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# **Social Capital and the Repayment of Microfinance Group Lending. A Case Study of Pro Mujer Mexico<sup>\*†</sup>**

Luminita Postelnicu<sup>‡</sup>

Niels Hermes<sup>§</sup>

Roselia Servin Juarez<sup>\*\*</sup>

## **Abstract**

This paper investigates how social networks of group borrowers come into play in joint liability group lending. We use a large and original dataset containing 802 mapped social networks of borrowers from Pro Mujer Mexico. This is the first paper to look at external ties, i.e. social ties with individuals outside the borrowing group. Our main finding is that group lending with joint liability works when group borrowers use the informal risk insurance arrangement embedded in their external ties as guarantee for loan repayment. The extent to which this informal arrangement is used as guarantee is not decided by the borrower, but it is determined by the configuration of the group borrowers' social networks, i.e. by their overlapping networks. These overlapping networks (or information channels) facilitate the diffusion of information into each other's networks, and, thus, increases the credibility of the threat of losing one's informal risk insurance arrangement in case of default. Our results show that the threat of losing the informal risk insurance arrangement embedded in one's external ties matters for loan repayment even more than internal ties (i.e. ties between group members).

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‡Université Libre de Bruxelles (ULB), SBS-EM, CEB and CERMi, email: luminita.postelnicu@ulb.ac.be

§University of Groningen and Université Libre de Bruxelles (ULB), CERMi, email: c.l.m.hermes@rug.nl

\*\*Colegio de Postgraduados-Campus Cordoba, e-mail: roselijasj@colpos.mx

## 1. Introduction

Lack of access to credit is arguably one of the main reasons keeping poor people into poverty. Microfinance institutions (MFIs) have managed to give access to credit to asset-poor individuals by implementing the methodology of group lending with joint liability. The main feature of this methodology is making group members responsible for the repayment of each-other's loan. This incentivizes them to use their social ties to screen, monitor and enforce loan repayment on each-other, inducing them to use their social capital as collateral for loan repayment.

The empirical literature investigating how group lending works looks at the social ties between group members<sup>1</sup> and shows that these ties predict the repayment by group borrowers. Borrowers are incentivized to curb their delinquent behavior when the threats of social sanctions are credible (Besley and Coate, 1995). On the other hand, important stocks of resources embedded in borrowers' social ties may lead to less repayment problems due to the fact that they can rely on these resources to repay their loans in case of economic default. The recent studies by Dufhues *et al.* (2012, 2013) map the social networks of the head of households where at least one member has a loan (individual or group loan) and look at aggregated network-level measures for the individual stock of social capital. They show that, indeed, social capital predicts access to credit and repayment performance.

Postelnicu *et al.* (2014) define social collateral in microfinance group lending, and provide a methodology to map social networks of group borrowers by disentangling between *internal ties* (i.e. the ties between group members), *information channels* (i.e. overlapping external networks of any two borrowers), and *other external ties* (i.e. ties between group members and other individuals from the community). Postelnicu (2015) defines the individual social capital from an economic perspective, and proposes a measurement for the resources embedded in social ties along two dimensions: (i) the tie's capacity to act as informal risk insurance device, and (ii) the tie's information diffusion potential. This methodology allows the measurement of the individual social capital by accounting for the network configuration (i.e. internal ties, information channels, other external ties).

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<sup>1</sup>See Zeller (1998), Wydick (1999), Godquin (2004), Hermes *et al.* (2005, and 2006), Van Bastelaer and Leathers (2006), Karlan (2007), Cassar *et al.* (2007), Feigenberg *et al.* (2010).

In this paper we investigate how social networks of group borrowers come into play in joint liability group lending. To do so, we combine the two methodologies proposed by Postelnicu *et al.* (2014) and Postelnicu (2015) in order to map the social networks of group borrowers and, respectively, measure their individual social capital. In particular, for each mapped social ties, we measure the resources it embeds along the two dimensions proposed by Postelnicu (2014). That is, the tie's capacity to act as informal risk insurance device, respectively the tie's potential to diffuse information within the borrower's network. We explore a large and original dataset collected among the borrowers of Pro Mujer Mexico. Our main finding is that group lending with joint liability works best when borrowers have larger informal risk insurance arrangements embedded in their external ties and their peers have the possibility to diffuse information about the borrower's behavior within these arrangements. In other words, when the threat of losing one's informal risk insurance arrangement is credible, borrowers are less likely to have repayment problems.

The contribution of this paper is twofold. First, this is the first paper to look at external ties of group borrowers. Second, the theoretical framework that we propose allows us to look at the configuration of group borrowers' networks and to test how it predicts repayment. This is the first paper that explicitly looks at the potential of group borrowers' social ties to diffuse information within the peers' networks. The importance of information diffusion for screening, monitoring and loan enforcement has been already acknowledged by microfinance researchers, but it has remained uninvestigated.

The remainder of this paper is organized as follows. Section 2 briefly reviews the related literature. Section 3 presents the theoretical framework of this paper. Section 4 presents the dataset, and section 5 discuss the empirical model. In section 6 we discuss the results and we conclude in section 7.

## **2. Literature review**

In microfinance research, a number of empirical studies look at the ties between group borrowers and show that they act as an effective disciplining device for the repayment of joint liability loans. The view of these studies on the role of the social ties between group members revolve around their importance for screening, monitoring and loan enforcement. The proxies

that these studies use for social ties measure mainly the *non-pecuniary* resources they embed. These proxies include: type of relationship (i.e. whether individuals are family, friends, or acquaintances), duration of relationship, meeting frequency, and geographic proximity.

The available research shows that the type of relationship can impact the repayment behavior of group borrowers. The presence of relatives in the group can affect repayment performance both ways. On the one hand, Sharma and Zeller (1997) and Ahlin and Townsend (2007) find that a high percentage of relatives within the group increases delinquency in Bangladesh and Thailand, whereas Al-Azzam *et al.* (2012) finds that it reduces delinquency for Jordan. Indeed, family relationships between group members facilitate the process of screening and monitoring through an easier access to information. Moreover, family relationships enhance reciprocity. However the effects of reciprocity on loan repayment may go both ways. On the one hand, it may enforce loan repayment. On the other hand, it may enforce delinquent behavior when family members mutually agree to default, or when social norms do not allow the individual who repays to punish a family member for non-repayment.

Regarding the duration of a relationship between group members, Hermes *et al.* (2006) show that repayment problems decrease when the group leader knew the other group members before forming the group. This facilitates access to more reliable information in the process of screening and monitoring one's peers.

Van Bastelaer and Leathers (2006) look at the frequency of group meetings in Zambia and find that more frequent group meetings are associated with higher delinquency, justified by the fact that the frequency of group meetings is triggered by crisis conditions. However, Feigenberg *et al.* (2010) look at the frequency of interactions between group members outside the group meetings, and they find that more frequent interactions lead to fewer default occurrences. This finding supports the assumption that information exchange is facilitated when individuals meet more often outside group meetings, hence, they are better able to monitor each other. Moreover, frequent interactions beyond the group may indicate a higher reciprocity agreement between individuals, which should curb their delinquent behavior.

Related to geographic proximity, available microfinance studies show that when group borrowers live close by, the loan repayment improves (see Simtowe *et al.* (2006), Karlan

(2007), Cassar *et al.* (2007), and Al-Azzam and Mimouni (2012)). The authors interpret this finding through the lens of the impact of geographic proximity on the monitoring activities. Indeed, the cost of information collection should be lower when individuals live closer to each other.

In addition to non-pecuniary resources embedded in the social ties between group members, they may also embed *pecuniary* resources. The proxies used to measure the non-pecuniary resources embedded by social ties fail to completely capture the exchange of pecuniary resources. This is because there is an asymmetry between the non-pecuniary and pecuniary resources embedded in a dyadic tie (Postelnicu, 2015). In particular, the pecuniary resources exchanged by two individuals is determined by the *network positions*<sup>2</sup> of the two individuals. This means that one cannot proxy the amount of pecuniary resources exchanged by a dyadic tie by the non-pecuniary resources embedded in that tie. While pecuniary resources are not likely to play an important role from the perspective of the effectiveness of screening and monitoring, they may be relevant for loan enforcement. Group borrowers may curb their delinquent behaviour in order to avoid losing ties with their peers when those ties embed important pecuniary resources. Moreover, these ties may help the individual with the repayment of her loan in case of economic default.

Van Bastelaer and Leathers (2006) and Ahlin and Townsend (2007) consider in their investigations the pecuniary exchanges between group members. In particular, they calculate the total number of types of goods and services shared by the members of a group. Overall, this sharing seems to improve the group repayment performance. However, Ahlin and Townsend (2007) show that sharing among non-relatives is bad for repayment, whereas sharing among relatives is positively related to repayment conduct. This may be due to the fact that relatives may pose more credible threats of social sanctions as compared to non-relatives.

To sum up, the studies investigating the determinants of the success of microfinance group lending have looked so far at the ties between group members. Researchers have emphasized the important role played by social ties in terms of screening, monitoring and loan enforcement.

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<sup>2</sup> An individual's *network position* is determined by whom s/he is linked with as well as the non-pecuniary resources embedded in each dyadic tie incident to the individual. Two individuals linked by a dyadic tie occupy different network positions, leading to asymmetric transfers of pecuniary resources. In other words, social ties embedding identical non-pecuniary resources may not embed identical pecuniary resources.

While largely focusing on measuring the non-pecuniary resources embedded by the ties between group members, a few studies have looked also at the pecuniary resources they embed. Overall, the results suggest that the pecuniary and non-pecuniary resources embedded by these ties predict the repayment by group borrowers. While the importance of information diffusion within the borrowers' networks is widely acknowledged as being critical for screening, monitoring and loan enforcement, the potential of ties to diffuse information within group borrowers' networks remains uninvestigated. In the next section we conceptualize social capital from a network-based perspective. In particular, we design a theoretical framework that allows us to test how social networks of group borrowers come into play in joint liability group lending.

### **3. Theoretical framework**

We conceptualize social capital from a network-based<sup>3</sup> perspective, according to most definitions of social capital provided by the sociological literature.<sup>4</sup> Social networks are patterns of social exchange and interaction that persist over time (Uphoff, 2000). The link between any two members of a social network is called social tie. Granovetter (1985) points out that virtually all economic behavior is embedded in networks of social relations. A large body of theoretical and empirical studies build on the fact that social ties embed reciprocity, which enables poor individuals to use social ties as informal risk insurance devices.<sup>5</sup> Another strand of literature looks at social ties from the perspective of their information diffusion potential (Granovetter (1983), Lin (1986)). Poor individuals rely on their social ties to collect information available in their network, as well as to cope with idiosyncratic shocks. These two roles played by social ties (i.e. of informal risk insurance devices and of information diffusion) make social ties very valuable for poor individuals. Hence, the threat of losing social ties may deter microfinance group borrowers' moral hazard behavior.

We build a theoretical framework that allows us to test how social networks of group borrowers come into play in joint liability group lending. For this, we combine the two methodologies

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<sup>3</sup> We look at individual social networks (in terms of both resources they embed as well as their configurations), and not at aggregated proxies for the individual social capital.

