Bank-Borrower Relationships and Transition from Joint Liability to Individual Liability Loans in Microcredit

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November 2012

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Abstract

We use primary data from Bangladesh to examine whether the strength of bank-borrower relationships affects the process of a borrower's transition from joint liability to individual liability loans in microcredit. Using a survival analysis framework, we show that borrowers who maintain non-mandatory savings accounts with their microfinance institutions (MFIs), and those who borrow from a single MFI (i.e., do not have banking relationships with multiple MFIs), graduate from joint liability to individual liability loans with a relatively short repayment history. Our findings imply that MFIs have incentives to invest in relationship development with their clients in order to expedite the process of a borrower's transition from group to individual loans which, in turn, can reduce the incidence of voluntary drop-outs by mature borrowers.

1. Introduction

Microfinance institutions (MFIs) in Bangladesh extend group loans, with a joint liability clause, to most of their new clients. [1] Many of these borrowers, however, graduate to individual loans over time. For example, every year, 10-15 percent of the group borrowers of BURO (Basic Unit for Resources and Opportunities—an MFI based in Bangladesh) graduate to individual loans (see for example, BURO, 2007). Similar evidence is found in Bangladesh Rural Advancement Committee (BRAC), where borrowers graduate to individual loans after completing a few cycles of joint liability loans. In this paper we examine whether the strength of bank-borrower relationships affects the process of a borrower's transition from joint liability to individual liability loans in the microcredit sector. The special nature of bank-borrower relationships has been the subject of extensive research in finance.[2] One major benefit of relationship banking is that it creates room for flexibility in loan contracts that permits the utilization of subtle and non-contractible information (Boot, 2000). This paper contributes to this literature by showing evidence that relationship driven soft information substitutes for the need for joint liability in microcredit contracts and, thereby, expedites the process of a borrower's transition from joint liability to individual liability loan.

Although there exist a large number of theoretical and empirical papers on relationship banking, there is a distinct paucity of empirical research that substantiates the role that bank-borrower relationships might play in the microcredit sector. To the best of our knowledge, the study by Chakravarty and Shahriar (2011) is the lone exception. The present study, however, differs from the existing literature in that while Chakravarty and Shahriar (2011) provides evidence that the strength of banking relationships affects the availability of microcredit in Bangladesh, we focus on whether banking relationships might affect specific contractual features related to microloans. We do so using primary data compiled from 34

[1] Although some MFIs, such as the Association for Social Advancement (ASA—a large MFI in Bangladesh), provide individual loans only, lending with a joint liability contract is the most common form of micro-lending in Bangladesh. Under a joint liability contract, potential borrowers form groups and collectively apply for loans. If the loan application is approved, each member of the group individually receives a loan but the entire group remains jointly responsible for repayment. Thus, if one borrower fails to repay, her group members are contractually required to repay in her stead. Such repayments are enforced through the threat of denial of future credit to all members of the defaulting group, or by drawing on a group fund that serves as collateral (Fischer and Ghatak, 2011).

[2] Relationship banking refers to the process of multiple interactions between a borrower and a lender over time. Through relationship banking the lender gathers borrower-specific information, which is not publicly available and is proprietary in nature. Prior studies have identified several potential benefits of relationship banking. See, for example, Bharath et al. (2007 and 2011), Berger and Udell (1995, 2002), Chakravarty and Scott (1999), Chakravarty and Yilmazer (2009), Cole (1998), Cole et al. (2004), and Petersen and Rajan (1994).

randomly selected villages in Bangladesh. Our sample includes 334 active micro-borrowers, who either graduated from a joint liability to an individual liability loan within one year prior to the survey, or still had a joint liability loan when the survey was conducted in 2009. Other details pertaining to the data collection process are provided in section 4. In order to examine whether a strong bank-borrower relationship expedites the process of a borrower's transition from joint to individual liability loans, we applied a survival analysis model the details of which are provided in section 5.

The results from our empirical analysis show that (a) borrowers who maintain a non-mandatory savings account[3] with their MFI, graduate sooner to individual loans than those who do not have such accounts, and (b) those who borrow from a single MFI, graduate sooner to individual loans than those who simultaneously borrow from multiple MFIs. We also estimate the role of relationships using an instrumental variables (IV) technique in order to better address a potential endogeneity problem.[4] The use of the IV method makes it credible to assert that there is a causal relationship between bank-borrower relationships and the process of transition from joint liability to individual liability loans.

Microfinance loan officers view voluntary drop outs (from the credit program), by their mature (in terms of their borrowing history) borrowers, as a serious problem (see for example, Wright, 2000 and 2001; and Meyer, 2002). New borrowers typically have smaller loans compared to existing borrowers, and they (the new borrowers) need training to get familiar with the rules and regulation of the MFIs. Thus, borrower drop outs increase the training and administrative costs of the MFIs. Current research also shows that the presence of the joint liability feature in the loan contract is a major reason for voluntary drop outs by the mature borrowers.[5] The results of our study suggest that a strong banking relationship expedites the process of a borrower's graduation from joint to individual liability loans. This, in turn, is expected to reduce voluntary drop outs by the mature borrowers, who do not like joint liability and seek greater flexibility associated with individual loan contracts. Thus, an implication of our findings is that both the borrowers and the lenders in the microcredit sector

[3] Borrowers from most of the MFIs in Bangladesh have to maintain a mandatory savings account in order to receive a micro loan. In addition to the mandatory savings, MFIs offer other non-mandatory savings schemes to their clients.

[4] We discuss the potential endogeneity problem and the choice of instrumental variables in detail in section 6.

[5] In 1995, the field staff of ASA conducted a study to identify the factors that drive the decision to exit microcredit programs (ASA, 1996). It has been found that the presence of joint liability in the loan contract is one of the main causes behind voluntary drop outs. Furthermore, based on information from secondary sources, Wright (2001) shows that more than 60 percent of the borrowers who drop out voluntarily from BRAC, do so because they do not like joint liability. Similar evidence is found in the Women's World Banking Report (2003).

have incentives to invest in relationship development in order to expedite the transition to individual loans.

The remainder of this paper is structured as follows: In section 2, we review the background literature. In section 3, we develop a simple model to formalize the effect of bank-borrower relationships in the transition from joint to individual loans. In section 4, we describe the data and variables. In section 5, we construct our empirical framework. In section 6, we present the findings of our empirical analysis. Finally, we conclude in section 7.

2. Background Literature

The theoretical literature on microcredit suggests that joint liability can mitigate adverse selection and moral hazard problems in the rural credit markets (see for example, Stiglitz, 1990; Varian, 1990; Ghatak and Guinnane, 1999; Armendariz de Aghion, 1999; and Ghatak 1999 and 2000). In fact, there is a widespread consensus among the researchers and policy makers in that it is the "discovery" of joint liability that made microcredit popular around the world (Armendariz de Aghion and Morduch, 2010). The recent trend in microcredit, however, suggests that, in spite of its apparent attractiveness, joint liability is losing popularity as the microfinance community is increasingly being aware of the hidden costs associated with such contracts (see, for example, Gine and Karlan, 2010).

Joint liability imposes a hidden cost to the borrowers as they have to bear the added responsibility of repaying the defaulting group member's loans. Furthermore, although some researchers (see for instance, Stiglitz, 1990) have assumed that peer monitoring is a costless byproduct of living in close proximities, in practice, however, peer monitoring is not costless no matter how close the group members live (Armendariz de Aghion, 1999). Finally, imposing social sanctions on the defaulting group members under joint liability contracts is costly as it deteriorates the development of social capital in the long run. Thus, it is not surprising to see why more than 70 percent of the group borrowers of the Women's World Banking affiliates in Bangladesh and Uganda revealed their preference for individual loans (Women's World Banking, 2003).

