-6 are the results of Multilevel Mixed Effect Probit models, among which Model 4 and Model 6 employ the instrumental variable

[9] Yet one may argue that i can estimate the idiosyncratic risk of others in the group by observing the realized weather and thus increases chance of her own strategic default under the bad weather in round $r-1$, further affecting her behavior in round r. We then regress individual strategic default decision on the weather and do not find any significant impact.

for the conformity measurement and thus 2SLS estimation results are reported. Consider first the main treatment effects on strategic default decisions. Model 1 is consistent with the t-test results from the summary in Panel B of Table 7: 1) being in the group lending significantly reduces strategic default behavior relative to individual loans; 2) joint liability further reduces probability of strategic default compared with individual liability in the group lending. Table 9 shows the marginal effects of Model 1-6 from Table 8. Across all columns, marginal effects of treatments are significant. Overall, group lending reduces probability of strategic default by 4.8%, and joint liability further reduces the probability of strategic default by 3.8%.

Model 2 reports the estimated coefficients for social relations, Model 3-4 report results for peer pressure measurements, and Model 5-6 regress strategic default on both social relations and peer pressure measurements. Model 2 shows that closeness has a quadratic impact on default, which is consistent across Models 2,5,and 6. Under group lending, being close to other group members initially helps decrease strategic default; yet as closeness gets higher, it has the opposite effect and begins to increase strategic default. We also find that closeness has no significant interaction with joint liability relative to individual liability. We plot the marginal effect (based on Model 2) in Figure 4 (see the Appendix F) under both individual liability group lending and joint liability group lending. Regression results show that the turning point for closeness tie is around 0, indicating that closeness ties can reduce default within groups below the mean value. Models 2,5 and 6 demonstrate no impact of trust on repayment under group lending or joint liability. Regarding the authority tie, we find that being exposed to one more authoritative figure under the joint liability lending would significantly reduce strategic default by about 3.4%; we find no impact of authority under individual liability.

Model 3-6 report the estimated coefficients of shame, guilt and conformity behavior measurements. Note that estimated coefficients in Model 4 and 6 using 2SLS estimation may be more reliable than Model 3 and 5 due to the potential endogeneity of the conformity measurement. All models confirm that shame proneness within groups and guilt proneness under the joint liability can significantly reduce strategic default behavior, which is consistent with the propositions from our theoretical model. According to Model 4, increase of shame proneness from 0 to 1 would reduce strategic default by 6.2%, while this number is 6.6% for the same amount of increase in guilt proneness. One interesting

phenomenon to observe is that after introducing guilt proneness, the impact of the joint liability treatment becomes significantly positive; this result suggests that joint liability clause itself could cause a free-rider problem when borrowers have low level of guilt proneness, and joint liability only reduces strategic default when guilt proneness is high. Since our sample has high average guilt proneness 0.96, borrowers tend to repay more under the joint liability lending relative to individual liability.

With respect to the impact of conformity, we find a positive impact in models 3, 4, and 6. According to Model 4, one standard deviation of increase in the rate of default among other group members increases a participant's probability of strategic default by 1.4% (see Table 9). We find no significant difference between joint liability lending and group lending with individual liability with respect to the impact of conformity. We also note that F-test results from the first stage in Model 4 and 6 demonstrate strong evidence that the relevance assumption holds for the IVs; given that weather outcomes were random in the experiments, these results suggest we have a valid IV. Lastly, the results for shame, guilt, and conformity measurements are robust when we include social relation measurements in Model 6. This indicates that it is necessay to separately investigate the roles of different dimensions of social capital.

Table 8: Main Regressions on Strategic Default Behavior

	Model1	Model2	Model3	Model4 2SLS	Model5	Model6 2SLS
Group	-0.18***	-0.23***	0.17	0.25	0.10	0.18
	(0.066)	(0.072)	(0.16)	(0.17)	(0.16)	(0.17)
JL	-0.14**	-0.093	0.75*	0.72*	0.81*	0.78*
	(0.070)	(0.076)	(0.43)	(0.43)	(0.46)	(0.47)
Social Relations within Group						
Group x Closeness		-0.078			-0.067	-0.065
		(0.061)			(0.066)	(0.066)
Group x Closeness^2		0.039**			0.046***	0.045**
		(0.017)			(0.017)	(0.018)
Group x Trust		0.076			0.055	0.049
		(0.061)			(0.066)	(0.067)
Group x Authority		0.036			0.067	0.065
		(0.14)			(0.16)	(0.16)
Social Relations within Joint Liability						
JL x Closeness		0.022			0.024	0.023
		(0.080)			(0.084)	(0.086)
JL x Trust		0.044			0.031	0.033
		(0.086)			(0.093)	(0.095)
JL x Authority		-0.53***			-0.68***	-0.66***
		(0.20)			(0.22)	(0.22)
Peer Pressure						
Group x Shame			-0.42**	-0.40**	-0.40**	-0.38**
			(0.18)	(0.18)	(0.18)	(0.18)
JL x Guilt			-0.97**	-0.94**	-0.96**	-0.93*
			(0.44)	(0.45)	(0.48)	(0.49)
Group x Conformity in Default			0.075*	0.26*	0.065	0.25*
			(0.040)	(0.14)	(0.041)	(0.14)
Constant	-0.44***	-0.42***	-0.50***	-0.58***	-0.47***	-0.55***
	(0.12)	(0.11)	(0.13)	(0.14)	(0.13)	(0.15)
F values of first stage regression				151.69		126.32
Individual Random Effect	YES	YES	YES	YES	YES	YES
Session Fixed Effect	YES	YES	YES	YES	YES	YES
Round Fixed Effect	YES	YES	YES	YES	YES	YES
Observations	4104	4104	3557	3557	3557	3557

Robust standard errors are in parenthesis.