<sup>4</sup> See Adler and Kwon (2002) for an overview.

<sup>5</sup> See, for instance, Fafchamps (1992), Townsend (1994), Udry (1994), Grimmard (1997), Murgai *et al.* (2002), De Weerd (2002), Genicot and Ray (2003), Fafchamps and Lund (2003), De Weerd and Dercon (2006), Comola (2007), Bramouille and Kranton (2007).

proposed by Postelnicu *et al.* (2014), respectively Postelnicu (2015). In order to map the social networks of group borrowers, we follow the methodology proposed by Postelnicu *et al.* (2014). For each identified social tie we measure the resources it embeds by using the methodology proposed by Postelnicu (2015), which relies on measuring social ties along two dimensions: i) their capacity to act as informal risk insurance devices, and ii) their information diffusion potential.

A tie's capacity to act as informal risk insurance device is determined by the value (in terms of both pecuniary and non-pecuniary resources) it can provide in case of need. In the sociological literature the value embedded in a tie has been referred to as the *strength* of the tie. Granovetter (1973) defines the strength of a tie as a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confidence), and the reciprocal services between two individuals. Hence, according to Granovetter, the strength of ties is determined jointly by the non-pecuniary resources they embed (in terms of the amount of time spent together, the emotional intensity and intimacy between individuals), as well as the pecuniary resources they embed (i.e. in terms of reciprocal services). Social ties have different strengths, varying from *weak* ties to *strong* ties.

In microfinance group lending, strong ties may reduce repayment problems through two channels. First, ties embedding important financial resources may provide direct financial help for the loan repayment. Ties embedding high non-financial resources may also translate into better loan repayment. This is because non-financial resources may indirectly improve the economic success of borrowers as a consequence of moral support, psychological aid, social validation, etc. The second way in which strong ties may contribute to the improvement of loan repayment is through the threat of losing them due to negative reputation within the network in case of delinquent behavior. Losing strong ties results in the reduction of one's informal risk insurance, hence, a reduction of her capacity to deal with idiosyncratic shocks. This loss can be achieved when the information regarding the borrower's delinquent behavior can reach those strong ties, thus when the borrower's social network has information diffusion potential.

A tie has information diffusion potential when it is able to act as carrier of new information within the network. To reveal whether a borrower's tie has information diffusion potential, we employ the mapping methodology proposed by Postelnicu *et al.* (2014). This methodology is

specially designed to map the social ties of group borrowers depending on their potential to diffuse information in each other's networks. In particular, we look at *internal ties* and *external ties* - which are further divided into *information channels*, and *other external ties*.

An *internal tie* is the link between two members of the same borrowing group. An *external tie* links a group borrower to another individual from her community, which is not member in her borrowing group. To formalize these concepts, let us consider a community  $C$  made up of  $n$  individuals,  $C = \{1, 2, \dots, n\}$ , and a joint liability borrowing group  $B$  made up of two individuals from community  $C$ ,  $B = \{a, b\}$ .<sup>6</sup> To highlight the importance of the network configuration, we use the network diagrams from Figs. 1 and 2. In these diagrams, individuals are represented by nodes and dyadic social ties by edges.

[Insert Figure 1 and Figure 2 Here]

In Fig. 1, the two borrowers,  $a$  and  $b$ , are linked by an internal tie. Information is directly diffused within internal ties as all the group members know when a peer does not repay. Moreover, the methodology of group lending with joint liability compels them to repay the loan of their delinquent peer. This may incentivize group borrowers to punish their delinquent peer by cutting their internal ties with the latter (or by reducing the latter's future access to the resources embedded in the internal ties). When the internal ties of a group borrower are strong, thus acting as informal risk insurance devices, the threat of losing these internal ties may deter her delinquent behavior. This is due to the reduction of her informal risk insurance that could be enabled in case of need. On the other hand, strong internal ties may reduce default occurrence due to the fact that they may be more willing to step in and help the respective borrower repay her loan.

**Hypothesis 1:** A high number of strong internal ties reduces repayment problems.

In Fig. 1, borrower  $b$  has an external tie with individual  $c$ , who does not belong to  $B$ , the group of borrowers. Borrower  $a$  is not linked to  $c$ . In this case, there will be no effective transmission of information about the behavior of the group members to individuals outside the group, because the members' external networks do not overlap. However, the situation changes in Fig.

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<sup>6</sup>We restrict the number of group members to two for expositional clarity.

2, where individual  $c$  is linked to borrower  $a$  as well, forming a so-called *direct information channel*. The tie of  $a$  with  $c$  has the potential to act as carrier of information within  $b$ 's network. Such a tie is critical not only for screening and monitoring, but also for loan enforcement (through the credibility of the threat of social sanctions in case of the peer's delinquent behavior).

Information channels have two purposes. First, they facilitate the diffusion of information within the peers' social networks. Figure 3 provides an example of a social network for borrowers  $a$  and  $b$ . In this figure, the overlapping external network of borrowers  $a$  and  $b$  is formed by two individuals (see the direct information channels with  $c$  and  $d$ ). Each borrower has also other external ties that are not part of their overlapping network (see the individuals  $e$ ,  $f$  and  $g$ ). The dashed edges show that the individuals  $d$  and  $e$ , respectively the individuals  $c$  and  $f$ , are connected. This indicates that in dense social networks, group borrowers can also indirectly diffuse information within each other's networks via indirect channels. Though  $b$  is not directly connected to  $e$ , information about  $a$ 's delinquent behavior might still get to  $e$  via  $d$ . This increases the potential social cost in case of loss of reputation within the community.

[Insert Figure 3 Here]

When information can be easily diffused within the peer's social network, the credibility of the threat of social sanctions for the concerned peer increases (Besley and Coate, 1995). This incentivizes borrowers to repay in order to avoid negative reputational consequences within the network. Hence, from the information diffusion perspective, the existence of direct information channels, regardless of their strength (i.e. whether they are strong or weak), increases the likelihood of information diffusion within the network, and, therefore, the probability that the members of the individual's informal risk insurance arrangement will find out about her delinquent behavior.

**Hypothesis 2:** A high number of direct information channels increases the credibility of the threat of social sanctions (through the information diffusion potential) and hence reduces the borrowers' repayment problems.

The second purpose of direct information channels is that they may also hold important resources. When the social tie forming a borrower's direct information channel is strong, this information channel not only has information transfer potential, but it is also a valuable component of the borrower's informal risk insurance arrangement. More exactly, the credibility of the threat of social sanctions is higher as information can be directly transferred to these valuable ties. Hence, borrowers may curb their delinquent behavior to avoid losing these risk-sharing information channels.

**Hypothesis 3:** A high number of strong direct information channels reduces the borrowers' repayment problems.

The overall informal risk insurance arrangement embedded in a borrower's external ties may play an important role for the success of group loan repayment. In particular, in case of economic default the borrower could ask assistance with the loan repayment from the informal risk insurance arrangement embedded in his external ties. Hence, the size of the informal risk insurance arrangement embedded a borrower's external ties may reduce repayment problems.

**Hypothesis 4:** A high informal risk insurance arrangement embedded in the external ties of a group borrower reduces repayment problems.

Hypothesis 4 holds also from the perspective of the potential social cost that a group borrower could incur in case of negative reputation within his network. That is, when social sanctions go beyond the group, a higher informal risk insurance embedded in the borrower's external ties increases the social cost. The borrower may curb her delinquent behavior to avoid losing these important resources.

#### **4. Dataset description**

In order to test our hypotheses, we mapped the social networks of 802 group borrowers from Pro Mujer Mexico, an NGO providing joint liability group loans to nearly 40,000 women, during the period April-June 2014. The loan portfolio of Pro Mujer Mexico is managed by 139 loan officers working across seven Mexican regions, as described in Table 1.

[Insert Table 1 Here]

In collaboration with Pro Mujer Mexico, we randomly selected our sample as follows. Based on the list of loan officers that we received from the institution, we randomly selected 60 loan officers.<sup>7</sup> From these 60 individuals, one was promoted as branch manager, three were newly employed, not having assigned any group yet, and two were finishing their working collaboration. Pro Mujer Mexico made available to us the portfolios of the remaining 54 loan officers. We pooled together the groups managed by these 54 loan officers and randomly selected 300 groups. Randomization resulted in a sample of 300 groups managed by 51 loan officers out of the 54 initially considered. The objective was to interview three group borrowers from each of the 300 groups. The randomization results are summarized in Table 2.

[Insert Table 2 Here]

As described in Table 2, our sampling objective was to collect data from 900 borrowers who are members of 300 groups and are part of the portfolios of 51 loan officers working in 27 branches across six Mexican regions. A comparison between the distribution of Pro Mujer's loan portfolio (see Table 1) and the distribution of our sampling objective (see Table 2) reveals that our randomly selected sample is representative. To map the social networks of the borrowers in our sample, we designed a survey following the methodology proposed by Postelnicu *et al.* (2014).

In order to map social ties, we used the following procedure. First, to map the internal ties of each group borrower from our sample, we collected the names of the other group peers from the Pro Mujer's archives. Moreover, during the interview we mapped up to three direct information channels that the interviewed borrower has with each of her peers. According to the individual social capital measurement proposed by Postelnicu (2015), for each dyadic tie we asked the interviewed borrower a series of questions with the aim to identify whether the concerned tie is used by the borrower as informal risk insurance device. The structure of the resulting dataset is summarized in Figure 4.

[Insert Figure 4 Here]

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<sup>7</sup> To do the randomization we assigned consecutive integer numbers to the list of loan officers and used a random sequence generator to select the 60 loan officers.

Next to this, we obtained aggregated measures for the size of the borrower's informal risk insurance arrangement embedded in her external ties. For this, we adapted social capital measurement questions commonly known in sociology as 'name generators'. In particular, we asked questions such as "How many people outside the group could you ask to take care of your kids/house if you are unable (sick, away from home, etc.)?", "How many people outside of your group could you ask to lend you a small sum of money if you needed it?", "How many people outside of your group could you ask to lend you a large sum of money if you needed it?", "How many people outside of your group could you ask to give you some advice related to your work/business if you needed it?", "How many people outside of your group could you ask to lend you a bike/motorbike/car?".

Marin and Hampton (2007) point out that the design of these questions leads individuals to think about their close relationships such as core family members or friends. This means that the answers to these questions indicate the stocks of pecuniary resources embedded in the ties characterized by high non-pecuniary resources. Hence, these questions reveal the external ties forming one's informal risk insurance arrangement. While these aggregated measurements give us the size of a borrower's informal risk insurance arrangement embedded in her external ties, it does not allow us to look at the configuration of the overall external network. However, it is not the configuration of the entire external network that is of relevance to our study, but rather the configuration of the group network. That is, the group internal ties and the overlapping networks of the group borrowers (i.e. their information channels). Beyond this, it is of importance to look at the size of each borrower's informal risk insurance arrangement, which we do through the above-mentioned aggregated measurements.