Additionally, the joint liability feature imposes hidden costs on the lenders because it may deteriorate their clients' incentives to repay their loans. First, a borrower's reliance on fellow group members to repay loans opens the door to free riding, causing the default rates to rise (Abbink, Irlenbusch, and Renner, 2006). Second, if within a group, one member's project succeeds and the others' fail, the former (who may have otherwise repaid under

individual contracts) may decide to default strategically, (see, for example, Besley and Coate, 1995; and Paxton, Graham, and Thraen, 2000). All of these factors may help explain why many major microfinance institutions have recently expanded into, or converted their portfolios to, individual liability loans (Armendariz de Aghion and Morduch, 2010). The current study, however, differs from this literature in that while previous research has primarily focused on the merits and demerits of joint liability over individual liability loans, we focus on the question of how, over time, micro-borrowers might graduate from one kind of loan to the other.

Several studies have examined similar graduation processes in the conventional credit markets. Notable examples are Diamond (1991) and Boot and Thakor (1994). Diamond, for instance, theorizes that new firms borrow from banks until they establish a good reputation in the credit market by repaying the monitored loans. Since reputation is a valuable asset, firms that build reputation have an incentive to protect it. As a result, these firms show greater prudence in their investment decisions, reducing the moral hazard problem and the associated credit risks faced by the bank. Diamond assumes that borrower's reputation is portable. Thus, borrowers can use their reputation in the private debt market to secure low-cost financing from the public debt market. In Boot and Thakor's model, new borrowers get secured loans from banks with above-market borrowing costs. Once these borrowers develop a reputation by repaying loans, they are offered loans at below-market borrowing costs without any collateral.

We argue that a similar reputation effect may be at play in the process of graduating from joint to individual liability loans in the microcredit sector. So, for instance, when an MFI extends group loans to its new clients, group members monitor each other's activities and exert pressure on those who misuse their funds. However, when these borrowers successfully complete a few loan cycles and establish a good reputation, they invest funds diligently in their own interest, and without any peer pressure. They do so in order to protect their valuable reputational capital, which can be used as a certification measure in the credit market. The MFIs then extend individual loans to these borrowers without increasing their credit risks.

It is, however, worth underscoring that in both of the above mentioned models, the development of reputational capital depends on the length of an uninterrupted repayment record. When a lender is uncertain about a borrower's type, the repayment of a loan revises upward the lender's belief about the creditworthiness of the borrower. As a result, borrowers with good repayment records receive loans with flexible terms and conditions. In the context

of microcredit, if the reputational capital (as evidenced by the borrower's uninterrupted repayment record) is the only factor that affects the transition from joint to individual liability loans, we should observe a certain threshold number of loan cycles after which every borrower would graduate from joint to individual liability loans. This is due to the fact that microloans in Bangladesh are typically extended with a fixed one year-contract, and that borrowers lose access to all kind of future loans from the same lender upon one single default. In practice, however, we are not aware of any such fixed threshold number of loan cycles, which implies that some borrowers receive individual loans with a relatively shorter repayment track record than others. For example, the length of repayment record that the group borrowers of BURO Bangladesh require to graduate to individual loans varies from one to eight years (BURO, 2007).[6] This implies that the magnitude of reputation effect (on the likelihood of transition form joint liability to individual liability loans) varies from client to client in the microcredit sector.

In the context of the conventional credit markets, Vercammen (1995) has shown that the magnitude of the reputation effect depends on the availability of information about a borrower's type. When a bank has little to no information about the borrower's type, it relies substantially on the value of the reputational capital, evidenced by the borrower's repayment record, in order to offer any flexibility in the loan contract. However, as client-specific information is generated over time, the importance of reputation gradually declines in updating the lender's belief about the borrower's type. In the limiting case, when the lender has perfect information about a borrower's type, the reputation effect may disappear altogether. The typical clientele of microcredit lack formal certification measures to offer to the lenders. For example, their clients do not have credit scores nor do they have formal financial statements. Moreover, they cannot offer assets to pledge against their loans. Therefore, the MFIs cannot collect client-specific information using conventional transactions-based methods.[7] Based on evidence from Bangladesh, Chakravarty and Shahriar (2011) have shown that, in the absence of transactions-based lending technology, MFIs rely substantially on lending relationships in extending loans. In relationship based lending, lenders invest in developing close ties with their borrowers, which produce valuable client-specific information of the type that is not readily observed (i.e., soft). Such information

[6] Copestake (2002) shows similar evidence that some group borrowers in the Zambian microcredit sector graduate sooner to individual loans than the others.

[7] In the transactions-based technology, lenders collect information from the borrower's credit scores, financial statements, and the amount of assets offered as collateral (Berger and Udell, 2002).

serves to predict future repayment behavior of the borrower without joint liability. Thus, we expect that borrowers with stronger relationship metrics might require a shorter repayment record to graduate to receiving an individual loan. This is the testable implication of the current paper, and is the focus of our empirical analysis. The next section formally develops the testable hypotheses.

3. The Model

Following Ghatak (2000), we consider a simple model of a competitive credit market where the lending side is represented by many profit maximizing MFIs and the borrowing side is represented by many utility maximizing borrowers.[8] Each borrower has one unit of labor and needs one unit of capital to invest in a project. Borrowers lack sufficient wealth and, therefore, need to borrow from the MFIs to launch projects. Upon receiving a loan, a borrower can undertake any one of the two projects: a relatively safe project that yields, if successful, a return of Y_S; and a relatively risky project that yields, if successful, a return of Y_R. If a project fails, the return is zero. The probability of success for each project is P_S and P_R, where

$$0 < P_R < P_S < 1 \qquad (1)$$

Following Stiglitz and Weiss (1981), we assume that safe and risky projects have the same mean return, but risky projects have a greater spread around the mean.[9] That is,

$$P_S\, Y_S = P_R\, Y_R \qquad (2)$$

We further assume that the project outcome (success or failure) is independently distributed for the same type as well as across different types of borrowers.

Borrowers do not have any formal certification measures, such as credit history or financial statements, to prove their creditworthiness in the loan application stage. Furthermore, the investment project chosen by a borrower, in the loan utilization stage, is not

[8] Specifically, we modify Ghatak's model to capture the effects of reputational capital in the microcredit sector.

[9] When this assumption holds, the credit market is characterized by an *under investment problem*, where lenders ration credit. In contrast, De Meza and Webb (1987) assume that both the safe and risky projects yield the same return when successful, but the risky projects have lower mean returns than the safe projects. Under this latter assumption, the credit market is characterized by an *over investment problem* because the risky borrowers are subsidized by the safe borrowers. It is worth underscoring that these two distinct assumptions can lead to different outcomes in the credit market. However, since existing evidence suggests that there is an unmet need for microcredit (see for example, Evans, Adams, Mohammed and Norris, 1999; and Meyer, 2002), we assume that there is credit rationing in this market. Our specific assumption therefore follows naturally.

observed by the MFI. That is, the credit market is characterized by both adverse selection and moral hazard problems. The use of collateral—a common solution to address information problems—is not feasible as the borrowers do not have any assets to pledge their loans. An MFI does two things under such a situation. First, it treats all borrowers identically and offers the same loan contract. Second, it adopts indirect mechanisms to address the information problems such that, when a borrower accepts the loan contract, she chooses specific actions in her own interest that serves to reduce the probability of default. One such mechanism offered by a lender is to offer credit under a joint liability contract. However, due to the hidden costs associated with joint liability, both the MFI and the borrowers prefer individual loans. But since individual loans do not induce any indirect mechanisms to address the information problems, such as peer screening and peer monitoring, initially the MFI offers only joint liability loans to all its borrowers. This leaves the borrowers with two options: they can either accept a joint liability loan contract, or they can reject the offer and forgo a valuable investment opportunity.