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

Table 9: Main Regressions on Strategic Default Behavior-Marginal Effects

	Model 1	Model 2	Model 3	Model 4 2SLS	Model 5	Model 6 2SLS
Group	-0.048***	-0.047***	-0.040**	-0.043**	-0.041**	-0.043**
JL	-0.038**	-0.041**	-0.050**	-0.049**	-0.054***	-0.053***
Closeness		-0.011			-0.009	-0.008
Closeness^2		0.006**			0.007***	0.007**
Trust		0.016*			0.011	0.010
Authority		-0.034*			-0.037*	-0.036*
Shame			-0.065**	-0.062**	-0.062**	-0.059**
Guilt			-0.069**	-0.066**	-0.067**	-0.064*
Conformity of Default			0.012*	0.014*	0.010	0.013*
Individual Random Effect	YES	YES	YES	YES	YES	YES
Session Fixed Effect	YES	YES	YES	YES	YES	YES
Round Fixed Effect	YES	YES	YES	YES	YES	YES
Observations	4104	4104	3557	3557	3557	3557

p<0.1 *, p<0.05 **, p<0.01 ***

4.3.3 Robustness Check

There could be a potential self-selection problem from the main regression in Table 8. Missing data in Round 2 due to defaults in Round 1 may create bias as the sample will over-represent borrowers that repay. This data truncation comes from two sources, mechanical default and strategic default. Mechanical default is determined purely by random draws in the experiment and poses not threat of bias. Strategic default, however, may introduce bias as social capital and other factors are likely correlated with the repayment decision. Here, we use two ways to test whether this potential truncation exists: 1) using a balance test to confirm a comparable sample between Round 1 and Round 2, and 2) using a Heckprobit model on Round 2 data to check for self-selection bias. The Heckprobit model is a probit model with sample selection based on Van de Ven and Van Pragg (1981). This approach controls for the selection process through jointly modeling the outcome of interest and the selection process. The binary strategic default variable in Round 2 is truncated by the status of loan access at the end of Round 1. The selection equation is therefore a model of whether the borrower continues to access to her loan at the end of Round 1, for which we use a probit model [10].

[10] Beyond all variables we have in Equation (1), we also include three variables, i.e. weather condition in Round 1, income level i receives, and the binary variable of whether receiving help from her partner, as the valid exclusion

Table 13 in the Appendix G shows the results of a balancing test between Round 1 participants and Round 2 participants. We find that the composition of group members, including three social ties, shame proneness and guilt proneness, does not significantly change from Round 1 to Round 2, under both group lending with individual liability and group lending with joint liability. This result indicates participants who get the chance to play Round 1 are not significantly different from those who play Round 2 based on observables. Thus, there should be no selection bias introduced by including Round 2 in our analysis. We also use the Heckprobit model to regress strategic default behavior in Round 2 only. We use the result from the Heckprobit model to evaluate the actual presence of selection in the sample, and it indicates no evidence of selection in the main regression [11]. Taken together, selection issue in Round 2 is not a concern, thus estimated results from Table 8 and Table 9 that combine Round 1 and Round 2 data should provide the unbiased results.

Furthermore, we provide two robustness regressions for the results in the main regression. First, we use the recalculated strategic default rate as our dependent variable, i.e. Panel C in Table 7, since the calculation in Panel C can avoid the bias of over representing repayers compared to Panel B. Results are shown in Table 14 (see Appendix H). Second, we use set-level data instead of round-level data for regression. Because each participant has the chance of re-entering the game at the beginning of each set regardless her decision in previous set, there is no self-selection problem at the set level. The new dependent variable calculated as the average strategic default rate of each individual in each set excluding Round 3. Results are shown in Table 15 (see Appendix H). Both tables demonstrate the robustness of the main regression in Table 8. Treatment effects, impacts of social relations, shame, and guilt, and existence of conformity behavior are stable in significance and magnitude. It is notable that estimated coefficients of conformity in Table 14 increases in terms of magnitude and significance after imputing the missing value compared to the main regression in Table 8. This further confirms the existence of conformity behavior in the group lending.

restriction for identification in the Heckprobit model. This valid exclusion restriction explains variation in the selection process but not the outcome variable.

[11] Results from the Heckprobit model show that the athrho coefficient (=-.0190529, p-value=0.921) is not significant. Coefficients of variables in the regression are not reported here.

5 Conclusion

Joint liability group lending has been viewed as a solution to several problems in microfinance, including high monitoring costs, moral hazard, and adverse selection. Yet, recent field evidence indicates that it may be the group aspect, rather than the joint liability aspect of group lending, that generates the high loan repayment rates usually seen in microfinance. Therefore, individual liability group lending may achieve similarly high repayment rates as joint liability lending. However, it is unclear what mechanisms within groups drive this effect on repayment. In this paper, we studied the impacts of different dimensions of social capital on strategic default decisions in individual lending, and group lending with and without joint liability using a framed field experiment with a social networks survey in rural China. While the literature on microfinance has mostly treated social capital as a unified concept, we show that various dimensions of social capital, such as shame, guilt, and social relations can play vastly different roles under different microcredit contracts.

Our results demonstrate that group aspect reduces strategic default behavior by 4.8%, and that the joint liability clause reduces strategic default by additional 3.8%. When looking into behavioral mechanisms, the positive effect of group aspect can be explained by a moderate level of closeness towards others and by shame. However, we also show evidence of conformity behavior, specifically that those who observe frequent defaults occurring among the rest of the group are more likely to default themselves, thus weakening the advantage of group aspect. Under joint liability, guilt prevents strategic default, yet joint liability clause can cause free-riding when guilt proneness is low. Our results provide a possible explanation for the heterogeneous performance of joint liability and individual lending in different areas from previous research.

Our results also indicate that the optimal lending contract design depends not only on the level but also on the type of social capital within a population. Compared with conventional individual loans, creating group feature would effectively increase borrowers' repayment incentives, and thus improve the profitability of lenders and the sustainability of local MFIs. However, our results also suggest that MFIs should set restrictions on the social relations within a group. In particular, better social ties reduce the propensity to strategically default, but if social ties are overly strong, the effect may be

reversed. Our results indicate that too strong social ties with others, such as core family members, would discourage borrowers to repay, undermining the positive effect of group lending. Additionally, MFIs may need to take immediate actions to prevent the subsequent downward spiral when negative common shocks occur and lead to widespread defaults among group members. In terms of liability clause, the effectiveness of joint liability depends largely on the guilt proneness of a population, which may be hard for the bank to measure. Yet, this study suggests that including authoritative members, such as village leaders, school teachers, and doctors, is an effective way to increase repayment rates under the joint liability lending.

There are some limitations when understanding the results of this research. First, the research focuses on the roles of social capital in individual repayment behavior through randomizing participants into groups, thus limiting the role of social capital in self-selecting members into different lending contracts. It is possible that social capital plays various roles in self-selection under different lending contracts. Also, social capital could evolve along with the interactions of group members in the long run, leading to dynamic impacts on repayment within a group. This experiment could not capture this long-term effect in an experimental setting. Second, one potential mechanism in group lending that may also incentivize repayment is participants' fear of potential social sanctions beyond the experiment, which is hard to identify. we did not allow sanctions within the experiment and emphasized that there would be no sanctions beyond the experiment, yet participants may be afraid of negative views from others when being observed to have defaulted. If that were the case, even without shame and guilt, a participant still feels hesitant to default in a high-information environment. In this sense, the shame proneness elicited from the revised dictator game is a good measurement of one's sensitivity towards others' view more than the sensitivity towards shame. Given these limitations, more work is needed to understand how social capital can affect microcredit in a dynamic environment and deepen our understanding of its various dimensions.

