GROUP AND INDIVIDUAL LOAN IN MICROFINANCE

Abstract

We investigate the MFI's choice of loan contract with particular emphasis on group and individual loans. Our data span 379 MFIs from 73 countries and are retrieved from rating bureaus' reports. The choice is determined by the MFI's emphasis on its objective to offer poor customers access to financial services and institutional conditions, such as market competition. We find that the higher the outreach objective, the more the group loan is preferred. This choice is strengthened by the MFI's history as founded by an international organization, and weakened by market competition. We cannot confirm that repayment is improved with a group loan. In a stochastic frontier analysis we find that the group loan is associated with higher costs, and that competition tends to lower operational costs. A prediction based on the analysis is that microfinance institutions will increasingly turn to individual lending.

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# 1 INTRODUCTION

Group lending is an alternative to traditional individual lending backed by collateral. The group loan is often seen as the defining characteristic of microfinance, a financial sector providing financial services to poor families and small businesses in developing countries. A common characteristic of the group lending contract is that a loan is given to an individual, but then the whole group is responsible for its repayment (Armendariz and Morduch, 2010). Why do microfinance institutions (MFI) choose to offer a group lending contract? What are the benefits and costs of using the group loan? We answer these questions by means of a two-step instrumental variable procedure (Wooldridge, 2010), assuming that the loan contract is taken to be endogenous. The loan contract endogeneity arises because the MFI is likely to have chosen for instance the group loan deliberately to achieve its objectives. In general, the MFI has two objectives, one is to reach out to poor families and small businesses with access to finance, and the second is financial sustainability (Morduch, 1999). The outreach goal is therefore essential to understand why the MFI chooses a given loan contract. From this first step we can form instruments for the loan contract that we use in the second step, to see consequences for the MFI's repayment record and the operational costs.

In microfinance, group lending was first piloted by Grameen Bank, Opportunity International and Accion International in the 1970s. However, not all microfinance loans are group loans (Armendariz de Aghion and Morduch, 2010). In our sample of 379 MFIs in 73 countries drawn from raters' reports, 26 per cent of the MFIs practice individual lending, 19 per cent are group lenders, and the remaining 55 per cent practice a mix of individual and group lending. There also seems to be a move away from group lending in favour of individual, underlined by "Grameen II", the Grameen Bank's emphasis on individual lending (Dowla and

Barua, 2006). Then it is important to understand the conditions that favour the group loan over the individual loan.

Group lending is held to solve the repayment problem. From an historical perspective the weight given to the repayment issue is not surprising. Subsidised individual loans in the 1950s-1980s had huge default rates. For example, Hulme and Mosley (1996b) report default rates of up to half the loan amount on small loans in Indian state banks in the late 1980's. The default rate in our sample, defined as the proportion of the portfolio 30 days overdue, is 5.3 percent for MFIs with only group loans and 7.3 percent for MFIs extending only individual loans. The default levels are far below the levels Hulme and Mosley report. However, the difference between group and individual loans are relatively small in economic terms, a fact that Banerjee and Duflo (2010) also notice. Further cost reductions due to better repayment can be hard to achieve. Furthermore, the group loan is not the solution it promised to be. We have already noted that the group lending pioneer Grameen Bank is turning away from group loans and towards individual, and Wydick (2001) reports that 80.3 per cent of his Guatemalan sample prefers an individual loan. These observations motivate a search for other explanations besides repayment for the MFI's choice of lending technology.

Group lending has spawned a large theoretical literature, where it is generally seen as a solution to the repayment problems (Stiglitz, 1990; Varian, 1990; Ghatak, 2000). For Stiglitz (1990) and Varian (1990) the superiority of group loans is due to the group members' joint liability for each member's loan, leading to mutual monitoring; for Ghatak (2000) it is due to group formation through "positive assortative matching", whereby group members' ex ante knowledge of other potential group members enable safe borrowers to team up with other safe borrowers. We call these the monitoring and matching theories, respectively. However, the theoretical validity of the joint liability model has been questioned (Laffont and N'Guessan,

2000; Laffont, 2003; Laffont and Rey, 2003; Rai and Sjöström, 2004). For instance, the Rai and Sjöström model shows that joint liability can be achieved without forming a group when borrowers alternatively enter into side-contracts to support each other in the case of shortfall in loan repayments.