Once the borrowers accept a joint liability loan contract, they form homogeneous risk groups using locally available information through a mechanism known as positive assortative matching (see, for example, Siglitz, 1990; and Ghatak, 1999 and 2000). That is, borrowers who have access to safe investment projects form groups among themselves leaving those with risky projects to form groups with similar risk-type partners.[10]

Repayment of a loan is a function of project outcome. Thus, if the project of a specific borrower fails, she cannot make any repayment as she lacks sufficient wealth to do so. If a borrower is unable to make repayment, and as a result, the loan is overdue for more than a year, the loan is declared as a 'bad loan' by the MFI, against which 100 per cent provision is to be made.[11] In our model, a borrower, whose loan has been declared as a bad loan, is said to have defaulted on her loan. It is worth underscoring that, typically, no further loan is extended to such borrowers by the same MFI. We assume that the outcome of a project of a borrower is observable and verifiable by the MFI at no cost. Moreover, the costs to enforce

[10] Prior research has shown that heterogeneous risk groups may also emerge in microcredit if group members transfer resources among themselves for purposes of risk sharing (see for example, Sadoulet, 1999; Sadoulet and Carpenter, 2001; and Chakravarty and Shahriar, 2011(b)). In the present model, however, we do not introduce intra-group resource transfer, and thus, rule out the possibility of heterogeneous group formation.

[11] This guideline is provided by the Microcredit Regulatory Authority of Bangladesh (see, for example, MRA, 2012) as a regulatory requirement.

repayment (if a project succeeds) are negligible. Thus, we rule out the possibility of strategic default by the borrowers.

If, on the other hand, the project is successful, the borrower makes a repayment of $r > 0$ to the MFI. Due to the joint liability clause, if the project of a specific borrower succeeds and that of one (or more) of her partners fails, in addition to her individual liability payment, r, the borrower is contractually required to pay a joint liability payment in order to bail out her defaulting peer(s). By the same token, if the project of a borrower fails but that of her partners succeed, she is bailed out by her peers. If a borrower fails to repay her loan, her borrowing partners, as a group, have to contribute c in order to bailout their defaulting partner. Here, c is constant for a given loan size, interest rate, and other service charges.

Upon successful repayment of a loan, a borrower accumulates a reputation in the credit market, which can be used as a certification measure of her creditworthiness in the future. Let V represent the present value of future rents from such reputational capital, which depends on the length of an uninterrupted repayment record, l. When a borrower does not have any repayment record (*i.e.*, when $l = 0$), the value of reputational capital is also zero. The value of reputation, however, increases with successful repayment of loans. Thus, as the length of repayment record increases, the value of V also goes up at a decreasing rate (*i.e.*, $V'(l) > 0$ and $V''(l) < 0$).

We can now derive the expected payoff function of a borrower. Let us consider a borrower who invests in a safe project. Through the mechanism of positive assortative matching, she forms group with N borrowing partners, all of whom invest in safe projects (this implies a borrowing group of size N +1). Under a joint liability contract, if a borrower invests in a safe project, her expected payoff is given by:

$$U_S = P_S \sum_{i=0}^{N} \binom{N}{i} P_S^i (1-P_S)^{N-i} \left[Y_S - r + V - \frac{(N-i)c}{1+i}\right] + (1-P_S) \sum_{i=1}^{N} \binom{N}{i} P_S^i (1-P_S)^{N-i}[V] \quad (3)$$

Equation (3) captures all possible combinations of a borrower's payoff—starting from the case where all the members of a group successfully repay their loans to the case where all the members fail to make a repayment. In appendix A, we provide an example where the borrowing group consists of three members.

The first part of the right hand side of equation (3) denotes the payoff of the borrower when her project is successful (which happens with a probability P_S), and the second part denotes the payoff when her project fails (which happens with a probability $1 - P_S$). In both

cases, *i* denotes the number of borrowing partners whose projects are successful, irrespective of the borrowers' own project status. Thus, if $i = 2$, for example, it means two out of N partners of the borrower have succeeded.

If the project of the borrower succeeds, it yields Y_S. In this case, the borrower repays her individual liability payment (*r*) to the bank and, in return, gains V in terms of reputational capital. In addition, the borrower needs to repay a joint liability payment to bailout her defaulting peers. We assume that, if successful, a project yields sufficient return to make both the individual and joint liability payments (*i.e.,* $Y_S \geqslant r + Nc$)[12]. The joint liability payment to bail out the defaulting peers in a group, however, is split equally among the successful members of the group. Thus, the borrowers' share of joint liability payment is given by $(N - i)c/(1 + i)$. If the project of the borrower fails, it does not yield any return, and the borrower does not repay the individual liability component of her loan. Moreover, in this case, she does not contribute to bailing out any defaulting peer. But if at least one of her partners succeeds, the successful partner makes repayment on her behalf due to the joint liability clause of the loan contract. This raises the value of her reputation to the lender by V. This indicates a noteworthy feature of a joint liability contract. Under such contracts, if a borrower fails to make any repayment but her borrowing partners make repayment on her behalf, she (the defaulting member of the group) still accumulates a good reputation in the credit market because, at the end of the day, the MFI only cares about overall repayment of a borrowing group which is captured in the second part of the right hand side of equation (3). This is due to the fact that when the project of the borrower fails, $i = 0$ implies that none of the members of her group would repay on her behalf, and thus, the borrower would not gain anything in terms of reputational capital (*i.e.*, $V = 0$).

Similarly, we can derive the expected payoff of a borrower when she (and her partners) invests in a risky project as follows:

$$U_R = P_R \sum_{i=0}^{N} \binom{N}{i} P_R^i (1 - P_R)^{N-i} \left[Y_R - r + V - \frac{(N-i)c}{1+i} \right] + (1 - P_R) \sum_{i=1}^{N} \binom{N}{i} P_R^i (1 - P_R)^{N-i} [V] \quad (4)$$

In this framework, a borrower will invest in a safe project only if $U_S \geq U_R$. In a group of two borrowers, this can be reduced to the following condition:

$$P_S P_S (Y_S - r + V) + P_S (1 - P_S)(Y_S - r - c + V) + (1 - P_S) P_S (V)$$
$$\geq P_R P_R (Y_R - r + V) + P_R (1 - P_R)(Y_R - r - c + V) + (1 - P_R) P_R (V) \quad (5)$$