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Appendix

A. Proof of Nash Equilibria and Propositions

The purpose of this part is first to describe the equilibria of the theoretical model and then to prove ***Proposition 1***, ***2***, and ***3***. In describing the equilibria of group lending with individual liability model, we simply state what the Nash equilibria are where Borrower 1's optimal choice is to to repay (i.e. (R, R) and (R, D)), in order to prepare for the calculation for Borrower 1's probability of repayment. The reader can easily validate these claims using Figure 1.

(a): When $S(s_2)+P(w_2) > L$ and $w_2 > L$, if $w_1 > L$ and $S(s_1)+P(w_1) > L$, (R, R) is the equilibrium.

(b): When $S(s_2) + P(w_2) < L$ or $w_2 < L$, if $w_1 > L$ and $P(w_1) > L$, (R, D) is the equilibrium.

Proof of Proposition 1: Borrower 1's probability of repayment $P_{1,IL} = Pr(w_1 > max(L, \hat{w}_1(s_1)), w_2 > max(L, \hat{w}_2(s_2))) + Pr(w_1 > max(L, P^{-1}(L)), w_2 < max(L, \hat{w}_2(s_2)))$, where $\hat{w}_i$ is the solution for $S(s_i) + P(w_i) = L$. According to the feature of shame function $S()$, we know that $\frac{\partial \hat{w}_i}{\partial s_i} <= 0$. Therefore, given all other parameters such as s_2 and L are held constantly, it is straightforward to have $\frac{\partial P_{1,IL}}{\partial s_1} >= 0$.

In describing the equilibria of group lending with joint liability model, we distinguish different cases. In each case, we will simply state what the Nash equilibria are where Borrower 1's optimal choice is to to repay (i.e. (R, R) and (R, D)), in order to prepare for the calculation for Borrower 1's probability of repayment. The reader can easily validate these claims using Figure 2.

Case 1: When $P(w_1) < 2L$ and $P(w_2) < 2L$, there is one sub-case:

(a): When $S(s_2)+P(w_2) > L$ and $w_2 > L$, if $w_1 > L$ and $S(s_1)+P(w_1) > L$, (R, R) is the equilibrium.

Case 2: When $P(w_1) > 2L$ and $P(w_2) > 2L$, there are two sub-cases:

(a): When $S(s_2) + G(g_2, w_2) > L$ and $w_2 > L$, if $w_1 > L$ and $S(s_1) + G(g_1, w_1) > L$, (R, R) is the equilibrium.

(b): When $S(s_2) + G(g_2, w_2) < L$ or $w_2 < L$, if $w_1 > L$, (R, D) is the equilibrium.

Case 3: When $P(w_1) < 2L$ and $P(w_2) > 2L$, there are one sub-case:

(a): When $S(s_2) + P(w_2) > L$ and $w_2 > L$, if $w_1 > L$ and $S(s_1) + G(g_1, w_1) > L$, (R, R) is the equilibrium.

Case 4: When $P(w_1) > 2L$ and $P(w_2) < 2L$, there are two sub-cases:

(a): When $S(s_2) + G(g_2, w_2) > L$ and $w_2 > L$, if $w_1 > L$ and $S(s_1) + P(w_1) > L$, (R, R) is the equilibrium.

(b): When $S(s_2) + G(g_2, w_2) < L$ or $w_2 < L$, if $w_1 > L$, (R, D) is the equilibrium.

Proof of Proposition 2: Borrower 1's probability of repayment$P_{1,JL} = Pr(max(L, \hat{w}_1(s_1)) < w_1 < P^{-1}(2L), max(L, \hat{w}_2(s_2)) < w_2 < P^{-1}(2L)) + Pr(w_1 > max(L, w_1^*(s_1, g_1), P^{-1}(2L)), w_2 > max(L, w_2^*(s_2, g_2), P^{-1}(2L))) + Pr(w_1 > max(L, P^{-1}(2L)), P^{-1}(2L) < w_2 < max(L, w_2^*(s_2, g_2))) + Pr(max(L, w_1^*(s_1, g_1)) < w_1 < P^{-1}(2L), w_2 > max(L, P^{-1}(2L))) + Pr(w_1 > max(L, \hat{w}_1(s_1), P^{-1}(2L)), max(L, w_2^*(s_2, g_2), P^{-1}(2L)) < w_2 < P^{-1}(2L)) + Pr(w_1 > max(L, P^{-1}(2L)),$
$w_2 < min(max(L, w_2^*(s_2, g_2)), P^{-1}(2L)))$, where $\hat{w}_i$ is the solution for $S(s_i) + P(w_i) = L$ and $w_i^*(s_i, g_i)$ is the solution for $S(s_i) + G(g_i, w_i) = L$. According to the feature of shame function $S()$ and guilt function $G()$, we know that $\frac{\partial \hat{w}_i}{\partial s_i} <= 0$, and $\frac{\partial w_i^*}{\partial s_i} <= 0$. Therefore, given all other parameters such as g_1, s_2 and g_2 are held constantly, it is straightforward to have $\frac{\partial P_{1,JL}}{\partial s_1} >= 0$.

Proof of Proposition 3: Borrower 1's probability of repayment $P_{1,JL}$ is calculated as above. And According to the feature of shame function $S()$ and guilt function $G()$, we know that $\frac{\partial w_i^*}{\partial g_i} <= 0$. Therefore, given all other parameters such as s_1, s_2 and g_2 are held constantly, it is straightforward to have $\frac{\partial P_{1,JL}}{\partial g_1} >= 0$.

B. Behavioral Game: Revised Dictator Game

Each participant was given two envelopes, one without her ID number on it, the other with her ID number on it. Participants were asked to make two similar decisions: distribute some (available choices are 2 RMB, 3 RMB, 4 RMB, 5RMB, 6RMB.) of their endowment income to their anonymously paired partner in the session. Their endowment income was determined by rolling the dice, 4 RMB with 1/2

probability and 10 RMB with 1/2 probability. The realized endowment was private information to participants themselves. After realizing the endowment income, participants put money according to their answers in the game sheet into each of the two envelopes. At the end of the session, enumerators randomly decided which one of the two envelopes was passed to the paired partner. The receiver did not have the right to refuse it but only accepted it.