In order to control for the individual's inclination toward building social capital, we identify whether the individual is part of any formal network (other than Pro Mujer) or informal network. Membership in informal networks gives individuals the possibility to strengthen their social ties, and, hence, to increase their informal risk insurance arrangements. Membership in formal networks link individuals from different network segments (i.e. individuals coming from different social circles). While the membership in formal networks does not translate into a better informal insurance arrangement, it gives individuals access to new opportunities

(Granovetter, 1973). This may result in better chances for the individuals to succeed financially, and, hence, repay their loans.

Table 3 summarizes the sample that we collected, as compared to the sampling objective.<sup>8</sup> In total, we interviewed 802 borrowers coming from 289 groups managed by 51 loan officers from 27 branches, across 6 Mexican regions. In total, our dataset contains 6,782 internal ties and 6,450 information channels. The 6,450 information channels are distributed as follows. Borrowers have reported 797 internal ties with one information channel, 494 internal ties with two information channels, and 1555 internal ties with three information channels. Out of the 6,782 internal ties, 42% (i.e. 2846 internal ties) have information channels associated. That is, from our dataset containing 6,782 mapped internal ties, 3936 internal ties do not have any overlapping network, whereas 2846 internal ties have reported to have at least one information channel. Overall, the group borrowers have reported between 0 and 42 information channels with her other peers. One group has between 4 and 25 group members.

[Insert Table 3 Here]

#### **4.1. Social Capital Measurement**

In order to investigate how group borrowers' social networks predict repayment problems, we map the social networks of group borrowers according to the methodology proposed by Postelnicu *et al.* (2014), and for each mapped dyadic tie we measure the resources it embeds following Postelnicu (2015). From an empirical perspective, we rely on the available research to come up with proxies for the pecuniary and non-pecuniary resources embedded in social ties. We look at the following six dimensions: type of relationship (whether individuals are core

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<sup>8</sup> There are two sources of attrition in our sample. First, seven loan officers from our sampling objective were not working anymore for Pro Mujer by the time we carried out the interviews in the respective branches. We replaced these loan officers by randomly selecting new loan officers from the concerned Pro Mujer branches, as well as re-selecting new groups from their portfolios. The second type of attrition was generated by the so-called "mora groups". These groups rallied against Pro Mujer, refusing to repay the loans. After several failed very time-consuming attempts to search/interview these individuals, we decided to replace the 29 mora groups from our sample by randomly selecting other groups from the respective loan officers' portfolios.

family, other family, friends, acquaintances, or other<sup>9</sup>), duration of relationship, closeness of relationship, meeting frequency outside the group meetings, geographic proximity and sharing during the last 12 months. The first five dimensions capture the tie's non-pecuniary resources, whereas the last one looks at whether it embeds pecuniary resources.

We recall that the methodology proposed by Postelnicu (2015) measures social ties from two perspectives: (i) their informal risk insurance capacity, and (ii) their information diffusion potential. Based on the above-mentioned six dimensions, we identify whether a tie is strong (hence, acting as informal risk insurance device) or weak. We reveal whether the tie has potential to diffuse information within a peer's network based on the type of tie (i.e. whether it is a direct information channel or not). The type of tie is revealed through the mapping methodology, as proposed by Postelnicu *et al.* (2014).

In order to identify whether a tie is strong or weak (hence, whether it acts as informal risk insurance or not), we proceed as follows. First, from a mathematical point of view, we consider a social tie to be a point in the space of the specified six dimensions. We use two-means cluster analysis<sup>10</sup> to identify two clusters of ties (i.e. a cluster of strong ties and a cluster of weak ties).<sup>11</sup> The two-means cluster analysis method aims to partition ties (defined by the above-mentioned six coordinates) into two clusters. In the first step, the clustering algorithm identifies two seeds by randomly taking two observations from the dataset.<sup>12</sup> Next, in an iterative process, the remaining observations are assigned one by one to the two groups based on their proximity (in terms of Euclidian distance) to the current group center. As soon as a new observation is

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<sup>9</sup>We included in the category "other" the peers that the group borrower said she/he does not know, or individuals with whom she/he has a bad relationship.

<sup>10</sup>This method of clustering social ties has been previously used in the literature - see for example, Zhao (2002) and Dufhues *et al.* (2011a, 2011b, 2012, 2013).

<sup>11</sup> Factor analysis is not suited for testing our hypotheses because it is concerned with grouping variables based on patterns of variation (correlation) and not with grouping objects (i.e. ties, in our case) based on their proximity. Separating ties acting as informal risk insurance devices (i.e. strong ties) from the other ties (i.e. weak ties) is essential for testing our hypotheses.

<sup>12</sup> The clustering method is typically sensitive to seed setting and outliers. When the data does not have clearly defined, well-separated clusters, there is a good chance that clusters based on different starting values (i.e. seeds) will be different (Makles, 2012). On this line, we also investigate the results by using different random seeds in the command for generating the two clusters. Most of our clustering results are consistent to the results presented in the paper.

assigned to a group, the group center changes according to the new mean of the observations forming that group. The process is repeated until the algorithm converges<sup>13</sup>. The clustering is performed with removing the ties with missing values on at least one of the six dimensions.<sup>14</sup>

We call the cluster with the highest group mean the cluster of strong ties and the cluster with the lowest group mean the cluster of weak ties. This is because the first cluster is formed by the dyadic ties characterized by a stronger type of relationship, and where the two individuals know each other for a longer time, they feel closer to each other, they meet each other more often outside group meetings, they live closer and they have shared goods or services during the last 12 months. The opposite is true for the ties forming the second cluster. Before performing the clustering, we ensure that the way our variables are assigned values are aligned with the intensity weak – strong. That is, the lowest values of the ordinal variables are assigned for weak intensity (such as weak closeness of relationship, or weak role relationship), whereas the highest values of the ordinal variables are assigned strong intensity (such as strong closeness of relationship, or strong role relationship) - see Table 4 from Annex.

When clustering the ties from our dataset, we pool together all the ties (i.e. both internal ties and direct information channels), and we mark each tie so that we will know later on whether it is an internal tie or an information channel.<sup>15</sup> Table 4 shows the descriptive statistics as well

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<sup>13</sup> The algorithm *converges* when the best two groups were found (i.e. when all the observations are assigned to their corresponding group *and* any further reassignment step will not have any effect). The continuity of the iterative process until the convergence of the algorithm is important. This is because after the first assignment of the last observation from the dataset to one of the two groups, the algorithm computes the new group center and it may conclude that a number of observations that were previously assigned to one group should be re-assigned to the other one. In this case the algorithm will be resumed and run until no such changes are necessary anymore (i.e. the algorithm converges). If two clusters cannot be partitioned based on the dataset (i.e. the algorithm cannot converge), then the data will remain distributed within one cluster.

<sup>14</sup> When clustering, we have lost in the process 1,903 internal ties (i.e. 28,06%) and 1,172 (i.e. 18,18%) of the direct information channels. Losing ties is also the case of the other empirical studies using cluster analysis for social ties (see Dufhues *et al.* (2011a, 2011b, 2012, and 2014)).

<sup>15</sup> It is important to pool together all ties when clustering, and not performing separate clustering for internal ties respectively for direct information channels in order to avoid potential result biases due to the sensitivity of the random seed settings as well as the different outliers that may be specific to one subsample or the other. In this way, we ensure that an internal tie characterized by specific values along the six dimensions will be part of the same group as an information channels characterized by the exact values along the six dimensions.

as the definitions for the six dimensions by which we define the strength of a tie. Table 5 shows the pairwise correlations between these six dimensions. The clustering results are summarized in Table 6.

[Insert Table 4, Table 5 and Table 6 Here]

The cluster of strong ties contains 2,552 social ties, of which 761 are internal ties and 1,791 are direct information channels. The cluster of weak social ties contains 7,602 ties, of which 4,118 are internal ties and 3,484 are direct information channels. We use this information to test the empirical model described in the next section.

## 5. The empirical model

To empirically test our hypotheses, we use the following model:

$$P_{ij} = E\left(Y_{ij} = 1 \mid I_{ij}^s, D_{C_{ij}}, C_{ij}^s, E_{ij}, N_{ij}, D_{ij}, G_j\right) = \frac{1}{1+e^{-Z_{ij}}}, \text{ where } Z_{ij} = \ln\left(\frac{P_{ij}}{1-P_{ij}}\right), \text{ and}$$

$$Z_{ij} = \alpha + \beta * I_{ij}^s + \gamma * D_{C_{ij}} + \delta * C_{ij}^s + \lambda * E_{ij} + \varphi * N_{ij} + \chi * D_{ij} + \omega * G_j + \varepsilon$$

$Y_{ij}$  captures the repayment behavior of borrower  $i$  from group  $j$ , taking the value 1 if the borrower has faced any repayment problem during the last two loan cycles, and 0 otherwise. We predict the likelihood of repayment problems through the following variate.  $I_{ij}^s$  represents the number of strong internal ties of borrower  $i$  from group  $j$  (it allows us to test Hypothesis 1).  $D_{C_{ij}}$  represents the number of information channels of borrower  $i$  from group  $j$  (it allows us to test Hypothesis 2).  $C_{ij}^s$  represents the number of strong information channels of borrower  $i$  from group  $j$  (it allows us to test Hypothesis 3).  $E_{ij}$  is a vector of variables measuring the resources embedded in the external ties of borrower  $i$  from group  $j$  (it allows us to test Hypothesis 4).  $N_{ij}$  captures the adherence to social norms, values and beliefs of borrower  $i$  from group  $j$ .  $D_{ij}$  represents the demographic characteristics of borrower  $i$  from group  $j$ , and  $G_j$  represents the characteristics of the group  $j$ .

To measure repayment problems we look at the past two loan cycles to avoid the situation where the last loan cycle of a group did not finish yet (or it may be even at its beginning) leading

borrowers to report no repayment problem if we had asked whether they faced repayment problems only during the last loan cycle. In order to measure repayment problems, we identify whether the borrower faced at least one of the following problems: (i) I had to borrow money from someone else in order to repay at least one installment, (ii) I had to withdraw my savings in order to pay at least one installment, (iii) I quarreled/had arguments/disputed with my spouse or other family members because of difficulties to repay the loan that I took, (iv) I had to sell some household assets to repay at least one of the installments; (v) I had to make personal sacrifices (eat less/withdraw children from school/neglect my health/etc.) to repay at least one of the installments; (vi) Other problems<sup>16</sup>; (vii) I did not encounter any problem.

Our dependent dummy variable takes the value 1 if the borrower mentioned that she encountered at least one form of problems, and 0 if she gave the last answer, i.e. (vii). We select this variable to measure the repayment problems of borrowers, as all borrowers in our sample have a clean portfolio, i.e. they manage to always find a solution to repay their loans. In other words, these problems with loan repayment that borrowers face are a consequence of their cash flow management problems. Schicks (2013a) points out that such problems faced by borrowers in order to meet repayment deadlines are a sign of over-indebtedness. Furthermore, Schicks (2013b) finds that over-indebtedness is strongly related to delinquency.