[12] This is also true with the risky projects, *i.e.,* $Y_R \geq r + Nc$

By solving this inequality condition, we find that a borrower invests in a safe project only if the following condition is met:

$$c \geq \frac{1}{P_S+P_R-1}[r + V(P_S + P_R - 2)] \quad (6)$$

Our model depicts a competitive credit market, where the lending side is characterized by many profit maximizing MFIs. Suppose an MFI's opportunity cost of capital is given by ρ. The zero profit constraint of the MFIs requires that the expected repayment from each loan be equal to the opportunity cost of capital. Let us denote (*r, c*) as the contract that satisfies the zero profit condition for both safe and risky borrowers. That is, (*r, c*) satisfies the following conditions in a group of two members:

$$r\,P_S + c\,(1 - P_S)P_S = \rho \quad (7)$$

$$r\,P_R + c\,(1 - P_R)P_R = \rho \quad (8)$$

By solving equations (7) and (8), we get:

$$r = c\,(P_S + P_R - 1) \quad (9)$$

Equation (9) implies that if $r > 0$, in order to rule out a negative joint liability payment, we must have $P_S + P_R - 1 > 0$.[13] Furthermore, the assumption that $0 < P_R < P_S < 1$implies that $P_S + P_R - 2 < 0$. These two conditions together imply that for a given value of *r*, *c* is decreasing in *V*. Therefore, for a sufficiently large value of reputational capital, the MFI can set $c = 0$ and still make sure that the loans are invested in safe projects. Particularly, when $V = kr$, where $k = 1/(2 - P_S - P_R)$, is some constant, the MFI can remove the joint liability feature altogether from the loan contract. To understand the intuition behind this, suppose a borrower enters the credit market and receives her first joint liability loan at period $t = 0$. This new borrower is not afraid of losing reputation in the credit market because she has not yet established any (*i.e.*, $V = 0$). Therefore, she may lack an incentive to invest in a safe project in order to increase the likelihood of repayment. Accordingly, the MFI sets $c > 0$ (*i.e.*, it extends loans with joint liability) so that the borrower feels peer pressure from her group members to invest in a safe project. However, once this borrower establishes a certain threshold level of reputation (*i.e.*, $V = kr$), she invests in a safe project on her own interest,

[13] Ghatak (2000) assumes similarly in his study.

without the need for any peer pressure, in order to protect her valuable reputation by decreasing the likelihood of default. At this point, the MFI can offer her individual loans without increasing credit risk. Let us denote this threshold level of reputation as $\bar{V}$. As mentioned earlier, the value of reputation in the credit market depends on the length of an uninterrupted repayment record. Suppose $\bar{l}$ denotes the length of repayment record that a borrower needs in order to accumulate the threshold level of reputation, $\bar{V}$.

Anecdotal evidence, however, suggests that the value of $\bar{l}$—in other words, the magnitude of the reputation effect—varies from borrower to borrower within the same MFI. As we mentioned earlier, the magnitude of a reputation effect in the credit market depends on how much information the lender has about a borrower's creditworthiness. Borrowers who have a strong relationship with their bank are informationally more transparent, which leaves room for the lender to make changes in loan terms. As a result, the transition from joint to individual liability loans might be fast-tracked for such borrowers.

In order to capture for the strength of banking relationships, prior research has suggested looking at the number of financial services that a borrower receives from a bank (see for example, Berger and Udell, 1995; and Chakravarty and Scott, 1999). A typical MFI in Bangladesh provides two major financial services, other than credit, to its clients—savings and insurance. While having a mandatory savings account is a pre-requisite for applying for microcredit in most cases, having a non-mandatory savings account is indeed a choice variable. Accordingly, we introduce (the maintenance of) a non-mandatory savings account as a relationship proxy. Buying insurance, however, is not a pure choice variable. Insurance schemes are available only beyond a certain threshold level of loan. As a result, we choose to not include (the purchase of) insurance as a relationship variable. By maintaining savings accounts that are not prerequisites to receive loans, borrowers reveal information about their financial strength and fiscal discipline. Thus, MFIs may offer individual loans to those who have maintained a non-mandatory savings account with a relatively shorter repayment record. This leads us to the first testable proposition of the paper.

> *Proposition (a): Borrowers who maintain a non-mandatory savings account are likely to graduate sooner from joint to individual liability loans compared to those who do not have such accounts with their MFI.*

A common feature of microcredit is the so-called progressive lending, where borrowers have the option of receiving a larger loan upon successful repayment of a given loan. Default on any single loan, on the other hand, terminates the lending relationship. In the

absence of any legal mechanism to induce repayment, this "carrot" works as a major borrower disciplining device. However, if a borrower has loans from multiple MFIs, the threat of denial of future credit loses its teeth. Hence, the MFIs always prefer to lend to those who have associations with a single MFI (see, for example, Meyer, 2000). These borrowers (with single banking relationships) are more inclined to maintain a long term relationship with their MFIs in order to ensure an uninterrupted supply of bank loans. As a result, they are more likely to invest in a safe project to enhance the likelihood of repayment, irrespective of the lending methodology. Therefore, MFIs may offer individual loans to these clients with a relatively shorter repayment record. This leads us to the second testable proposition.

> *Proposition (b): Clients who borrow from a single MFI are likely to graduate sooner from joint to individual liability loans compared to those who borrow from multiple MFIs.*

4. Data and Variables

We use a data set that was compiled based on a household survey of 34 randomly selected villages conducted in Bangladesh over the summer of 2009.[14] A multi-stage sampling method was used to select the specific villages to survey. In the first stage, the following six districts were chosen randomly from the six administrative divisions of the country in order to collect data from a representative sample: Mymensingh, Rajshahi, Meherpur, Barisal, Maulavibazar and Chittagong.[15] In the second stage, two counties were selected from each of the six districts as follows. First, all of the counties in each district were ranked based on population density, but only after excluding counties that are part of district headquarters, or other municipality areas, in order to avoid urban population.[16] Next, one

[14] Chakravarty and Shahriar (2011) have used the same data set.

[15] In 2009, Bangladesh was divided into six administrative divisions. The six divisions were divided into 64 districts, 491 counties or sub-districts, and 4,498 unions—a union being the lowest administrative unit in the rural areas, consisting of a group of villages. However, in early 2010, the old Rajshahi division was divided into two divisions: Rangpur and Rajshahi. Accordingly, there are now seven administrative divisions in Bangladesh.

[16] The theoretical models on group lending described above are based on a crucial assumption that the group borrowers have the necessary information on each other, which they exploit in forming groups and obtaining loans. This assumption, although appropriate in the rural areas of Bangladesh, is often violated in the urban settings where people living in close proximity do not know each other well. Laffont and N'Guessan (2000) provide evidence that when group members do not know one other, the collateral effect of group lending does not work. Therefore, we felt that including urban settings in our survey design would introduce noise in the data without an obvious upside.

county was randomly selected from those that had more than the median population density, and one was randomly selected from those that had less than the median population density. In the third stage, one union was randomly selected from each of the 12 counties but only after excluding unions that are part of county headquarters. In the fourth stage, three villages were randomly selected from each of the 12 unions. The only exception was Meherpur district, where 2 villages were randomly selected from each county. More detailed on the sampling method has been discussed in Chakravarty and Shahriar. Our sample includes 334 active micro-borrowers (*i.e.,* they had ongoing loans with the MFI when the survey was conducted). Out of these 334 borrowers, 82 graduated from joint to individual liability loans within one year prior to the survey. The rest 252 borrowers started with joint liability loans and still had the same when the survey was conducted.

A noteworthy feature of micro-lending in Bangladesh is that if a borrower defaults on a loan obligation (*i.e.,* if a loan is overdue for more than a year), no further loan is extended to that borrower, and as a result, the banking relationship between the borrower and the MFI is terminated. Therefore, for active micro-borrowers, the length of membership with their MFIs can be used as a proxy for the length of an uninterrupted repayment record. In our survival analysis model, for borrowers who graduated to individual loans, the length of membership is measured at the point they received their first individual loan, as a proxy for the length of repayment record that the borrowers needed to graduate. For the borrowers who did not graduate (*i.e.,* who still had a group loan), the length of membership is measured at the point they received their most recent joint liability loans as a proxy for the length of repayment record. The explanatory variables that are of primary interest in this study are those which measure the strength of bank-borrower relationships in the microcredit sector. We use two particular measures to estimate the strength of banking relationships for a given borrower— maintenance of a non-mandatory savings account and the presence of a single banking relationship.