Before the endowment income was realized, each participant was asked by the enumerator to answer the questions on the game sheet below about her choices under two potential incomes for two envelopes. Since participants realized their endowment incomes and made decisions in the privacy box, and even the lowest transfer choice was reasonably fair under low income, one's choices with her ID revealed was protected by this imperfect information. Each participant's payoff from the modified dictator game was: distributed money from her realized endowment (the chosen envelope) + distributed money from her partner's endowment (the chosen envelope). We used this revised dictator game to elicit participants' shame proneness. Since identity being revealed does not change the final offer one's partner receives, one who cares about how the others view her would be likely to distribute more in the second envelope.

Table 10: The envelope without participant' ID number

How much to distribute to the other?	When receiving 4 RMB	When receiving 10 RMB
2 RMB		
3 RMB		
4 RMB		
5 RMB		
6 RMB		

Table 11: The envelope with participant's ID number

How much to distribute to the other?	When receiving 4 RMB	When receiving 10 RMB
2 RMB		
3 RMB		
4 RMB		
5 RMB		
6 RMB		

C. Social Network Survey

1. Please indicate those individuals who you consider to be a: (1) acquaintance, (2) friend, (3) core family member, (4) other family members, and (5) neighbor

2. Please indicate those with whom you contact/talk more than twice per week on average

3. Please indicate those with whom you have the experiences of being in the same Cooperative

4. Please indicate those with whom you have/had any social activities together

5. Please indicate those who has a higher social standing than you do

6. If you are in need of a small sum of money, say 1,000 RMB, please indicate whom you would ask for as a loan

7. Please indicate which whom you feel comfortable leaving your kids with

8. Please indicate who help you or your family when you are in need

9. Please indicate whom you help when s/he is in need

D. Shame and Guilt Proneness Scale Questions

Imagine yourself in each situation and then state how likely it is that you would feel or act the way that is described in the survey[12].

1. You go to the market and make a purchase but then realize that you received 5 RMB more change. You then decide to keep this 5 RMB because the merchant did not notice. What is the likelihood that you would feel uncomfortable about keeping the money?

2. You reveal a close friend's secret, though your friend never finds out. What is the likelihood that your failure to keep the secret would lead you to exert extra effort to keep secrets in the future?

3. You strongly defend a point of view in a discussion, and though nobody was aware of it, you realize that you were wrong. What is the likelihood that this would make you think more carefully before you speak?

[12]We utilize a selection of 8 questions from the standardized Guilt and Shame Proneness Scale developed by Cohen et al (2010). We adapted these questions to apply more readily to the Chinese cultural context.

4. At a relative's wedding, you spill red wine on their new cream-colored cover of the chair. You cover the stain with a napkin so that nobody notices your mess. What is the likelihood that you would feel that the way you acted was pathetic?

E. Compensation

After finishing the behavioral game, payoff from each game was calculated and distributed according to the rules: 1) the sum of payoffs within each set of each microfinance game would be calculated, and one set would be randomly chosen to be the final payoff for each microfinance game; 2) anonymous pairings in the behavioral game were realized and the payoffs would be calculated accordingly; 3) in the microfinance games, Yuan would be converted into RMB by the rate of 100-to-1, and incomes from the behavioral game would remain at the rate of 1-to-1; 4) participants got their payoff in the envelope before they left.

Pictures taken upon participants' arrival for the purpose of social network survey would be deleted by enumerators from their laptops after the social network survey was finished. In case participants had any other questions related to the study, they could contact us using the information card handed out during the verbal consent process.