The prediction of the monitoring and matching theories is that group lending will improve the MFI's repayment record. Another prediction is that the group lending scheme is viable in societies with strong social ties or high homogeneity. According to Ghatak and Guinnane (1999) "…group lending derives its effectiveness from the social ties among potential group members". But none of the theories consider the MFI's objective of reaching out to poor customers with offers of access to financial services. This is a cornerstone in the present analysis. Specifically, we consider the MFI's outreach by measuring the average loan, the weight put on female customers, and to rural customers.

Furthermore, the monitoring and matching theories overlook other costs to the MFI. Over-zealous collection methods motivated by a desire to show low default rates may even be counter-productive, as witnessed in the backlash against microfinance in Bangla Desh and Andhra Pradesh in India. The cost saving in a lower default rate might come at the expense of increasingly higher operational costs. On the other hand, group lending may be the most cost efficient way to service the poorest segments, since the loan officer may then deal with many borrowers at the same time, saving on meeting time. Thus, a prediction is simply that the group loan entails lower operational costs.

We find that the group is favoured when the MFI puts stronger emphasis on outreach. Furthermore, we find that MFIs founded by international organisations tend to choose the group loan, but that a higher competition works against the group loan. We cannot find evidence of a better repayment record in group based lending, but that higher operational

costs comes with the group loan. Thus, in the long term the group loan's viability is in question.

The paper proceeds as follows. Section 2 contains theory discussion and formulation of testable hypotheses, in section 3 we describe the data. Section 4 gives descriptive evidence of the relationships we investigate. Section 5 explains the regression specifications used in testing, while section 6 reports results from the econometric testing. Section 7 concludes and gives further perspectives.

## LITERATURE AND HYPOTHESES

We investigate the two questions of why the MFI chooses the group loan and what consequences the group loan has for repayment and operational costs. Here we look for guides from literature to construct hypotheses.

A group loan is said to be superior to an individual loan in microfinance due to better screening of potential borrowers, better monitoring, better auditing, and better enforcement (Ghatak and Guinnane, 1999). The poor often lack collateral, and then the social capital implied in a group loan acts as a substitute (Tirole, 2006 p180 ff). The so-called joint liability condition in a group lending contract leads to an incentive by group members to monitor other members (Stiglitz, 1990; Varian, 1990). To the joint liability condition, sequential financing, and contingent renewal schemes are often part of the group loan contract. Sequential financing refers to the practice of first giving, say, two members of a group a loan, and then step up to two more if the first two loans are repaid (Morduch, 1999). Contingent renewal is the refusal to lend again to any group member if not all outstanding debt is settled. The

auditing model of Besley and Coate (1995) says that group members are better able to verify each other's effort to fulfill obligations.

The membership to the group is often done by self-selection, that is, the members themselves form the group, and do so by "positive assortative matching" (Ghatak, 2000), where good risk borrowers team up with other good risk borrowers. A maximum number of group members is often set, for instance the five member group is the common group size in the classical Grameen Bank system and the original solidarity groups practiced by Accion International affiliates. In other models, for example the Village bank system practiced by FINCA and Freedom from Hunger, groups can be of around 20 members with or without intra-groups of around five members within the Village Bank (Armendariz de Aghion and Morduch, 2005).