We are unaware of any theoretical or empirical study, which can guide to choose the set of control variables that might affect the timing of transition from joint to individual liability loans in microcredit. Armendariz de Aghion and Morduch (2010), however, identify some borrower, MFI, and community specific features that distinguish group loans from the individual loans. Based on evidence from 74 group and 73 individual lending programs across the world, they have for instance, shown that (a) MFIs are more likely to extend individual loans to their relatively well-off clients; (b) individual loans are more common in sparsely populated regions; and (c) MFIs using individual lending methodology tend to be

smaller in size (in terms of outreach). We expect that the same factors might affect the process of transition from joint to individual liability loans. We have also introduced the frequency of repayment as a control variable in our survival analysis. Typical microcredit contracts require weekly repayment of loans in small installments. Although frequent repayment schedule increases the transaction costs, MFI loan officers believe that it is critical for the success of their programs (see for example, Yunus, 2004).[17] The expected impact of repayment frequency on the process of transition, however, is not clear. On one hand, microfinance practitioner's belief that a less frequent repayment schedule (for example, bi-weekly or monthly, as opposed to weekly) may increase delinquencies and defaults may induce the MFIs to delay in offering individual loans to the borrowers who repay their loans with a less frequent schedule. On the other hand, a borrower who has a successful repayment record with a lower repayment frequency relative to an otherwise identical borrower with a higher repayment frequency has demonstrated that she can handle higher risk, and therefore, may be eligible to graduate to an individual loan sooner.

<Table 1 here>

Table 1 shows the formal definitions of the independent variables introduced in the analysis. SAVINGS is measured as a dummy variable that equals one if the borrower has maintained a non-mandatory savings account with the MFI, and zero otherwise. SINGLE_BANK_RELATIONSHIP is defined as a dummy variable that equals one if a borrower has banking relationships with one MFI and zero if she borrows from multiple MFIs. Ownership of tangible assets (ASSET), such as land, home, livestock etc., is measured in terms of the market value of assets owned by the borrower's household divided by the number of household members. In regression analyses, we use the natural logarithm of one plus the market value of household assets in order to control the skewness in the ownership of assets and to include households without any tangible assets. We define large MFIs

[17] Empirical evidence provides support of this belief of microfinance practitioners. For example, when BRAC experimented with moving from weekly to bi-weekly repayment schedule in Bangladesh, delinquencies increased significantly (Armendariz de Aghion and Morduch, 2010). Satin Credit Care, an urban MFI in north India, experienced increasing delinquencies when it experimented with a move from daily to weekly repayment (Fischer and Ghatak, 2011). Field and Pande (2008), however, conducted a randomized controlled experiment with the clients of the Village Welfare Society in India, and found no significant impact of repayment frequency on loan repayment rates. Fischer and Ghatak have argued that the loan size in the Field-Pande experiment was, probably, too small to create any temptations to default.

(LARGE_MFI) as those which have more than one hundred thousand active members. We choose this cutoff value based on the definition of large MFIs provided by the Bangladesh Microcredit Regulatory Authority (2008).[18] Population density (DENSITY) per square kilometer is estimated at the county level. The data on population density is collected from the Community Series of the Bangladesh Population Census Report-2001 (Bangladesh Bureau of Statistics, 2005). Finally, the dummy variable, WEEKLY_REPAYMENT equals one if the borrower repays loan on a weekly basis, and zero otherwise.

5. Estimation

In this section, we estimate the duration of an uninterrupted repayment record that a borrower needs to graduate from joint to individual liability loans. The appropriate method to study durations of any kind is estimating a survival model (see for example, Kiefer, 1988; Meyer, 1990; and Lancaster, 1990). Following the standard notation of survival analysis models, let T_j denote the duration of borrower *j*'s spell with joint liability loan. The probability that *j* would graduate to individual loan within a short interval of time, (*t, t+dt*), conditional on the fact that she has not graduated as of period *t*—also known as the hazard[19] function—can be calculated as follows:

$$h_j(t;\, \boldsymbol{X_j}) = \lim_{dt \to 0} \frac{P(t \le T_j < t+dt \,|\, T_j \ge t; \boldsymbol{X_j})}{dt} \qquad (10)$$

Here, **X** is the vector of covariates that are likely to affect the duration of a spell. In this case, **X** includes covariates that may affect the duration of an uninterrupted repayment record that a borrower needs to graduate to an individual loan, such as the strength of bank-borrower relationships.

[18] Bangladesh Microcredit Regulatory Authority (2008) categorizes the MFIs into five groups based on borrower outreach: (a) very large MFIs with more than one million active members, (b) large MFIs with more than hundred thousand but less than a million active borrowers, (c) medium MFIs with more than fifty thousand but less than hundred thousand members, (d) small MFIs with more than ten thousand but less than fifty thousand members, and (e) very small MFIs with less than ten thousand active members.

[19] It is worth underscoring that the survival analysis model, which owes its origin to medical research, has primarily been used to examine the factors that affect the duration of life of a cancer patient (see for example, Collet, 2003). In survival analysis, therefore, it is standard practice to note the conditional probability of an event (which is the death of a patient) as the "hazard of the event". Labor economists, for example, used the term "the hazard of getting employed" while looking at the duration of unemployment (see for example, Meyer, 2001) although getting employed is a positive attribute while hazard has a negative connotation. In the present study, we used terms, such as, "the hazard of graduation," and "the risk of graduation" in order to be consistent with standard notation.

To examine the effects of the covariates on the duration of a spell, previous researchers have used a proportional hazards model, which assumes that the covariates act multiplicatively on some underlying baseline hazard—the hazard rate when all the covariates are set equal to zero (see Kiefer (1988) for a review of the applications of survival models). An important specification issue in a proportional hazards model is the distributional assumptions regarding duration (or, equivalently, the distributional assumptions regarding the baseline hazard). The distribution of the hazard may be assumed to be parametric or nonparametric. A problem with the parametric approach is that there is little theoretical support for any particular parametric shape of the baseline hazard and, when the assumed parametric form is incorrect, it inconsistently estimates the covariate effects. On the other hand, if one uses a nonparametric baseline hazard when a particular parametric form is appropriate, the resulting estimates are consistent and the loss of efficiency (resulting from disregarding information about the base line hazard's distribution) may not be very substantial (Meyer, 1990). Therefore, the use of a nonparametric proportional hazard model is a reasonable starting point in any survival analysis. Accordingly, we start with estimating the Cox proportional hazards model (Cox, 1972) in order to estimate the hazard rates and the factors affecting it. This model asserts the hazard for the j^{th} borrower is as follows:

$$h(t|\boldsymbol{X}_j) = h_0(t)\exp(\boldsymbol{X}_j\beta_x) \tag{11}$$

Here, $h_0(t)$ is the baseline hazard, and the regression coefficients β_x are estimated from the data. The advantage of the Cox model is that it does not require any parameterization of the baseline hazard, and that no restrictions are imposed about the shape of hazard over time.