F. Marginal Effects and Correlation Table

Figure 4: Distribution of Closeness and Adjusted Predictions with 95% Cls

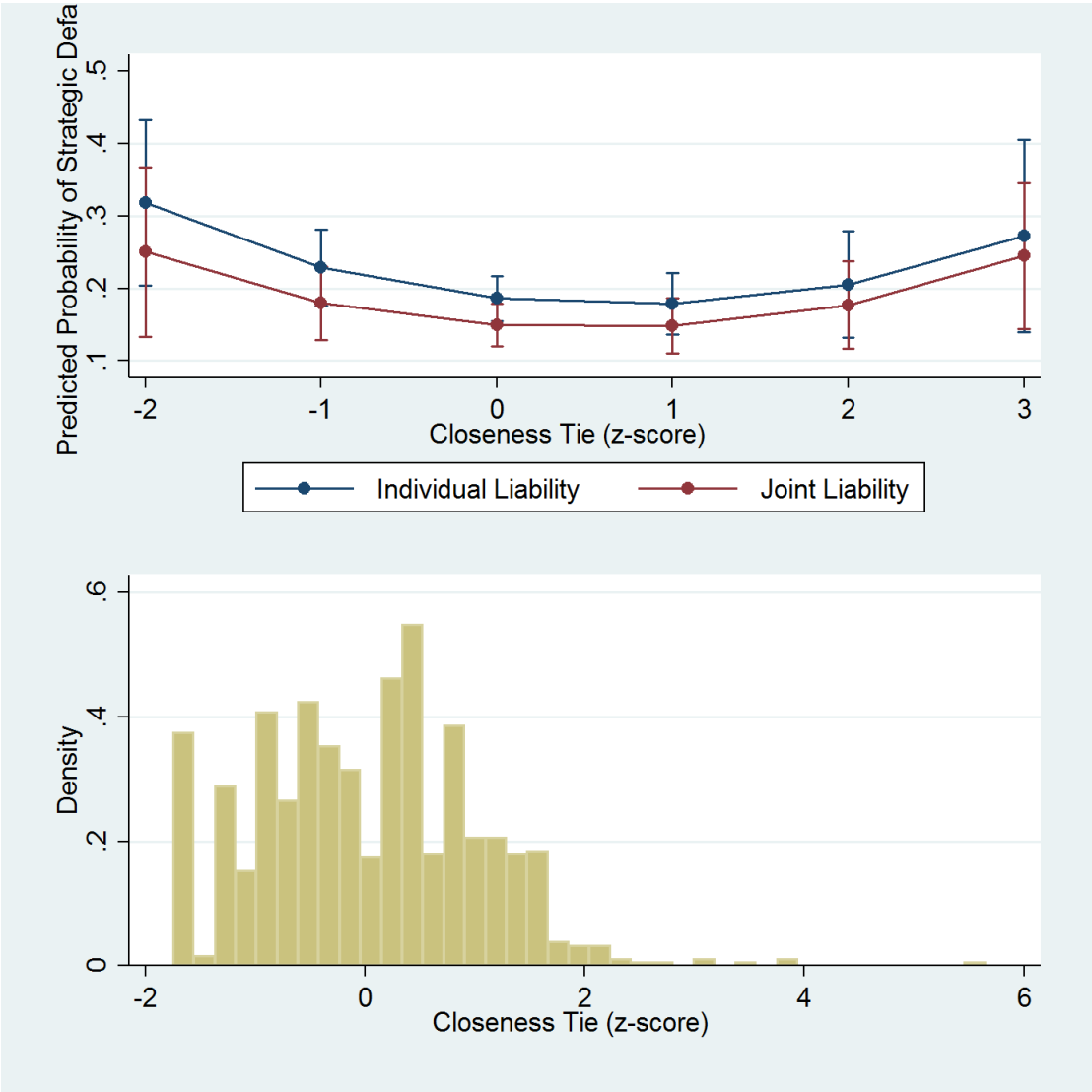

Figure 5: Distribution of Trust and Adjusted Predictions with 95% Cls

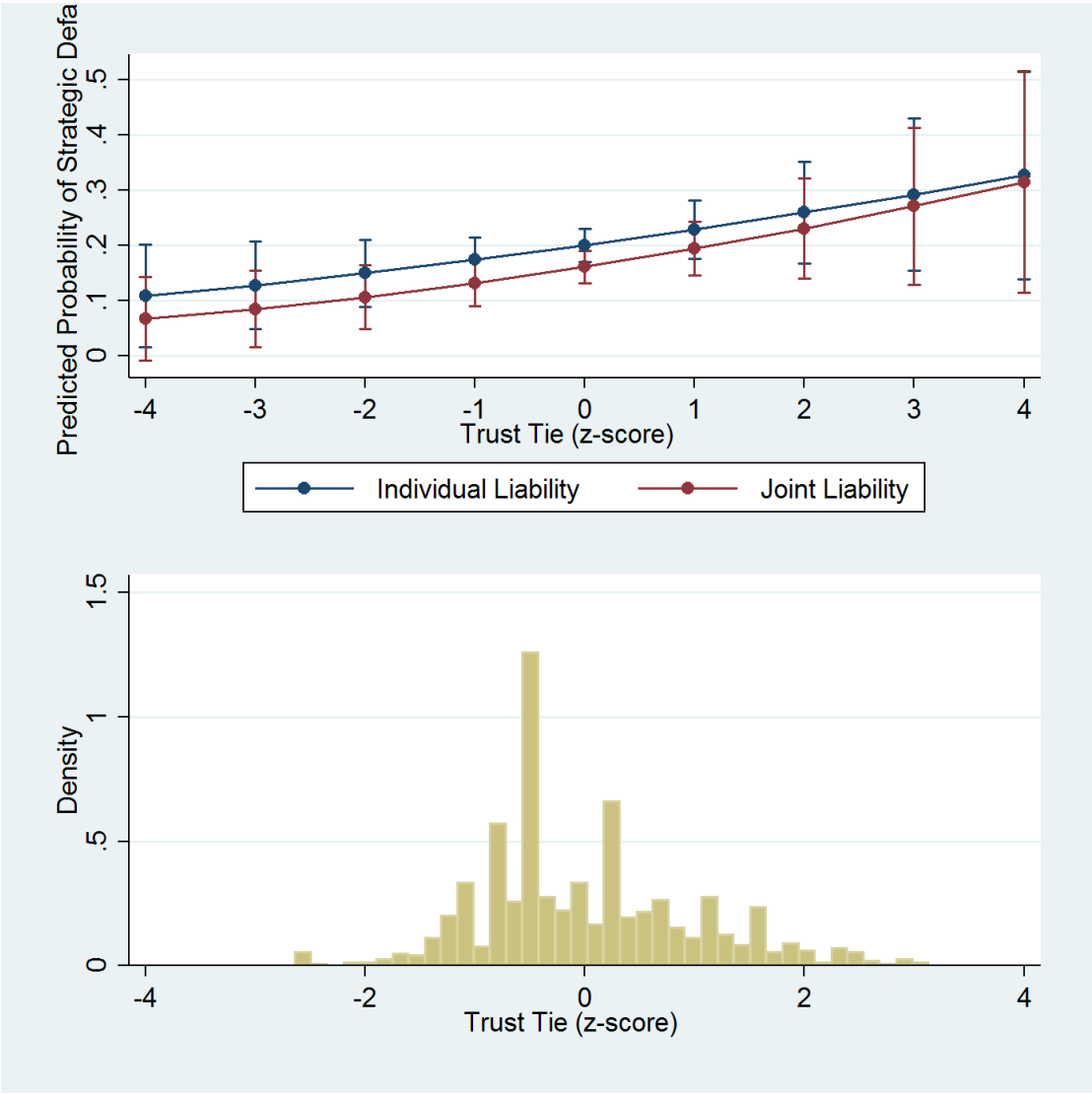

Figure 6: Distribution of Authority and Adjusted Predictions with 95% Cls

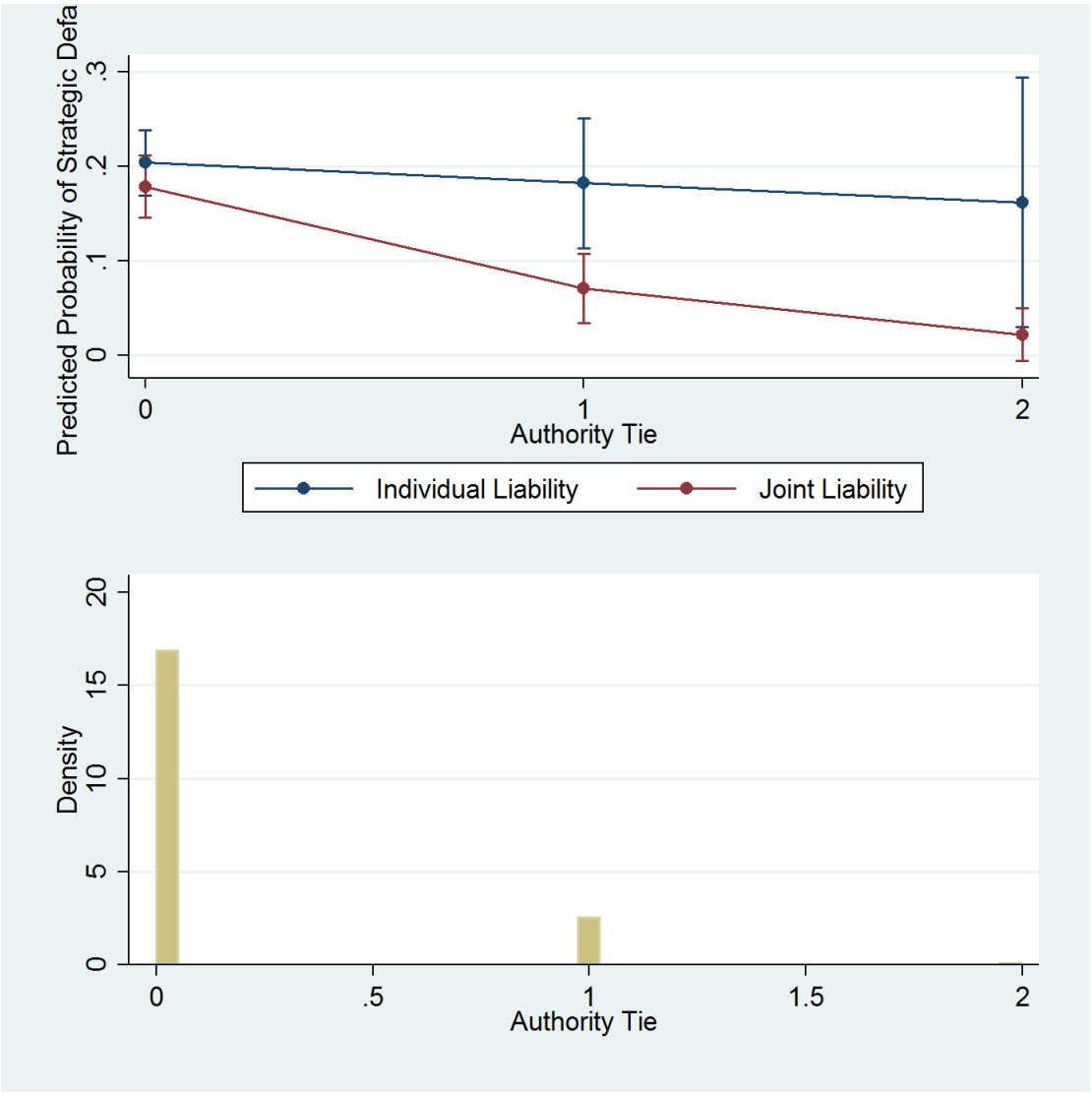

Figure 7: Distribution of Conformity and Adjusted Predictions with 95% Cls

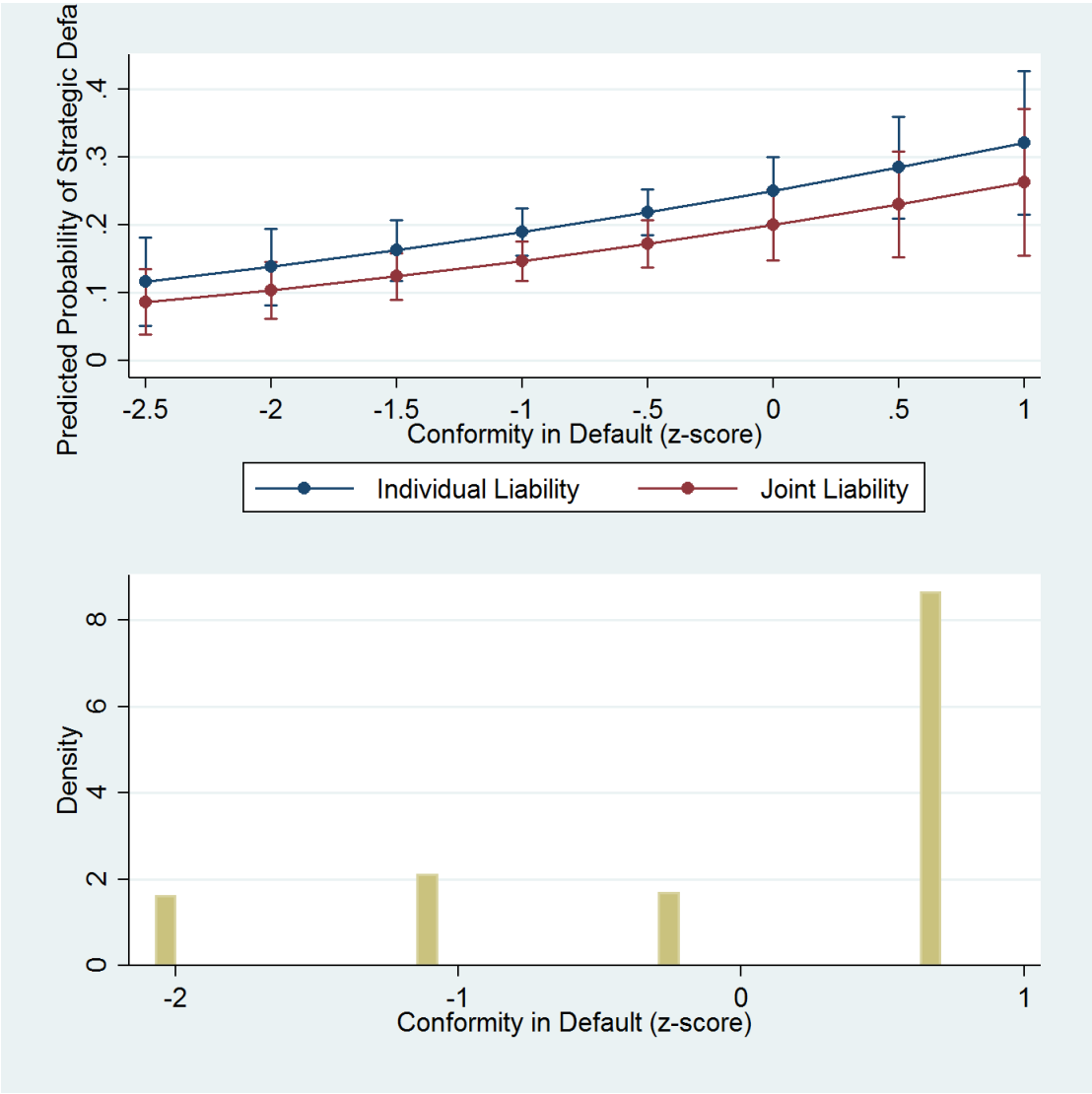

Figure 8: Distribution of Shame and Adjusted Predictions with 95% Cls

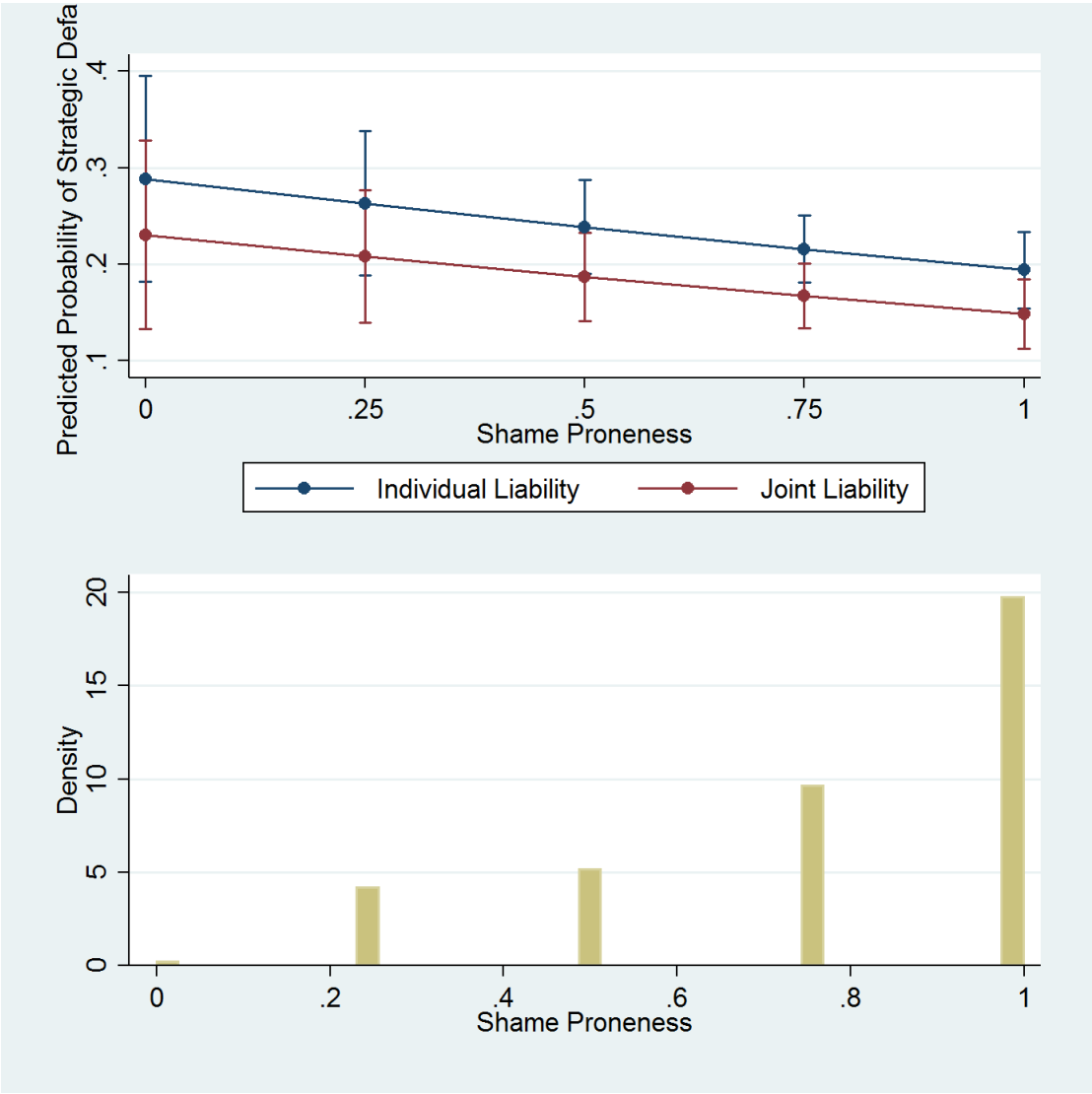

Figure 9: Distribution of Guilt and Adjusted Predictions with 95% Cls

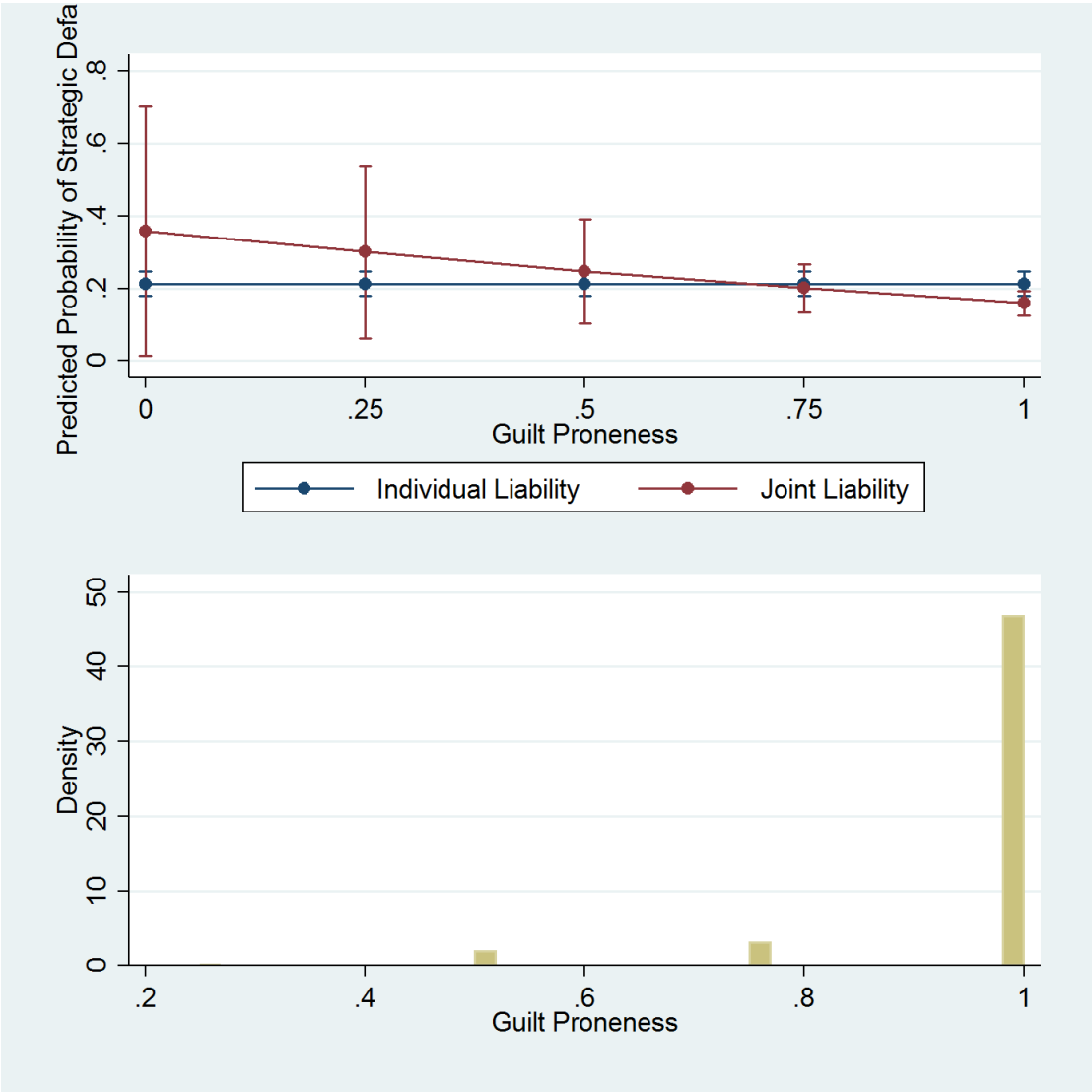

Table 12: Correlation - Social Capital Indices

Variables	(1)	(2)	(3)	(4)	(5)
(1) Closeness	1.000				
(2) Trust	0.491	1.000			
(3) Authority	0.144	0.089	1.000		
(4) Shame	0.093	0.079	-0.020	1.000	
(5) Guilt	-0.010	-0.076	0.004	0.073	1.000

G. Balance Test of Social Capital Measurements

Table 13: Balance Test of Round 1 vs. Round 2 (Mean Values)

	Round 1	**Round 2**	**Round2-Round1**
Panel A: Group Lending with Individual Liability			
Closeness	-0.027	0.001	-0.028