Many investigations concentrate on the predicted relationship between repayment in the group loan contract and social cohesion. From field study data of urban and rural borrowing groups in Guatemala, Wydick (1999) finds that rural groups are much more willing to exert social pressure to repay than urban groups, but finds no effects of social ties, such as same gender or partaking in the same social activities. In contrast, Zeller (1998) and Karlan (2007) find that repayment increases with social cohesion, or what Karlan calls social connectedness. Ahlin and Townsend (2007a) document an inverted U-shaped curve linking social cohesion and repayment. Thus, beginning at a low social cohesion, the repayment rate increases, but then falls off at high levels of social cohesion. Karlan (2007) finds that stronger social connections of the group lead to higher repayment rates and savings in a comparison of groups within FINCA-Peru, a group lending organization. Hermes et al. (2005) report that the group leader's authority in the group, measured as the leader's social connectedness, increases the group's repayment record.

These studies are partial in the sense that the focus is limited to repayment and group loans. They do not consider other costs or the effect of the MFI's outreach goal.

The strong theoretical predictions and the empirical evidence leads Ghatak (2000) to argue that group loans will drive out individual loans. Nevertheless, in reality the MFIs grant more individual than group loans. In our sample, 26.0 per cent of 377 MFIs give only individual loans, 19.9 only group loans, and 54.1 per cent a mix of the two. If the group loan is superior, we should expect a far higher proportion. It seems as if the importance of group lending is exaggerated, perhaps grounded in the high default rates during the subsidized rural lending preceding microfinance. After all, Hulme and Mosley (1996b) report default rates of 50 per cent in state-owned rural financial institutions in the 1980s.

**The endogenous loan contract**

An implication from the theoretical literature on the group loan is that this loan contract is chosen endogenously by the MFI in order to achieve its goals. The MFI pursues the two goals of outreach to poor customers and financial sustainability (Morduch, 1999). The theories are couched in financial sustainability terms, but this should equally concern the outreach goal. MFIs differ in the weight they put on either goal. A natural way to model this is to assume that the MFI maximizes outreach subject to a break-even condition as in Jain and Mansuri (2003) and Armendariz and Morduch (2010). But whether the MFI follows a break-even policy or not is an empirical question. The upshot is that it is necessary to include both outreach and financial sustainability in regressions.

The empirical evidence is rather scant on the relationship between the loan contract and goal attainment. In a case study of Bolivia, Navajas et al. (2000) find that the group loan is

preferred when lending to the poorest. Mersland and Strøm (2010) report that group lending is a strong predictor for outreach to the poor using a global data set, while Cull et al. (2007) find no relation to financial sustainability among leading MFIs. Also MFIs starting as individual lender MFIs, e.g. Diaconia Frif in Bolivia and D-Micro in Ecuador, add group loans in order to reach out to the poorer segments. Thus, it appears that the existing evidence supports the notion that the group loan is chosen in order to reach out to poor people. A related question is the tradeoff between the outreach and the financial sustainability goals. Hermes et al. (2011) find that the goals are negatively related in a stochastic frontier analysis using a global data set. Louis et al (2013) fail to establish the tradeoff between goals in study of 650 MFIs using the recent self-organizing map methodology. Salim (2013) studies the MFI's objective function explicitly in a study of the two largest MFIs in Bangladesh, BRAC and Grameen Bank (GB), where the decision to locate in poor or less-poor areas reveals the MFI's poverty targeting as opposed to profit maximization. He concludes that neither BRAC nor GB are pure profit-maximizers, and that the deviation from profit maximization is in the direction of poverty targeting. This ongoing debate underlines the importance of including both outreach and financial sustainability objectives in our regressions.

Let us first look at outreach measures. Our outreach variables, rurality, gender bias, and average loan, are what Schreiner (2002) calls of the depth of outreach, that is, the outreach to the poorest customers. We capture what Schreiner (2002) defines as the breadth of outreach with the number of credit clients. Thus, the more the MFI wishes to reach out to rural areas, to female customers, and to poor customers, the more likely the MFI is to choose group lending.