We have also used parametric models in order to check whether our results are sensitive to the choice of a particular assumption regarding the distribution of the baseline hazard. The two most common distributions used in survival models are the exponential and Weibull models (Gompers, 1995). The exponential model is the simplest form of parametric hazard models because it assumes that the baseline hazard is constant. Particularly, in exponential models, the hazard function is estimated as follows:

$$h(t|\boldsymbol{X}_j) = h_0(t)\exp(\boldsymbol{X}_j\beta_x) = \exp(\beta_0)\exp(\boldsymbol{X}_j\beta_x) \tag{12}$$

Here β_0 is some constant. A potential problem with the exponential model is that the hazard function of such models reflects no duration dependence.[20] In the present case, however, the likelihood of graduation to individual loans is expected to increase over time as the duration of repayment record increases, holding everything else equal. Therefore, we expect that the hazard would reflect positive duration dependence in our data. When the hazard is duration dependent (either positive or negative), the Weibull distribution fits the model better as it allows the hazard function to increase or decrease over time (see for example, Meyer, 1990; Lancaster, 1990; and Gompers, 1995).[21] In the Weibull model, the baseline hazard is estimated as follows:

$$h_0(t) = \gamma\alpha t^{\alpha-1} \qquad (13)$$

Here, γ and α are ancillary parameters. The hazard function is increasing in duration if $\alpha > 1$, decreasing if $\alpha < 1$, and constant if $\alpha = 1$. Duration dependence does not depend on the value of γ. The value of γ depends on the explanatory variables. In the next section, we report the results of our empirical analyses.

6. Results

An illustration of the pattern of graduation from joint to individual liability loans can be seen in Table 2, which reports the Kaplan-Meier (KM) estimate of the empirical hazard rates. The empirical hazard at time *t,* H_t, is given by the number of borrowers who graduated at time *t,* G_t, divided by the number of borrowers who are at risk of graduation, D_t. It is evident that there are several periods when the empirical hazard is noticeably higher than in the surrounding periods. Zero hazard rates for the first 12 months imply that no graduation has occurred until the borrowers complete their first loan cycle. The hazard rates are higher between 12 and 14 months, and then between 23 and 24 months. It implies that many of the transitions occur right after the first or the second cycle of joint liability loans. The empirical hazard rate is the highest at 120 months. But this is due the fact that only a few (6) borrowers continued their membership with their lenders for 10 years. In other words, at 120 months, the value of D_t was sufficiently low, which drives the high value of the empirical hazard rate.

[20] If the probability of an event increases (decreases) over time, the hazard reflects positive (negative) duration dependence.

[21] In fact, numerous authors have fitted models with a Weibull baseline hazard despite lack of theoretical support for any particular shape (Meyer, 1990).

<Table 2 here>

Table 3 reports the results of our empirical estimation. The results of the Cox proportional hazards model, exponential model and Weibull model are reported in the second, third, and fourth columns, respectively. It is evident that both of the relationship variables have significant positive association with the hazard ratio in all three specifications. In the Cox proportional hazards estimation, for example, those who maintain a non-mandatory savings account face a hazard that is more than double of those who do not have such accounts, and those who bank with a single MFI face a hazard that is 60 percent greater than those who borrow from multiple MFIs. This implies that when the distributional form of the baseline hazard is ignored and, a non-parametric estimation model is used, the relationship variables show a positive impact on the process of graduation from joint to individual loans. Although the variable, SINGLE_BANKING_RELATIONASHIP, is not statistically significant, the coefficients associated with the relationship variables in the exponential model are not substantially different from that in the Cox proportional hazards model. However, the coefficients associated with the relationship variables increase substantially in the Weibull model, where the baseline hazard is assumed to be duration dependent. In particular, according to the Weibull model estimation, those who maintain a non-mandatory savings account face a hazard more than three times greater than those who do not have such accounts, and those who bank with a single MFI face a hazard more than four times greater than those who borrow from multiple MFIs. This is is expected as both of our relationship variables are likely to vary with time.[22] Since Weibull model assumes a duration dependent baseline hazard, coefficients of time-varying covariates, which especially depend on the time pattern of the hazard, are more likely to be affected than the coefficients associated with time consistent covariates (see for example, Meyer, 1990). This is evident from the results reported in Table 3. Variables that are consistent, at least over a short period of time, such as size of the MFI and population density of a locality, also do not vary much across specifications. In sum, however, we argue that our main findings that a strong bank-borrower relationship expedites the process of graduation in microcredit. The Weibull model which, in the present context, has a better approximation of the baseline hazard than a non-parametric,

[22] As we discuss in the next section, the likelihood of both (a) opening a non-mandatory savings account with an MFI and (b) maintaining banking relationships with multiple MFIs— increases as the borrower matures over time.

or a duration-independent parametric model, shows the greatest impact of relationship variables on the process of transition from joint to individual loans.

<Table 3 here>

The results from Table 3 further shows that borrowers who borrow from large MFIs face a lower hazard of graduation than those who borrow from small MFIs. Thus, borrowers who borrow from large MFIs need a longer duration of repayment record prior to graduation to individual loans compared to the borrowers who borrow from small MFIs. This is due to the fact that extending group loans incurs higher operational costs, and small MFIs are more inclined to reduce such costs by extending individual loans to their clients (Armendariz de Aghion and Morduch, 2010). Small MFIs, therefore, offer individual loans to their clients with relative shorter repayment records. Finally, our results suggest that graduation to individual loans is fast-tracked in relatively less densely populated regions, where peer monitoring is costly and imposing social sanctions on defaulting group members is difficult.

6.1. Estimation of Survival Model Using Instrumental Variables

The results presented in Table 3 require a more careful analysis as there might be potential endogeneity problems in our empirical model. Poor household members in the developing countries, who are the typical clients of microcredit, always face an enormous temptation to meet immediate consumption needs (Yunus, 2004). Previous researchers have defined such behavior as a present bias,[23] which is considered as one of the major constraints to saving in the poor countries (Armendariz de Aghion and Morduch, 2010). Participants in a microcredit program, however, are contractually required to make regular repayments of outstanding loans and make regular deposits to mandatory savings accounts at fixed intervals. These are expected to improve the fiscal discipline of the poor borrowers (Ashraf, Karlan, and Yin, 2006), and reduce their degree of present bias. Thus, as the duration of membership with an MFI increases and the borrowers become more disciplined, they tend to hold a smaller share of their savings at home in order to avoid the temptation of consuming at the current point in time. This implies that the likelihood of maintaining a non-mandatory savings account with an MFI is expected to increase with the length of membership, i.e., the

[23] Bauer, Chytilova, and Morduch (2010) have conducted framed field experiments in South Indian villages in order to examine the impact of present bias on economic and financial decision making of the poor households. One third of the respondents in their sample have shown present bias behavior. See Frederick, Lowenstein, and O'Donoghue (2002) for a critical review of time inconsistent behavior.

duration of uninterrupted repayment records, with the MFI. Therefore, SAVINGS can be an endogenous variable in our model.

Furthermore, based on evidence from a randomized trial experiment in India, Banarjee, Duflo, Glennerster, and Kinnan (2010) have shown that the access to microcredit allows small entrepreneurs expand the size of their businesses. Thus, as the duration of membership with an MFI increases and the business expands in size, an entrepreneur tends to demand larger loans in order to meet her increased business demand. But microcredit programs typically have a low credit ceiling, which often drives mature borrowers to borrow from multiple sources in order to obtain the required capital. McIntosh et al. (2005) and McIntosh and Wydick (2005) have identified this as one of the two major reasons of multiple borrowing in microcredit.[24] In the present context, this suggests that the variable SINGLE_BANK_RELATIONSHIP can also be endogenous: as the length of membership (i.e., the duration of uninterrupted repayment records) with an MFI increases, the likelihood of maintaining an association with a single MFI is expected to fall.