			(0.574)
Trust	-0.044	-0.059	0.015
			(0.764)
Authority	-0.002	0.009	-0.011
			(0.826)
Shame	0.007	0.019	-0.012
			(0.813)
Guilt	-0.001	0.014	-0.015
			(0.768)
Panel B: Group Lending with Joint Liability			
Closeness	0.087	0.085	0.002
			(0.970)
Trust	0.086	0.087	-0.001
			(0.987)
Authority	0.015	0.056	-0.041
			(0.454)
Shame	0.007	0.070	-0.063
			(0.207)
Guilt	-0.001	-0.010	0.009
			(0.855)

P-values are in the parenthesis.
p<0.1 *, p<0.05 **, p<0.01 ***

H. Robustness Check Regression

Table 14: Robust Test 1–Regressions on Recalculated Strategic Default Behavior

	Model1	Model2	Model3	Model4 2SLS	Model5	Model6 2SLS
Group	-0.22***	-0.25***	0.23	0.30	0.18	0.25
	(0.077)	(0.084)	(0.18)	(0.19)	(0.19)	(0.19)
JL	-0.15*	-0.11	0.84*	0.80*	0.89*	0.86
	(0.081)	(0.087)	(0.47)	(0.48)	(0.53)	(0.54)
Social Relations within Group						
Group x Closeness		-0.099			-0.093	-0.091
		(0.072)			(0.074)	(0.075)
Group x Closeness^2		0.036**			0.042**	0.040**
		(0.018)			(0.018)	(0.018)
Group x Trust		0.12			0.097	0.090
		(0.073)			(0.077)	(0.078)
Group x Authority		-0.049			-0.022	-0.030
		(0.16)			(0.17)	(0.18)
Social Relations within Joint Liability						
JL x Closeness		0.056			0.060	0.059