We perform the logit regression with and without clustering of observations at group level to estimate how the independent variables predict the probability of borrowers facing problems with the repayment of their loans. Starting from the baseline specification, after carefully analyzing the data, we identify high pairwise correlations between three variables measuring resources embedded in external ties. In particular, the number of people outside the group that can take care of your house/kids is highly correlated with the number of people outside the group that can give you advice on your business and the number of people outside the group that can help you with a bike/motorbike/car if you need it. We dropped the latter two variables, keeping the former one because it has the highest explanatory power for the model (based on Pseudo R2 comparisons). We also remove from the analysis the variable capturing the gender of the borrower because only 4.03% of our sample are males.

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<sup>16</sup>For this category we gave the opportunity to the borrower to tell us what problems she faced.

Table 7 summarizes the variables used in the empirical analysis, and Table 8 presents the descriptive statistics for these variables.

[Insert Table 7 and Table 8 Here]

In order to test our hypotheses, we control for a wide range of variables. We look at the detailed demographic characteristics of the borrower, the social norms, values and beliefs of the borrower, as well as the characteristics of his/her group. Regarding the dependent variable, our low variation (10% of borrowers have encountered any repayment problem) is common in research investigating microfinance group repayment performance.<sup>17</sup> However, we perform also a rare events logit test which confirms the results from our standard logit regression. In the next section we present the results of the above described model.

## **6. Empirical results**

We carry out the empirical analysis by adding one by one the independent variables in order to check for the stability of the coefficients' signs and significances. Also, we run the logit regression with and without clustering at group level. The model is stable in both cases, but with fewer significant variables in the clustered regression. Table 9 shows the empirical results for the regression with clustering at group level. The overall fit of the model is satisfactory and the pairwise correlations as well as the variance inflation factor do not suggest multicollinearity problems.

[Insert Table 9 Here]

### **6.1. Results related to hypotheses**

We have tested our four hypotheses launched in the theoretical framework (see section 3), and we have obtained the following results. Our first hypothesis states that a high number of strong internal ties should reduce repayment problems. That is, the probability of repayment problems decreases when a high number of the borrower's internal ties are part of her informal risk

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<sup>17</sup> See, for instance Dufhues *et al.* (2012) with 9% repayment problems, or Sharma and Zeller (1996) with 13.3% delinquency.

insurance arrangement. We indeed obtain a negative sign for our variable measuring the number of strong internal ties, but it is not significant. It may be that the borrower assumes the risk of losing these strong ties in case of problems ex-ante (i.e. when agreeing to become borrower in the same group with a number of individuals that are members in her informal risk insurance arrangement). By taking joint liability loans with these individuals, the borrower accepts and expects this social cost. Hence, the threat of losing these ties in case of problems with the loan repayment is an ex-ante ‘calculated risk’.

Our second hypothesis states that the number of a borrower’s information channels should be negatively related to her repayment problems. In other words, the extent to which the social networks of the borrower’s peers overlap with her own social network may be positively related to the credibility of the threat that information can be diffused into her own social network. Thus, the borrower may properly assess her capacity to repay a loan, and hence not over-state the loan amount that she is capable to pay back to the MFI in order to avoid repayment problems at a later stage. We find, as expected, a negative relation between repayment problems and the number of direct information channels, but it is not significant. It may be that the borrower is not affected by the extent to which information can be diffused into her wider network.

We test further whether the borrower is affected by the extent to which information can be diffused to a specific category of ties, in particular, to those ties acting as her informal risk insurance arrangement. The credibility of the threat of information diffusion toward these particular ties may play an important role. This is the objective of our third hypothesis, which states that a higher number of strong information channels reduces the likelihood of repayment problems. Our results show that, indeed, this is the case. The borrower is less likely to have repayment problems when her peers have the possibility to transfer information directly to those external ties acting as her informal risk insurance arrangement. These ties embed important resources that the borrower may not want to lose.

Our fourth hypothesis states that a high informal risk insurance arrangement embedded in the external ties of a group borrower reduces repayment problems. On the one hand, having a high informal risk insurance arrangement may signal reliability of the borrower, as well as the option that the borrower has to get help from her external network in case of problems related to the loan repayment. On the other hand, having a large informal risk insurance arrangement

embedded in the external ties may incentivize the borrower to properly manage her cash flow in order to repay her loan. This is because a larger informal risk insurance arrangement embedded in a borrower's external ties may result in a more credible threat of social sanctions in case of a negative reputation within the network.

In order to test the fourth hypothesis, we use five variables capturing the resources embedded in the borrower's external ties, as follows: the number of external ties that can lend a small amount of money, the number of external ties that can lend a large amount of money, the number of external ties that can take care of house/kids in case of need, and whether the borrower is member in any formal network (except for Pro Mujer), respectively informal network. We find that the number of external ties that can lend the borrower a small amount of money are negatively, but non-significantly, related with repayment problems. However, our results show a positive and significant correlation between repayment problems and the number of external ties that can lend the borrower a large amount of money. This result may indicate that group borrowers having the possibility to borrow from their external networks large amounts of money are less incentivized to take care of their loan repayment.

The number of external ties that can take care of the borrower's house/kids is negatively and strongly associated with repayment problems. This result is in line with our second hypothesis. While the borrower's membership in formal networks is not significantly related with repayment problems, her membership in informal networks confirms our second hypothesis. In particular, borrowers are less likely to report repayment problems when they are members in informal networks. Indeed, informal networks are responsible for providing the social incentive for non-delinquent behavior. This result supports the idea that social capital plays an important role in the success of group lending programs.

## **6.2. Results related to control variables**

We control for a wide range of variables, which we have organized into three groups, as follows. The first group contains variables measuring the borrower's social norms related to the microcredit activity, her values and beliefs. The second group of variables captures the demographic characteristics of the borrower, whereas the third group of variables captures the group characteristics.

In terms of norms and values of group borrowers, we find a negative and strongly significant sign for the variable ‘Social Sanction for Shirking’ showing whether borrowers consider that a shirking borrower should be sanctioned or not for such behavior. It is more likely to have repayment problems when the borrowers believe that no social sanctions should be applied to shirking borrowers. We also find out that when borrowers assign a very high importance to having access to credit in the future from Pro Mujer, they are less likely to have repayment problems. This finding is in line with Hermes *et al.* (2006) who find the same result for group leaders.

Regarding the set of demographic characteristics of the borrowers, we find significant results for a number of variables, as follows. Repayment problems are more likely for borrowers living in urban areas. As urban social networks are usually less dense as compared to rural ones, this result supports the idea of social capital playing an important role for shaping group borrowers’ repayment behaviors. We also look at the civil status of the borrower and we find that borrowers having a partner (i.e. married or co-habitation) are less likely to have repayment problems as compared to single, divorced or widowed borrowers. This may indicate that intra-house exchange plays also an important role in microcredit, as group borrowers may rely at times on the partner’s support for loan repayment. In addition, our results show that more educated borrowers are more likely to face repayment problems. It may be that more educated borrowers have more opportunities, which may reduce their incentives to repay their loans.

In our analysis we also look at the borrower’s household structure and find out that a higher number of kids or household members older than 60 years old are positively related with repayment problems, although the former variable loses significance in the full model. This may indicate a competition on the borrower’s financial resources between the household members’ needs and microcredit repayment. A similar measure is used by Sharma and Zeller (1996), who look at the dependency ratio of a borrower, but in their case, the authors find a positive correlation with repayment. However, in their case it remains unclear how members qualifying as dependents have been defined.

We also find that when the number of household members having a fixed income increases there is less likely for the borrower to have loan repayment problems. Perhaps the group

borrower relies on these household members' support in case of repayment problems. We find the same result for the borrower's income. As expected, when the borrower has a higher income, she/he faces less repayment problems. Finally, we find that when the borrower's household receives remittances she/he declares having more repayment problems. A closer look at our data shows that households receiving remittances are overall poorer<sup>18</sup>, and this may explain the positive relation between repayment problems and receiving remittances. In addition, as remittances are not delivered at precise time-intervals and in constant amounts, borrowers receiving remittances may over-evaluate their ability to repay loans (as they rely on an uncertain amount delivered at an uncertain moment).

In line with the literature (see Sharma and Zeller (1996) and Godquin (2004)), we find a positive association between loan size and repayment problems. We also find that when borrowers have other loans than the one with Pro Mujer, they are more likely to encounter repayment problems.

Most related empirical literature has performed group-level analysis, but the results on similar variables have been sometimes divergent. In our case, we control for a number of group characteristics and obtain the following results. First, we find a negative, though non-significant relation between the age of the group and repayment problems. This result is in line with Khandker (2012), but opposite to the findings of Paxton (1996), Hermes *et al.* (2006), Ahlin and Townsend (2007), and Al-Azzam *et al.* (2007). Moreover, we find a significant negative relation between group size and repayment problems, which is in line with the literature (see Zeller (1998), Wydick (1999)). This result indicates that when joint liability is shared by a larger number of group members, repayment problems decrease.

The size of the loan received by the whole group is strongly positively associated with repayment problems. This makes sense as a higher group loan size implies stronger joint liability and responsibility for the peer's loan repayment. Associated with the likelihood that higher individual loans create more repayment problems, it may be that in groups where higher loans have been disbursed, good borrowers are less incentivized to repay their loans when they might be more often required to contribute for the repayment of their peer's loans. Moreover,

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<sup>18</sup> The Pearson correlation coefficient between the borrower's income and the variable measuring whether she received or not remittances is -0.1930, with a p-value < 0.1

we find that when the loan has to be repaid in more installments, the repayment problems increase.

Finally, we point out that for a number of variables there is not too much variation in our dataset (see Table 8). The non-significance of variables whose coefficients' signs are consistent across various regressions may be due to their small variation. As a robustness check, we carry out the regressions with ties defined based on five and four dimensions. We present in Table 10 the results obtained by clustering ties on all combinations of five dimensions.

[Insert Tables 10 Here]

A bias of our estimate may potentially arise due to the low variation of our dependent variable (only 10% of our borrowers have encountered repayment problems). We thus run a 'rare events logit' (firthlogit) and compare the results with our standard logit regression. We run the rare events logit without clustering at group level, as it does not allow this option. As Table 11 shows, the rare events logit results keep strictly the same signs as our standard logit regressions (with and without group-level clustering), but the results are highly significant - which was also the case of our un-clustered standard logit. Hence, we conclude that the low variation of our dependent variable does not bias our results.

### **6.3. Testing for Endogeneity Problems**

The relationship between our variables of interest and the outcome (i.e. repayment performance) may be affected by endogeneity. We perform two tests for the most common causes of endogeneity. First, there may be an uncontrolled cofounder causing both our dependent variable and at least one of the independent variables, leading to a correlation of these variables and the error term. To address this, we employ the methodology used by Hermes *et al.* (2012). We look at the extent to which the coefficients of our variables of interest change when we include control variables. In particular, we assume that the possible bias due to selection on unobservables can be proxied by the bias due to selection on observables. In this sense, Table 12 shows the coefficients of our variables of interest without any control variable, respectively the coefficients obtained in the full model.