In order to overcome these potential endogeneity problems, we use an instrumental variables technique. An instrumental variables (IV) estimation is made possible by replacing the endogenous variable with an instrumental variable, which is (a) correlated with the endogenous variable, (b) uncorrelated with the error term of the estimation model, and (c) not an explanatory variable in the original equation (Murray, 2006). Condition (c), more specifically, requires that the instrumental variable should affect the dependent variable only through its effects on the endogenous (*i.e.*, the excluded) variable. The advantages of using IV estimation are twofold: it reduces inconsistencies in parameter estimates even in non-linear models (Angrist, 2008); and it enables drawing causal inferences.[25]

We have used the exposure to natural disasters as an instrument for SAVINGS. Particularly, we define the variable NO_DISASTER such that it equals one if the borrower did not experience natural disasters such as flooding, river erosion, or disordering rain within the last one year prior to the survey, and zero if the borrower experienced natural disasters. Exposure to natural disasters causes temporary negative income shocks. Simple consumption models predict that if households are not credit constrained and if the temporary income shocks do not substantially affect permanent income, consumption and savings would respond only marginally. Poor households in developing countries, however, tend to be credit

[24] The other major reason for multiple borrowing is the requirement to meet unforeseen consumption demand especially during the time of crises.
[25] Rhodes (2010), for instance, used IV technique to draw causal inferences from survival models.

constrained and, therefore, respond significantly to temporary income fluctuations (Schmidt-Hebbel, Webb and Corsetti, 1992). This suggests that the choice of NO_DISASTER as an instrumental variable for SAVINGS meets the first criteria of a good IV because NO_DISASTER is likely to have a significant positive association with SAVINGS. There is, however, no reason to believe that the length of membership with an MFI can affect the borrower's exposure to natural disaster. Thus, the exposure to natural disasters is not expected to be correlated with the error term of the original equation. Finally, existing research suggests that when poor borrowers experience temporary income shocks, they draw down from their savings (Pitt and Khandker, 2002) in order to make repayments of outstanding loans, which is a prerequisite of continuing membership with an MFI. Thus, we expect that the exposure to natural disasters can affect the length of membership through a borrower's capacity to save money, *i.e.*, the borrower's likelihood of maintaining a non-mandatory savings account.[26]

We have used the level of competition among the MFIs in a particular region as an instrumental variable for SINGLE_BANK_RELATIONSHIP. We measure the degree of competition in each of the survey locations by the number of households covered by the PKSF's partner organizations (COVERAGE). PKSF (Palli Karma-Shahayak Foundation) is the largest organization in Bangladesh that disburses funds to microfinance institutions. Currently, 37 percent of the micro-borrowers in Bangladesh receive loans from PKSF's partner organizations (Institute for Microfinance, 2010; and PKSF, 2010). Thus, the number of households covered by the PKSF's partner organizations, operating in a particular region, can be used as a reasonably good proxy for the degree of competition. Particularly, a low value of COVERAGE indicates a high degree of competition among the MFIs in a particular region. In our empirical analysis, however, we have used the natural logarithm of COVERAGE. Existing evidence suggests that increased competition among MFIs raises the incidence of borrowing from multiple MFIs (see for example, McIntosh et al., 2005; and McIntosh and Wydick, 2005). Thus, we expect that the likelihood of maintaining a banking relationship with a single MFI falls as the level of competition among MFIs (that is, the inverse of COVERAGE) increases in a particular region. Thus, COVERAGE fulfills the first criteria as a good instrumental variable for SINGLE_BANK_RELATIONSHIP. It also fulfills the second criteria of a good instrument as there is no reason to believe that the level

[26] It is worth underscoring that the poor households in the developing countries use a wide range of informal mechanisms to save. See Rutherford (2000) for a description of such mechanisms. However, for those who are members of an MFI, non-mandatory savings schemes, offered by the MFI, constitute a major source of household savings (Ashraf et al., 2006).

of competition among the MFIs, which is exogenously determined by the factors related to the institutional and industrial organization of the microcredit sector in a particular region, can be affected by an individual borrower's length of membership with an MFI. McIntosh et al. further show that multiple memberships, followed by increased competition, display increased over-indebtedness and default rates in the microcredit sector. Since default on a loan obligation terminates membership with the MFI, it can be argued that increased competition among the MFIs can reduce the length of membership through increasing the likelihood of multiple borrowing and over-indebtedness.

Following Angrist and Pischke (2009) and Abbring and van den Berg (2005), Rhodes (2010) suggests a simple procedure to estimate the survival model using instrumental variables. The first step is to test for the strength of the instruments. This can be done by regressing the endogenous variables—the maintenance of a non-mandatory savings account and single banking relationship—on the exogenous and instrumental variables, using a logit or probit model. Although there is no absolute test for the strength of an instrument, a significant association between the endogenous and instrumental variables is indicative of the strength of the instrument. We use logit models to check for the strength of our instruments. The results are reported in Table 4. It is evident that (a) borrowers who did not experience any natural disaster are 21 percentage points more likely to have a non-mandatory savings account than those who experienced a natural disaster (this association is statistically significant at the five percent level); and (b) a one unit increase in the value of (the natural logarithm of) COVERAGE raises the likelihood of maintaining an association with a single MFI by 17 percentage points (this association is statistically significant at the one percent level).

<Table 4 here>

The second step is to estimate the survival model using the exogenous and instrumental variables as explanatory variables. This is similar to the estimation of the reduced form equation in a two-stage least squares model. The results of this survival model are presented in Table 5. It is evident that those who have a non-mandatory savings account face a significantly greater hazard of graduation than those who do not have such accounts with the MFI; and those who borrow from one MFI face a significantly greater hazard of graduation than those who borrow from multiple sources. The results are robust across a range of non-parametric and parametric specifications. Thus, our main results—that borrowers with a strong banking relationship graduate sooner from joint to individual liability

loans than those who do not have a strong relationship with the MFI—also hold true in the instrumental variables estimation.

<Table 5 here>

Rhodes (2010) has, however, suggested that an additional step is needed in order to draw causal inferences from survival analysis using instrumental variables. Following his suggestion, we estimated the hazard rate at a given point in time based on the survival model that uses exogenous variables and the instrumental variables as explanatory variables. The estimated hazard rates are then regressed on the probability of maintaining a non-mandatory savings account and the probability of maintaining a relationship with a single bank, using an ordinary least squares method. Particularly, we estimated the hazard rates from the exponential and Weibull models. The probabilities of maintaining a non-mandatory savings account and maintaining a relationship with a single bank are estimated based on logit models. The results of the OLS regression are presented in Table 6. It is evident that the coefficients with both the probabilities of maintaining a non-mandatory savings account and maintaining a relationship with a single bank are statistically significant at the one percent level in both specifications. This implies that the association between bank-borrower relationships and the process of transition from joint to individual liability loans is not merely a correlation. Rather, one can reasonably argue that a strong bank-borrower relationship expedites the process of graduation from joint to individual liability loans.

<Table 6 here>

7. Concluding Remarks

Existing research suggests that borrowers have to establish a good reputation in the credit market, by repaying loans, in order to enjoy flexibilities in loan contracts (Diamond, 1991; and Boot and Thakor, 1994). One common form of providing flexibilities in microcredit contracts is to remove the joint liability clause (Navajas *et al.*, 2003). Borrowers who have established a good reputation by repaying loans use their loans with more prudence without any peer pressure in order to protect valuable reputational capital. As a result, MFIs can offer individual loans to these borrowers without increasing their credit risks. In this paper, we show that the strength of bank-borrower relationships affects the duration of a repayment record that a borrower requires to graduate from joint to individual liability loans. Particularly, the results of our empirical analysis show that borrowers (a) who maintain a

non-mandatory savings account with the MFI, and (b) who borrow from a single MFI, receive individual loans with relatively shorter repayment records.