		(0.094)			(0.095)	(0.097)
JL x Trust		0.034			0.020	0.025
		(0.10)			(0.11)	(0.11)
JL x Authority		-0.51**			-0.65***	-0.61**
		(0.24)			(0.23)	(0.24)
Peer Pressure						
Group x Shame			-0.47**	-0.43**	-0.45**	-0.43**
			(0.21)	(0.21)	(0.21)	(0.21)
JL x Guilt			-1.06**	-1.02**	-1.06*	-1.02*
			(0.49)	(0.50)	(0.54)	(0.56)
Group x Conformity in Default			0.14***	0.38***	0.13***	0.36***
			(0.036)	(0.13)	(0.036)	(0.13)
Constant	-0.45***	-0.42***	-0.55***	-0.64***	-0.51***	-0.60***
	(0.12)	(0.12)	(0.13)	(0.14)	(0.14)	(0.15)
F values of first stage regression				151.69		126.32
Individual Random Effect	YES	YES	YES	YES	YES	YES
Session Fixed Effect	YES	YES	YES	YES	YES	YES
Round Fixed Effect	YES	YES	YES	YES	YES	YES
Observations	4534	4534	3984	3984	3984	3984

Robust standard errors are in parenthesis.

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

Table 15: Robust Test 2–Strategic Default Behavior at the Set Level

	Model1	Model2	Model3	Model4 2SLS	Model5	Model6 2SLS
Group	-0.059***	-0.067***	0.089*	0.11*	0.066	0.085
	(0.020)	(0.021)	(0.052)	(0.056)	(0.054)	(0.057)
JL	-0.049***	-0.038*	0.17	0.16	0.18	0.18
	(0.019)	(0.020)	(0.11)	(0.11)	(0.11)	(0.12)
Social Relations within Group						