[Insert Table 12 Here]

We assume that the ratio between the coefficient without controls and the difference between the coefficient without and with controls is a proxy for the covariance between the unobserved variables and our variables of interest, relative to the covariance between the observed variables and our variables of interest. Hermes *et al.* (2012) cite Altonji *et al.* (2005) who argue that the absolute value of this ratio should be less than 1. In our case (see last column from Table 12), most of the variable revolve around 1, with the first variable (i.e. Number of Strong Internal Ties) having a coefficient of about 4. This means that the results for our variables of interest hold, except for the first one. For the first variable we observe a part of its effect on repayment performance, but it is likely that there is some unobserved variable affecting both repayment performance and the number of strong internal ties. In any case, this variable does not result to be significant, and hence we do not focus our results interpretation on it.

The second endogeneity test that we perform relates to problems that may appear due to reverse causality between our variables of interest and the outcome variable. It may be that social capital increases as a consequence of the fact that borrowers repay their loans without facing any problem. Repaying loans may signal reliability of the concerned individual, and, hence, the individuals from her community may want to build ties with her. To address this, we follow Dufhues *et al.* (2012) who drop the dyadic ties that have been formed after the individual took the loan. In our case, as we focus on group borrowers, we drop the dyadic ties that have been formed after the group formation. We re-perform the analysis and the results are showed in Table 13a and 13b.

[Insert Tables 13a and 13b Here]

Table 13a shows the number of ties resulted after the clustering. In total, we have remained with 1,604 strong ties (out of which 519 are internal ties and 1,085 are information channels), and 4,142 weak ties (out of which 2,165 are internal ties and 1,977 are information channels). The results of the logit regression, clustered at group level, are shown in Table 13b. As this table shows, the coefficients of our variables have the expected signs, and a stronger significance. Hence, our previous conclusions stand.

## 7. Conclusion

This paper has analyzed how social networks of group borrowers come into play in joint liability group lending. We use a large and original dataset containing 802 mapped social networks of borrowers from Pro Mujer Mexico. This is the first paper to look at external ties, i.e. social ties with individuals outside the borrowing group. Our main message is that group lending with joint liability works when group borrowers use the informal risk insurance arrangement embedded in their external ties as guarantee for loan repayment. The extent to which this arrangement is used as guarantee is not decided by the borrower, but it is determined by the configuration of the group borrowers' social networks (i.e. by their overlapping networks). These overlapping networks (or information channels) facilitate the diffusion of information into each other's networks, and, thus, increases the credibility of the threat of losing strong ties (i.e. ties acting as one's informal risk insurance devices). Our results show that the threat of losing these strong external ties matters for loan repayment even more than internal ties. This finding is new to the literature.

Social capital can be used by MFIs as an effective disciplining device. The main practical implication of this study relates to the way groups are formed. MFIs may pay attention at the group borrower's network configurations (so that group borrowers know each-other and are linked by strong ties to common external individuals). Moreover, MFIs may measure the resources to which borrowers usually have access to from their own external networks, and consider their potential impact on loan repayment when disbursing the loans or deciding the loan sizes.

Further investigations on how the group borrowers' repayment behavior is driven by social mechanisms is necessary. We suggest two research paths here. First, the theoretical framework of our study may be applied to other MFIs based in other countries in order to see whether these results can be generalized. It is our belief that external ties should play an important role in the success of micro-credit programs, but different aspects of the networks' configurations may be more important than others in different cultures. Second, it is important to look also at the ties between borrowers and loan officers in order to understand the role of the interaction between the two players for the success of the groups. The microfinance literature has a serious gap in this direction.

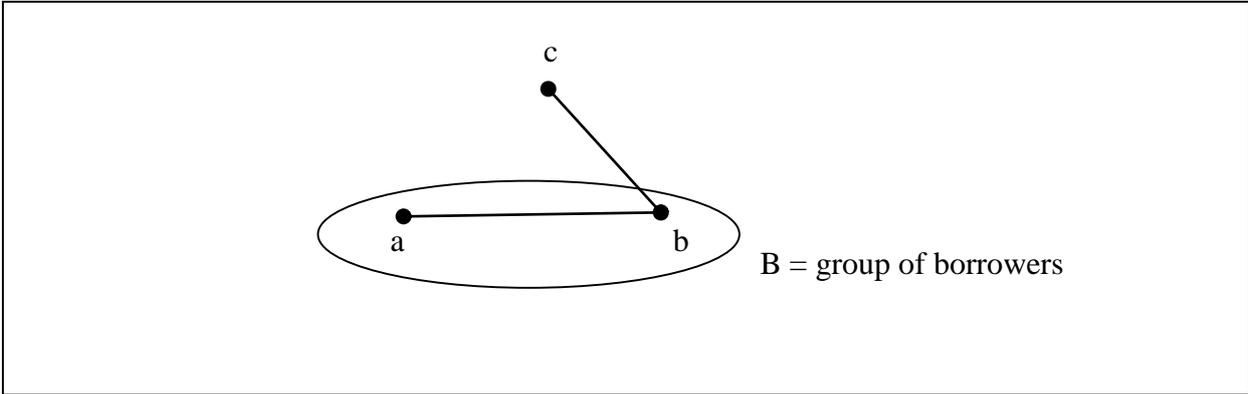
Finally, we acknowledge the limitations of our analysis, which are mainly related to the challenges faced when working with network data. Investigating network data requires working with large datasets, which are usually unbalanced if they are collected directly from the field, as in our case. In order to look at the structure of social networks, as well as at the resources they embed, we use the two-means clustering method. This method has been used in previous similar studies, and implies losing a number of ties in the analysis. We have tried to compensate for this by performing the analysis on various combinations of clustering starting from the initial six dimensions that we have used to define social ties. We have also performed the cluster analysis by setting various seeds, as clustering is very sensitive to the seed setting. We believe our results are fairly robust.

Social ties are very important in understanding the economic behavior of individuals. To perform our research, we have used the available statistical software which greatly limit the analysis and misrepresent the network model. In order to advance the empirical research on social networks new software packages able to perform statistical operations on structures of relational data are necessary. Steps in this directions are being taken, as quite a number of non-statistical software for data visualization and manipulation are available. A few new packages able to recognize network data have been developed in R as well. However, statistical tests (for instance, a t-test for networks) would greatly facilitate the advancement of empirical research on social networks.

**APPENDIX**

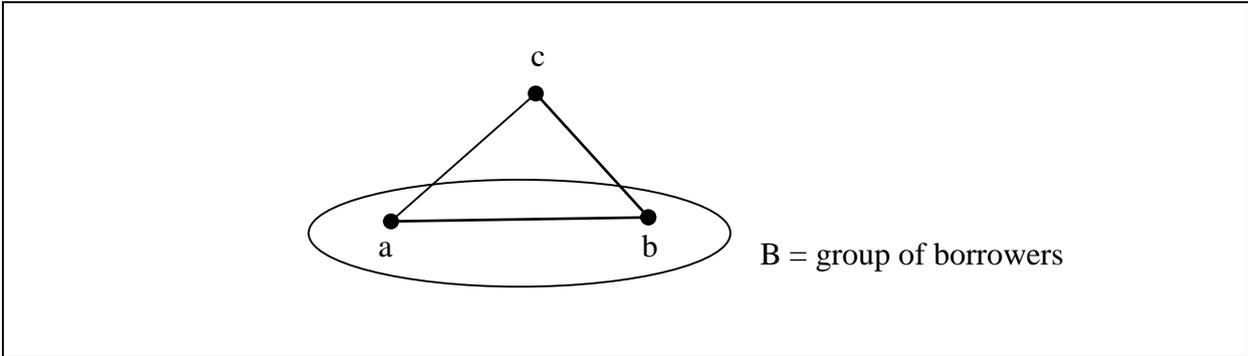
**List of Figures**

**Figure 1: Internal and External Ties**



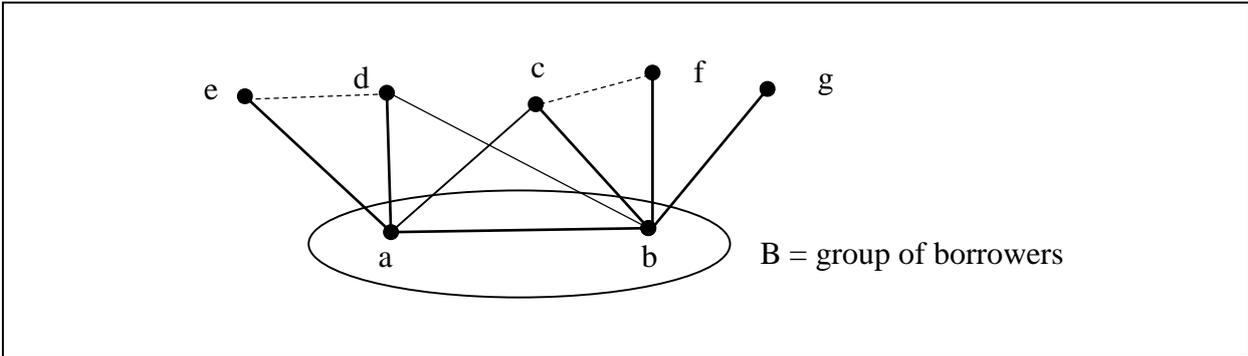
Source: Postelnicu *et al.* (2014)