There is widespread consensus among researchers and practitioners in that maintaining repeat borrowers is critical for the long run financial viability of the MFIs (see for example, Wright, 2000 and 2001; and Meyer, 2002). Repeat borrowing reduces administrative costs and lowers default risks. Thus, MFIs have a clear incentive to protect voluntary drop out by their mature borrowers. Existing studies further suggest that the presence of joint liability is a major driver of voluntary drop outs in the microcredit sector as it creates excessive tensions among group members (ASA, 1996; and Women's World Banking, 2003). The results of our empirical analysis, therefore, have important implications for microfinance practitioners. Particularly, our results imply that MFIs should invest more in producing relationship driven information. Such information would help expedite the process of a borrower's graduation from a joint to an individual liability loan which, in turn, would reduce voluntary drop outs by otherwise creditworthy borrowers.

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Table 1

Operational Definitions of the Variables and Descriptive Statistics

Variable	Definitions
SAVINGS	1 if the borrower maintains a non-mandatory savings account; 0 otherwise
SINGLE_BANK_RELATIONSHIP	1 if the borrower borrows from a single MFI; 0 if she borrows from multiple MFIs
ASSET	Market value of household assets divided by the number of household members
LARGE_MFI	1 if the corresponding MFI has more than one hundred thousand active borrowers; 0 otherwise.
DENSITY	Population density at the county level per square kilometer.
WEEKLY_REPAYMENT	1 if the borrower repays her loan on a weekly basis, and zero otherwise

Table 2

Graduations, Censorings, and the Kaplan-Meier Empirical Hazard

Duration of repayment record (months) T	Number of borrowers at risk of graduation D_t	Number of graduation at time t G_t	Number of censored observations at t C_t	Hazard rate H_t
1	334	0	12	0
2	322	0	26	0
3	296	0	10	0
4	286	0	6	0
5	280	0	4	0
6	276	0	23	0
8	253	0	5	0
10	248	0	2	0
11	246	0	3	0
12	243	6	48	0.024
13	189	15	1	0.079
14	173	22	23	0.127
15	128	8	4	0.062
16	116	7	10	0.06
18	99	3	12	0.03
22	84	0	5	0
23	79	1	0	0.012
24	78	11	23	0.141
25	44	1	0	0.022
30	43	1	1	0.023
32	41	0	1	0
36	40	2	8	0.05
45	30	0	1	0
48	29	3	5	0.103
60	21	0	3	0
66	18	0	2	0
72	16	1	4	0.0625
84	11	0	2	0
90	9	0	2	0
108	7	0	1	0
120	6	1	5	0.166

Table 3

Hazard of Graduation from Joint to Individual Liability Loans

	Cox Proportional Hazard Model	Exponential Model	Weibull Model
Explanatory variables	Hazard ratio	Hazard ratio	Hazard ratio
SAVINGS	2.235***	2.435***	3.176***
SINGLE_BANK_RELATIONSHIP	1.605*	1.486**	4.112***
ASSET	0.980	0.972	0.961*
LARGE_MFI	0.513***	0.558**	0.471***
DENSITY	0.999***	0.999***	0.998**
WEEKLY_REPAYMENT	0.108	1.019	1.642
Log-likelihood	-378.710	-188.890	-166.192
Chi-square	28.01	30.22	63.72
p-value	0.000	0.000	0.000
A			0.535 (SE = 0.041)

* significant at 0.1 level, ** significant at 0.05 level, *** significant at 0.01 level

Table 4

Estimating the Strength of the Instrumental Variables

	Dependent variable: SAVINGS	Dependent variable: SINGLE_BANK_RELATIONSHIP
Explanatory variables	Marginal Effects	Marginal Effects
NO_DISASTER	0.218**	0.099
COVERAGE	0.080	0.169***
ASSET	-0.001	0.007*
LARGE_MFI	0.032	0.075*
DENSITY	0.001***	0.001
WEEKLY_REPAYMENT	-0.043	-0.037
Log-likelihood	-201.114	-134.969
Chi-square	15.18	32.11
p-value	0.03	0.07

* significant at 0.1 level, ** significant at 0.05 level, *** significant at 0.01 level

Table 5

Hazard of Graduation Using Instrumental Variables

	Cox Proportional Hazard Model	Exponential Model	Weibull Model
Explanatory variables	Hazard Ratio	Hazard Ratio	Hazard Ratio
SAVINGS[a]	2.213**	2.243***	3.094***
SINGLE_BANK_RELATIONSHIP[b]	2.001***	2.241**	3.471***
ASSET	0.994	0.978	0.981
LARGE_MFI	0.596**	0.639**	0.636**
DENSITY	0.999	0.999	0.999
WEEKLY_REPAYMENT	0.856	0.829	0.734
Log-likelihood	-379.601	-188.157	-176.691
Chi-square	26.23	31.64	-42.71
p-value	0.002	0.000	0.000
A			1.474 (SE = 0.104)

* significant at 0.1 level, ** significant at 0.05 level, *** significant at 0.01 level
a. estimated by instrumental variable, NO_DISASTER
b. estimated by instrumental variable, COVERAGE

Table 6

Regression of the Estimated Probability of Graduation on the Probability of Maintaining Non-Mandatory Savings and the Probability of Single Banking Relationship

	Dependent variable: Probability of Graduation Estimated by the Exponential Model	Dependent variable: Probability of Graduation Estimated by the Weibull Model
Explanatory variables	OLS coefficients	OLS coefficients
Probability of Maintaining Non-Mandatory Savings	3.061***	3.593***
Probability of Single Banking Relationship	1.845***	3.016***
Constant	-17.56	-23.72
Adjusted R^2	0.56	0.62
F (2, 331)	211.33	265.39
p-value	0.000	0.000

* significant at 0.1 level, ** significant at 0.05 level, *** significant at 0.01 level

APPENDIX

Suppose there are three members in a borrowing group: Max, Mop, and Min, all of whom invest in a safe project. The following table shows all possible combinations of borrower Max's payoff under the assumption that the Max's project outcome is independently distributed of that of Mop and Min.

Table A: Calculation of Expected Payoff in a Group of Three Borrowers

Project outcome of Max	Project outcome of Mop	Project outcome of Min	Likelihood of the event	Max's payoff
Success	Success	Success	$P_S.P_S.P_S$	Y_S-r+V
Success	Success	Failure	$P_S.P_S.(1-P_S)$	Y_S-r+V-(c/2)
Success	Failure	Success	$P_S.(1-P_S).P_S$	Y_S-r+V-(c/2)
Success	Failure	Failure	$P_S.(1-P_S)(1-P_S)$	Y_S-r+V-2c
Failure	Success	Success	$(1-P_S).P_S.P_S$	V
Failure	Success	Failure	$(1-P_S).P_S.(1-P_S)$	V
Failure	Failure	Success	$(1-P_S).(1-P_S).P_S$	V
Failure	Failure	Failure	$(1-P_S).(1-P_S).(1-P_S)$	0

Max's expected payoff can, therefore, be calculated from the table as follows:

$$U_{S,\,MAX} = P_S\,[P_S^2\,(Y_S\text{-}r+V) + 2\,P_S\,(1-P_S)\,(Y_S\text{-}r+V\text{-}(c/2)) + (1-P_S^2)\,(Y_S\text{-}r+V\text{-}2c)] + (1-P_S)\,[P_S^2\,(V) + 2P_S\,(1-P_S)\,(V)]$$

The same condition can be directly derived from equation (3).