Group x Closeness		-0.023			-0.022	-0.022
		(0.017)			(0.020)	(0.020)
Group x Closeness^2		0.0076*			0.014***	0.014***
		(0.0044)			(0.0054)	(0.0054)
Group x Trust		0.026			0.010	0.0097
		(0.017)			(0.022)	(0.022)
Group x Authority		0.0077			0.027	0.027
		(0.041)			(0.048)	(0.048)
Social Relationship within Joint Liability						
JL x Closeness		0.024			0.031	0.030
		(0.023)			(0.027)	(0.027)
JL x Trust		-0.0072			0.00016	0.00063
		(0.023)			(0.028)	(0.028)
JL x Authority		-0.095**			-0.13**	-0.13**
		(0.048)			(0.056)	(0.056)
Peer Pressure						
Group x Shame			-0.12**	-0.11**	-0.11**	-0.11**
			(0.050)	(0.050)	(0.051)	(0.051)
JL x Guilt			-0.23**	-0.22*	-0.23*	-0.22*
			(0.11)	(0.11)	(0.12)	(0.12)
Group x Conformity in Default			0.027**	0.036**	0.026**	0.035**
			(0.012)	(0.017)	(0.012)	(0.017)
Constant	0.45***	0.45***	0.45***	0.45***	0.46***	0.46***
	(0.042)	(0.042)	(0.052)	(0.051)	(0.053)	(0.052)
F values of first stage regression				301.87		250.21
Individual Random Effect	YES	YES	YES	YES	YES	YES
Session Fixed Effect	YES	YES	YES	YES	YES	YES
Observations	2477	2477	1917	1917	1917	1917

Robust standard errors are in parenthesis.

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