**Figure 2: Direct Information Channel**

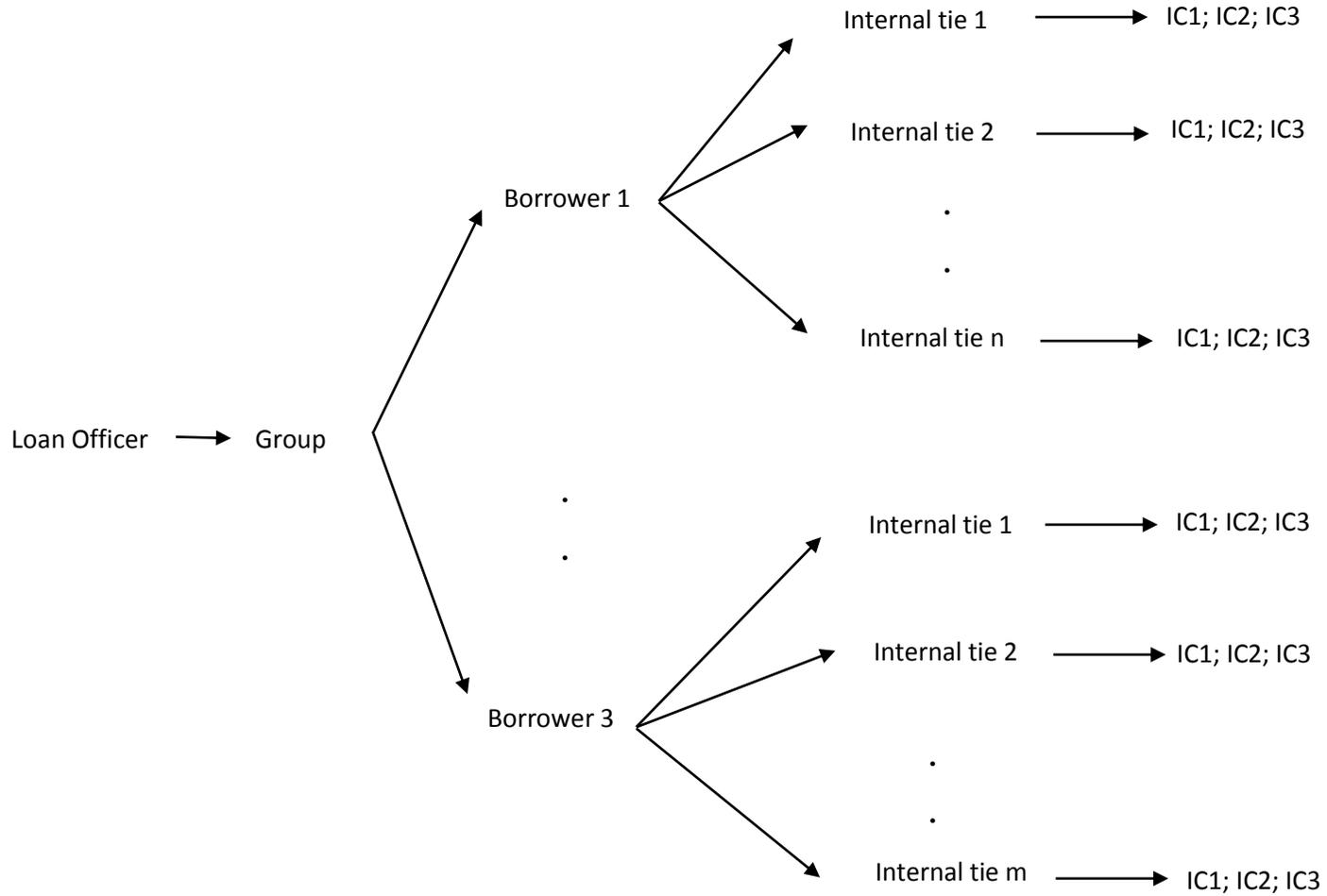


Source: Postelnicu *et al.* (2014)

**Figure 3: Example of Overlapping Networks of Borrowers *a* and *b***



**Figure 4: Structure of the Dataset**



Legend:

- IC1=Information Channel 1
- IC2=Information Channel 2
- IC3=Information Channel 3

## Tables

**Table 1: Pro Mujer Loan Portfolio**

Region	# LO	%GLP
Mexico	44	31.65
Hidalgo	40	28.78
Puebla	20	14.39
Veracruz	12	8.63
Distrito Federal	10	7.19
Queretaro	10	7.19
Oaxaca	3	2.16
<b>TOTAL</b>	<b>139</b>	<b>100</b>

**Table 2: Sampling Objective**

Region	# LO	# Groups	# Borrowers	# Branches
Mexico	15	102	306	9
Hidalgo	17	112	336	9
Puebla	9	37	111	4
Veracruz	4	20	60	2
Distrito Federal	4	20	60	2
Queretaro	2	9	27	1
<b>TOTAL</b>	<b>51</b>	<b>300</b>	<b>900</b>	<b>27</b>

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**Table 3: General Description of Collected Sample**

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<b>Mexican Regions</b>	6
<b>Number of Branches</b>	27
<b>Number Loan Officers</b>	51
<b>Number of Groups</b>	289
<b>Number of Borrowers</b>	802
<b>Number of Internal Ties</b>	6782
<b>Total Number of Direct Information Channels</b>	6450
Number of Internal Ties with one Info Channel	797
Number of Internal Ties with two Info Channels	494
Number of Internal Ties with three Info Channels	1555
<b>Number of Direct Information Channels per Borrower</b>	0 - 42

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**Table 4: Summary Dimensions Social Ties**

Variable	Description	Obs	Mean	Std.Dev.	Min	Max
Type of Relationship	5=core family, 4=other family, 3=friends, 2=acquaintances, 1=other	12938	2.85	1.12	1	5
Duration of Relationship	For how many years do you know each other?	12810	11.41	11.68	0*	82
Closeness of Relationship	5=I feel very close to "X", 4=I feel close to "X", 3=I feel somewhat close to "X", 2=I feel not so close to "X", 1=I am not close at all to "X"	12784	3.83	1.06	1	5
Meeting Frequency	How often do you meet this individual outside of group meetings? **	12231	8.83	10.22	0	64
Geographic Proximity	Do you live within 15 min walking distance from her house? 1=No, 2=Yes ***	11359	1.6	0.49	1	2
Sharing	Sharing last year? 1=No, 2=Yes ****	12524	1.61	0.48	1	2

\*We have four ties in the dataset with the value 0

\*\*When mapping information channels we asked "How often do you meet this individual? The answer options were "per week, per month, or per year", and the value in the table is computed as frequency per month.

\*\*\*During the pilot project we asked the distance in meters between the individuals' houses, but the interviewees found difficult to approximate it.

\*\*\*\*We aggregated this indicator based on detailed information on the type of sharing between individuals during the last 12 months, such as money, free work, food, or personal or business advices.

**Table 5: Pairwise Correlations for the Six Dimensions Defining the Strength of Ties**

	Type of Relationship	Duration of Relationship	Closeness of Relationship	Meeting Frequency	Geographic Proximity	Sharing
Type of Relationship	1					
Duration of Relationship	0.3535	1				
Closeness of Relationship	0.1972	0.303	1			
Meeting Frequency	0.4496	0.2784	0.2487	1		
Geographic Proximity	0.2902	0.2692	0.1462	0.2283	1	
Sharing	0.2538	0.2076	0.0801	0.1836	0.1278	1

<b>Table 6: Results of Clustering</b>	
<b>Social Ties Cluster</b>	<b>Number of Ties</b>
<b>Strong</b>	<b>2,552</b>
out of which:	
Internal Ties	761
Information Channels	1,791
<b>Weak</b>	<b>7,602</b>
out of which:	
Internal Ties	4,118
Information Channels	3,484

<b>Table 7: Description of variables used in the empirical analysis</b>	
<b>VARIABLE</b>	<b>EXPLANATION</b>
<b>DEPENDENT VARIABLE (Z<sub>ij</sub>)</b>	
<i>Repayment Problems</i>	1 if the group borrower has encountered any form of problem with her/his loan repayment during the last two loan cycles, 0 otherwise
<b>INDEPENDENT VARIABLES</b>	
<i>Number Strong Internal Ties</i>	The number of strong internal ties of borrower <i>i</i>
<i>Number Information Channels</i>	The number of information channels of borrower <i>i</i>
<i>Number of Strong Information Channels</i>	The number of strong information channels of borrower <i>i</i>
<i>Resources Embedded in External Ties</i>	
Number of External Ties that can lend a small amount of money	Number of individuals outside the group from which the individual could borrow a small amount of money

Number of External Ties that can lend a large amount of money

Number of individuals outside the group from which the individual could borrow a large amount of money

Number of External Ties that can take care of your kids/house

Number of individuals outside the group that could take care of the borrower's kids or house if she/he is sick of away from some time

Membership in Formal Networks\*

1 if the group borrower is part of any other formal network (except from Pro Mujer), 0 otherwise.

Membership in Informal Networks\*

1 if the group borrower is part of any informal network, 0 otherwise.

***Social norms, values and beliefs***

Utility of microcredit activity:  
1=very useful, 5=not useful

In your view, the microcredit activity is: 1=Very useful (It helps people develop their businesses and improve their lives); 2= Useful ( It has positive outcome only for some individuals, whereas it does not make any difference in other individuals' lives); 3=Somewhat useful (It is neither a good, nor a bad activity. Mostly, it does not make people neither better off, nor worse off); 4=Not so useful (It does good to some people, but most people do not have the ability to use it wisely and end up worse off); 5=Not useful (It is a dreadful activity. It harms people. I do not know anyone who got better off because of microcredit);

Social sanctions for shirking: 1=Yes,  
0=No sanction

This is a variable aggregated from the following question: Suppose that someone from your group defaults, though you suspect that s/he could repay her/his loan. What would be, in your view, the punishment that s/he deserves? (multiple answers possible)

1=To lose access to future credit from the actual lender; 2=To lose access to future credit from the actual lender and any other alternative source of credit in the community; 3=To be marginalized/excluded by the group members; 4=To be marginalized/excluded from the community activities; 5=To be marginalized/excluded together with her/his family; 6=Other punishment. Please specify \_\_ ; 7=No punishment;

The variable we use in our empirical investigation takes value 0 if the borrower gave the answer 7, and 1 otherwise;

Willingness to help as compared to 10 yrs ago: 1=Less willing, 0=More or equally willing	Do you think that people today are more willing or less willing to help each other than they used to be, say ten years ago? 1=less willing, 0=more willing or equally willing
How much confidence in churches: 1=a great deal of confidence, 4=None at all	How much confidence do you have in churches? 1=A great deal of confidence; 2=Quite a lot of confidence; 3=Not very much confidence; 4=None at all
Access to credit in the future	Importance of access to credit in the future from Pro Mujer: 1= Very important, 5= Not important at all

***Borrower's demographic characteristics***

Borrower's Age	The age of the borrower
Borrower lives in: 1=Urban, 0=Rural	Borrower is currently living in a 1=Urban area, 0=Rural area
Number of years the borrower has been living in the current area	The number of years the borrower has been living in the current area
Marital Status	Borrower's Marital Status: 1=Married or Cohabitation, 0=Single, Divorced or Widow
Religion	Borrower's Religion: 1=Catholic, 0=Other religions
Education	Borrower's Education: 1=No education; 2=Primary school, 3=Secondary school, 4=Preparatory/Vocational; 5=University degree; 6=Postgraduate
Number of household members	Number of household members
Number of HH members older than 60 years old	Number of household members older than 60 years old
Number of kids	Number of kids
Number of HH members having a fixed income	Number of household members having a fixed income
Borrower's weekly income	Borrower's weekly income
Current loan amount with Pro Mujer	Current loan amount with Pro Mujer
Other loans	Do you have other loans? 1=Yes, 0=No
Government help	Receive government help/subsidies: 1=Yes, 0=No
Remittances	Received remittances during the last 12 months: 1=Yes, 0=No

**Group characteristics**

Loan officer in charge of group	Number of months the current loan officer has been in charge of the group
Age of the Group	Age of the Group
Number of members in the Group	Number of members in the Group
Group initiation	The Group was initiated by: 1=Loan officer/Pro Mujer, 0=the borrowers themselves
Group loan amount	Net loan amount received by the whole group
Monthly interest rate for the current loan	Monthly interest rate for the current loan
Number of installments	The number of installments/payments in which the group loan will be repaid.

\*Note: In order to measure the membership in Formal/Informal networks, we have provided borrowers with a list of such networks that we identified during the pilot project, and we also left an open answer for them to give us other answers. These dummies are aggregated measurements of those answers.

**Table 8: Descriptive statistics of the variables used in the empirical analysis**

Variable	Obs	Mean	Std.Dev	Min	Max
Repayment Problems (dependent variable)	6740	0.10	0.30	0	1
Number Strong Internal Ties	761*	1.36	2.24	0	14
Number Information Channels	6447	8.37	8.36	0	42
Number of Strong Information Channels	1791	2.42	5.21	0	42
Number of External Ties that can lend a small amount of money	6764	5.05	47.06	0	1000
Number of External Ties that can lend a large amount of money	6763	1.35	2.06	0	30
Number of External Ties that can take care of your kids/house	6761	1.91	2.04	0	20
Membership in Formal Networks: 1=Yes, 0=No	6782	0.32	0.47	0	1
Membership in Informal Networks: 1=Yes, 0=No	6777	0.28	0.45	0	1
Utility of microcredit activity: 1=very useful, 5=not useful	6766	1.26	0.49	1	3
Social sanctions for shirking: 1=Yes, 0=No sanction	6689	0.95	0.21	0	1

Willingness to help as compared to 10 yrs ago: 1=Less willing, 0=More or equally willing	6726	0.72	0.45	0	1
How much confidence in churches: 1=a great deal of confidence, 4=None at all	6646	2.35	0.97	1	4
Importance of access to credit in the future from Pro Mujer: 1= Very important, 5= Not important at all	6678	1.39	0.58	1	4
Borrower's Age	6741	40.41	11.72	18	78
Borrower lives in: 1=Urban, 0=Rural	6782	0.84	0.37	0	1
Number of years the borrower has been living in the current area	6742	22.94	14.88	0.17	75
Borrower's Status: 1=Married or Cohabitation, 0=Single, Divorced or Widow	6782	0.75	0.44	0	1
Borrower's Religion: 1=Catholic, 0=Other religions	6754	0.82	0.38	0	1
Borrower's Education	6775	3.19	1.02	1	6
Number of household members	6782	4.36	1.82	1	15
Number of HH members older than 60 years old	6570	0.36	0.68	0	5
Number of kids	6757	2.48	1.62	0	10
Number of HH members having a fixed income	6638	1.43	1.07	0	9
Borrower's weekly income	6522	1769.05	2074.43	0	24500
Current loan amount with Pro Mujer	6717	11324.89	8611.89	1000	62000
Do you have other loans? 1=Yes, 0=No	6762	0.40	0.49	0	1
Receive government help/subsidies: 1=Yes, 0=No	6782	0.18	0.38	0	1
Received remittances during the last 12 months: 1=Yes, 0=No	6356	0.07	0.25	0	1
Number of months the current loan officer has been in charge of the group	5926	14.43	10.68	1	72
Age of the Group (months)	6321	53.97	42.68	1	204
Number of members in the Group	6356	11.07	4.18	4	25
The Group was initiated by: 1=LO/Pro Mujer, 0=the borrowers themselves	6302	0.43	0.50	0	1

Net loan amount received by the whole group (in Pesos)	6242	115492.5	83227.6	11000	430000
Monthly interest rate for the current loan	6164	3.43	0.47	3	12
Number of installments	6242	10.82	2.46	2	24

\* The 761 strong internal ties from our sample are distributed between 299 borrowers (i.e. 299 borrowers have strong internal ties, the remaining being linked to their peers only by weak internal ties). The borrowers from our sample have between 0 and 14 strong internal ties, with a mean of 1.36.

**Table 9: Logit regression (dependent variable Repayment Problems: 1=Yes, 0=No), clustered by Group**

VARIABLES	(1) RepayProbl	(2) RepayProbl	(3) RepayProbl	(4) RepayProbl	(5) RepayProbl	(6) RepayProbl
Number Strong Internal Ties	-0.126* (0.0745)	-0.0646 (0.0926)	-0.0703 (0.0926)	-0.0360 (0.109)	-0.0851 (0.148)	-0.165 (0.127)
Number Information Channels		-0.00383 (0.0312)	-0.00790 (0.0363)	-0.00796 (0.0404)	-0.0101 (0.0349)	-0.0627 (0.0428)
Number Strong Information Channels		-0.107** (0.0528)	-0.101* (0.0582)	-0.149** (0.0665)	-0.269** (0.110)	-0.244** (0.105)
Number of External Ties that can lend a small amount of money			-0.0126 (0.0440)	-0.00974 (0.0460)	-0.00395 (0.00274)	-0.00755 (0.00759)
Number of External Ties that can lend a large amount of money			0.115 (0.0816)	0.105 (0.0830)	0.100 (0.0918)	0.259** (0.104)
Number of External Ties that can take care of your kids/house			-0.154 (0.112)	-0.136 (0.114)	-0.136 (0.113)	-0.374** (0.188)
Membership in Formal Networks: 1=Yes, 0=No			0.702* (0.373)	0.834** (0.416)	0.669 (0.435)	0.755 (0.590)
Membership in Informal Networks: 1=Yes, 0=No			-0.190 (0.394)	-0.270 (0.409)	-0.533 (0.462)	-1.711*** (0.664)

Utility of microcredit activity: 1=very useful, 5=not useful	-0.0160 (0.474)	0.0728 (0.476)	-0.262 (0.607)
Social sanctions for shirking: 1=Yes, 0=No sanction	-1.859*** (0.510)	-2.240** (0.872)	-4.159*** (1.222)
Willingness to help as compared to 10 yrs ago: 1=Less willing, 0=More or equally willing	0.162 (0.449)	-0.452 (0.469)	0.119 (0.665)
How much confidence in churches: 1=a great deal of confidence, 4=None at all	0.102 (0.194)	0.0138 (0.237)	-0.110 (0.240)
Importance of access to credit in the future from Pro Mujer: 1= Very important, 5= Not important at all	0.496 (0.377)	0.950** (0.457)	1.285** (0.623)
Borrower's Age		0.0137 (0.0200)	0.0196 (0.0257)
Borrower lives in: 1=Urban, 0=Rural		0.776 (0.670)	1.899** (0.924)
Number of years the borrower has been living in the current area		-0.0111 (0.0183)	-0.0140 (0.0247)
Borrower's Status: 1=Married or Cohabitation, 0=Single, Divorced or Widow		-0.447 (0.481)	-1.154** (0.582)
Borrower's Religion: 1=Catholic, 0=Other		0.557 (0.435)	1.288** (0.521)
Borrower's Education		0.565** (0.235)	0.556* (0.294)
Number of household members		-0.0972 (0.145)	-0.103 (0.130)
Number of HH members older than 60 years old		0.478* (0.235)	0.588* (0.294)

	(0.269)	(0.352)
Number of kids	0.288*	0.239
	(0.163)	(0.222)
Number of HH members having a fixed income	-0.312	-0.746**
	(0.252)	(0.308)
Borrower's weekly income	-0.000492**	-0.000701**
	(0.000247)	(0.000284)
Current loan amount with Pro Mujer	5.66e-05**	5.73e-05**
	(2.50e-05)	(2.89e-05)
Do you have other loans? 1=Yes, 0=No	0.422	1.146**
	(0.474)	(0.535)
Receive government help/subsidies: 1=Yes, 0=No	-0.276	0.0421
	(0.695)	(0.885)
Remittances during the last 12 months: 1=Yes, 0=No	1.822**	2.699***
	(0.739)	(0.893)
Number of months the current loan officer has been in charge of the group		0.0205
		(0.0231)
Age of the Group		-0.00928
		(0.0116)
Number of members in the Group		-0.222*
		(0.127)
The Group was initiated by: 1=LO/Pro Mujer, 0=the borrowers themselves		0.459
		(0.735)
Net loan amount received by the whole group		1.39e-05**
		(6.07e-06)
Monthly interest rate for the current loan		-0.257

						(0.237)
Number of installments						0.199** (0.0830)
Constant	-2.342*** (0.182)	-2.002*** (0.353)	-2.075*** (0.414)	-1.555 (1.091)	-4.237* (2.238)	-3.219 (2.241)
Observations	21,428	15,840	15,696	15,200	13,132	10,664
Pseudo R2	0.0070	0.0282	0.0611	0.1191	0.2667	0.4221

Robust standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 10: Robustness checks: Logit regressions (dependent variable Repayment Problems: 1=Yes, 0=No), clustered by Group, with cluster of internal ties by all combinations of five dimensions**

VARIABLES	(1) RepayProbl	(2) RepayProbl	(3) RepayProbl	(4) RepayProbl	(5) RepayProbl	(6) RepayProbl
Number Strong Internal Ties	-0.245 (0.163)	-0.222 (0.140)	-0.158 (0.127)	-0.173 (0.132)	-0.117 (0.0815)	-0.182 (0.134)
Number Information Channels	0.0191 (0.0383)	-0.0749 (0.0460)	-0.0609 (0.0430)	-0.0642 (0.0425)	-0.133** (0.0558)	-0.0633 (0.0430)
Number Strong Information Channels	-0.180** (0.0721)	-0.0813 (0.102)	-0.242** (0.104)	-0.203** (0.0875)	0.102** (0.0486)	-0.236** (0.102)
Number of External Ties that can lend a small amount of money	-0.00752 (0.0178)	-0.0117 (0.0838)	-0.00773 (0.00914)	-0.00797 (0.0110)	-0.00702 (0.00432)	-0.00764 (0.00767)
Number of External Ties that can lend a large amount of money	0.227*** (0.0873)	0.240 (0.151)	0.252** (0.103)	0.262** (0.104)	0.314*** (0.110)	0.263** (0.103)

Number of External Ties that can take care of your kids/house	-0.310** (0.125)	-0.447*** (0.169)	-0.376** (0.188)	-0.377** (0.188)	-0.410** (0.203)	-0.384** (0.187)
Membership in Formal Networks: 1=Yes, 0=No	0.947* (0.494)	0.902 (0.551)	0.783 (0.595)	0.744 (0.588)	0.848 (0.559)	0.742 (0.580)
Membership in Informal Networks: 1=Yes, 0=No	-0.886* (0.518)	-1.110* (0.671)	-1.672** (0.662)	-1.683** (0.658)	-1.535** (0.640)	-1.692** (0.664)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.270** (1.999)	-2.855 (2.355)	-3.095 (2.255)	-3.253 (2.198)	-4.604* (2.426)	-3.107 (2.229)
Observations	12,380	10,884	10,884	10,796	10,664	10,744
Pseudo R2	0.3499	0.3753	0.4237	0.4165	0.4026	0.4231

Robust standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Note: Each column shows the logit regression results for ties clustered along five dimensions as follows:

Column (1): Cluster of internal ties by the following five dimensions: type of relationship, frequency of meetings, duration of relationship, closeness of relationship and sharing.

Column (2): Cluster of internal ties by the following five dimensions: type of relationship, geographic proximity, duration of relationship, closeness of relationship and sharing.

Column (3): Cluster of internal ties by the following five dimensions: type of relationship, geographic proximity, meeting frequency, duration of relationship, and closeness of relationship.

Column (4): Cluster of internal ties by the following five dimensions: type of relationship, geographic proximity, meeting frequency, duration of relationship, and sharing.

Column (5): Cluster of internal ties by the following five dimensions: type of relationship, geographic proximity, meeting frequency, closeness of relationship and sharing.

Column (6): Cluster of internal ties by the following five dimensions: geographic proximity, meeting frequency, duration of relationship, closeness of relationship and sharing.

**Table 11: Results Rare Events Logit**

VARIABLES	(1) RepayProbl	(2) RepayProbl	(3) RepayProbl	(4) RepayProbl	(5) RepayProbl	(6) RepayProbl
Number Strong Internal Ties	-0.125*** (0.0155)	-0.0639*** (0.0179)	-0.0706*** (0.0185)	-0.0363* (0.0205)	-0.0838*** (0.0265)	-0.209*** (0.0308)
Number Information Channels		-0.00376 (0.00412)	-0.00812* (0.00443)	-0.00815* (0.00471)	-0.0101* (0.00522)	-0.0552*** (0.00763)
Number Strong Information Channels		-0.106*** (0.0100)	-0.100*** (0.0104)	-0.148*** (0.0131)	-0.267*** (0.0177)	-0.271*** (0.0191)
Number of External Ties that can lend a small amount of money			-0.00290* (0.00165)	-0.00256 (0.00156)	-0.00271** (0.00125)	-0.00511*** (0.00122)
Number of External Ties that can lend a large amount of money			0.104*** (0.0106)	0.0968*** (0.0110)	0.0982*** (0.0157)	0.208*** (0.0204)
Number of External Ties that can take care of your kids/house			-0.158*** (0.0196)	-0.140*** (0.0193)	-0.136*** (0.0224)	-0.386*** (0.0325)
Membership in Formal Networks: 1=Yes, 0=No			0.698*** (0.0613)	0.830*** (0.0674)	0.665*** (0.0796)	0.572*** (0.101)
Membership in Informal Networks: 1=Yes, 0=No			-0.182*** (0.0661)	-0.263*** (0.0723)	-0.530*** (0.0847)	-1.666*** (0.121)
Utility of microcredit activity: 1=very useful, 5=not useful				-0.0160 (0.0753)	0.0734 (0.0873)	-0.0310 (0.105)
Social sanctions for shirking: 1=Yes, 0=No sanction				-1.855*** (0.0955)	-2.227*** (0.132)	-3.986*** (0.215)
Willingness to help as compared to 10 yrs ago: 1=Less willing, 0=More or equally willing				0.159** (0.0739)	-0.451*** (0.0852)	0.103 (0.114)

How much confidence in churches: 1=a great deal of confidence, 4=None at all	0.101*** (0.0321)	0.0143 (0.0386)	-0.101** (0.0498)
Importance of access to credit in the future from Pro Mujer: 1= Very important, 5= Not important at all	0.496*** (0.0569)	0.945*** (0.0715)	1.285*** (0.0884)
Borrower's Age		0.0135*** (0.00400)	0.0225*** (0.00467)
Borrower lives in: 1=Urban, 0=Rural		0.771*** (0.114)	2.085*** (0.177)
Number of years the borrower has been living in the current area		-0.0110*** (0.00304)	-0.00377 (0.00357)
Borrower's Status: 1=Married or Cohabitation, 0=Single, Divorced or Widow		-0.444*** (0.0878)	-0.957*** (0.109)
Borrower's Religion: 1=Catholic, 0=Other		0.553*** (0.104)	1.155*** (0.140)
Borrower's Education		0.561*** (0.0414)	0.690*** (0.0529)
Number of household members		-0.0968*** (0.0221)	-0.102*** (0.0262)
Number of HH members older than 60 years old		0.475*** (0.0522)	0.680*** (0.0649)
Number of kids		0.287*** (0.0302)	0.340*** (0.0377)
Number of HH members having a fixed income		-0.310*** (0.0425)	-0.702*** (0.0592)
Borrower's weekly income		-0.000489*** (3.93e-05)	-0.000721*** (5.07e-05)

Current loan amount with Pro Mujer					5.64e-05*** (4.09e-06)	4.61e-05*** (6.05e-06)
Do you have other loans? 1=Yes, 0=No					0.421*** (0.0778)	1.052*** (0.0961)
Receive government help/subsidies: 1=Yes, 0=No					-0.272** (0.112)	-0.282* (0.152)
Remittances during the last 12 months: 1=Yes, 0=No					1.816*** (0.122)	2.735*** (0.159)
Number of months the current loan officer has been in charge of the group						0.0316*** (0.00457)
Age of the Group						-0.00665*** (0.00158)
Number of members in the Group						-0.171*** (0.0178)
The Group was initiated by: 1=LO/Pro Mujer, 0=the borrowers themselves						0.503*** (0.113)
Net loan amount received by the whole group						1.44e-05*** (9.25e-07)
Monthly interest rate for the current loan						-0.216*** (0.0525)
Constant	-2.342*** (0.0296)	-2.003*** (0.0573)	-2.074*** (0.0731)	-1.550*** (0.174)	-4.217*** (0.332)	-3.305*** (0.491)
Observations	21,428	15,840	15,696	15,200	13,132	10,664

Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 12: Coefficients' variation for main variables**

Variable	Coefficient without any control variable (1)	Coefficient full model (2)	(2)/((1)-(2))
Number Strong Internal Ties	-0.126	-0.165	-4.23
Number Information Channels	-0.0075	-0.0627	-1.14
Number Strong Information Channels	-0.1201	-0.244	-1.97
Number of External Ties that can lend a small amount of money	-0.0015	-0.00755	-1.25
Number of External Ties that can lend a large amount of money	0.0497	0.259	-1.24
Number of External Ties that can take care of your kids/house	-0.0793	-0.374	-1.27
Membership in Formal Networks: 1=Yes, 0=No	-0.0793	0.755	-0.90
Membership in Informal Networks: 1=Yes, 0=No	0.666	-1.711	-0.72

**Table 13a: Results of Clustering after Removing Ties Formed after Forming the Group**

Social Ties Cluster	Number of Ties
<b>Strong</b>	<b>1,604</b>
out of which:	
Internal Ties	519
Information Channels	1,085
<b>Weak</b>	<b>4,142</b>
out of which:	
Internal Ties	2,165
Information Channels	1,977

**Table 13b: Logit regression (dependent variable Repayment Problems: 1=Yes, 0=No), clustered by Group, with ties formed after forming the group removed**

VARIABLES	(1) RepayProbl	(2) RepayProbl	(3) RepayProbl	(4) RepayProbl	(5) RepayProbl	(6) RepayProbl
Number Strong Internal Ties	-0.221** (0.110)	-0.200 (0.162)	-0.270 (0.175)	-0.258 (0.203)	-0.780* (0.417)	-0.743* (0.416)
Number Information Channels		-0.0435 (0.0453)	-0.0475 (0.0546)	-0.0558 (0.0564)	-0.0521 (0.0409)	-0.112** (0.0495)
Number Strong Information Channels		-0.161** (0.0671)	-0.183** (0.0735)	-0.176** (0.0871)	-0.316*** (0.107)	-0.466*** (0.123)
Number of External Ties that can lend a small amount of money			-0.00509 (0.00716)	-0.00438 (0.00650)	-0.00464** (0.00218)	-0.00742*** (0.00239)
Number of External Ties that can lend a large amount of money			0.160* (0.0871)	0.139 (0.0918)	0.205* (0.107)	0.315*** (0.122)
Number of External Ties that can take care of your kids/house			-0.0579 (0.112)	-0.0325 (0.114)	0.000572 (0.152)	-0.0270 (0.268)
Membership in Formal Networks: 1=Yes, 0=No			1.209** (0.476)	1.300** (0.553)	1.416** (0.653)	0.998 (0.831)
Membership in Informal Networks: 1=Yes, 0=No			-0.613 (0.509)	-0.859* (0.512)	-1.829** (0.753)	-3.453*** (1.009)
Utility of microcredit activity: 1=very useful, 5=not useful				-0.0100 (0.490)	-0.180 (0.706)	0.623 (0.905)
Social sanctions for shirking: 1=Yes, 0=No sanction				-1.871*** (0.724)	-2.831*** (1.030)	-5.393*** (1.344)

Willingness to help as compared to 10 yrs ago: 1=Less willing, 0=More or equally willing	0.193 (0.501)	-0.478 (0.642)	0.0844 (1.087)
How much confidence in churches: 1=a great deal of confidence, 4=None at all	0.160 (0.283)	-0.396 (0.281)	-0.234 (0.343)
Importance of access to credit in the future from Pro Mujer: 1= Very important, 5= Not important at all	-0.0673 (0.423)	0.441 (0.500)	0.132 (0.607)
Borrower's Age		-0.00784 (0.0361)	-0.00368 (0.0441)
Borrower lives in: 1=Urban, 0=Rural		1.868** (0.928)	4.484*** (1.734)
Number of years the borrower has been living in the current area		0.00199 (0.0228)	0.00443 (0.0405)
Borrower's Status: 1=Married or Cohabitation, 0=Single, Divorced or Widow		-1.384** (0.614)	-2.192*** (0.830)
Borrower's Religion: 1=Catholic, 0=Other		0.650 (0.601)	2.398** (0.991)
Borrower's Education		0.569* (0.343)	0.596 (0.489)
Number of household members		0.0504 (0.151)	-0.0193 (0.180)
Number of HH members older than 60 years old		0.439* (0.265)	1.177** (0.480)
Number of kids		0.437*	0.802***

	(0.227)	(0.288)
Number of HH members having a fixed income	-0.761** (0.306)	-0.907** (0.398)
Borrower's weekly income	-0.000755** (0.000314)	-0.00131** (0.000640)
Current loan amount with Pro Mujer	5.30e-05* (2.99e-05)	2.75e-05 (7.12e-05)
Do you have other loans? 1=Yes, 0=No	1.536*** (0.561)	3.024*** (0.852)
Receive government help/subsidies: 1=Yes, 0=No	0.129 (0.719)	-0.0472 (0.976)
Remittances during the last 12 months: 1=Yes, 0=No	2.498** (0.999)	4.298*** (1.381)
Number of months the current loan officer has been in charge of the group		0.0780 (0.0677)
Age of the Group		-0.0378 (0.0337)
Number of members in the Group		-0.109 (0.175)
The Group was initiated by: 1=LO/Pro Mujer, 0=the borrowers themselves		0.977 (0.848)
Net loan amount received by the whole group		2.01e-05** (9.15e-06)
Monthly interest rate for the current loan		-0.105

						(0.275)
Number of installments						0.0941 (0.198)
Constant	-2.327*** (0.233)	-1.350*** (0.492)	-1.807*** (0.606)	-0.497 (1.465)	-1.717 (2.634)	-5.817 (4.394)
Observations	11,488	7,836	7,736	7,604	6,828	6,024
Pseudo R2	0.0166	0.0658	0.1468	0.1851	0.4186	0.5604

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Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

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