Presumably, an individual is less exposed to neighbors' and relatives' watch in the anonymity of the city than in a rural village. The social heterogeneity is also likely to be larger in an urban setting. MFIs whose lending is mainly to rural villages should be more likely to employ

group lending than in an MFI mainly lending in urban communities. The gender aspect is discussed in Armendariz de Aghion and Morduch (2010), where one learns that women choose group loans to a larger extent than men. Three reasons explain why the MFI focuses on women, that is, women are poorer, less mobile, and more likely to repay. Thus, when the MFI has a conscious gender bias it is likely to lend more to groups. Average loan is our third outreach variable. Mersland and Strøm (2010) use this as their most important outreach variable. When borrowers are heterogeneous with respect to risk aversion, wealth, and project plans, group loans become difficult to implement. Banerjee et al. (1994) observe how member heterogeneity due to income and wealth was a major impediment in the development of credit cooperatives in Germany as well as its transplant in Ireland. Thus, the higher is average loan the more likely the MFI will give individual loans.

It is difficult to observe the social heterogeneity in the communities in which the MFIs operate. We use the country development level, summarized in the Human Development Index (HDI) as a proxy. The UN Development Programme issues the index which consists of an income component together with components for the educational level and the health status of the population of the country. We assume that the higher is the score on the HDI, the more capable the individual is to borrow in a responsible way, and thus, to demand an individual loan. The index also acts as a country identifier in regressions, removing country specific effects.

We use three different measures for financial sustainability, ROA and operational self-sufficiency (OSS1 and OSS2). The latter two are particular to microfinance. Both have total financial revenue in the nominator, OSS1 has financial expense and operational costs in the denominator, while OSS2 is defined as financial revenue on operational costs. Thus, OSS2 is

a pure operational measure, not influenced by the capital structure in the MFI. In this paper, we prefer to use OSS2, but keep the other two for comparison.

The MFI's choice of loan contract may also be influenced by institutional characteristics and the MFI's age. The institutional characteristics encompass the MFI's ownership type, its establishment by an international or a domestic organization, and competition. The MFI's incorporation is a possible determinant of the loan contract. We differentiate between stock companies and other incorporation, specifically NGOs, cooperatives, state organisations, and other. It is possible that the stock company prefers the individual loan if MFIs with this organizational form prefer better transparency. On the other hand, an internationally founded MFI is likely to underline outreach, since this was the rationale for establishing the MFI in the first place. Then we should expect that an international founder is positively related to the use of the group loan. Notice that these variables are exogenous, since the international founder necessarily is present before the MFI reaches out to poor customers, and the MFI's incorporation is in fact seldom changed.

Competition may make the group loan difficult to uphold. Ghatak and Guinnane (1999) underline that competition among MFIs may upset group lending since the strong sanctions implicit in many group lending schemes are difficult to uphold if the borrower can simply walk away and choose a different bank. If it is the case that the individual borrower prefers the individual contract, as Wydick (2001) discovers when borrowers are faced with a choice, greater competition should lead to greater use of individual loans.

Finally, the MFI's age may play a role. It is possible that the group loan is also an information revealing mechanism, informing the MFI who is a reliable borrower and who is not. Then, in a second step it is easier for the reliable borrower to ask for an individual loan. If such a

mechanism is at play, we should expect to see more emphasis on the individual loan with the MFI's age.

**Repayment and operational costs**

The theoretical literature on microfinance finds that the group loan solves the repayment problem either by mutual monitoring or by matching. We look at two consequences of using the group loan, the repayment of loans and operational costs.

Repayment loss is, of course, not the only cost item for the MFI. The MFI's profit function for loans is the difference between interest income and interest expense (the intermediation margin), deducting loss on loans and operational expenses (Hulme and Mosley, 1996a, p. 19). A higher repayment rate will reduce loss on loans and thus contribute to higher financial sustainability. But in an empirical investigation the operational costs should be included as well. Operational costs may increase as a consequence of high effort in securing repayment. But on the other hand, the group loan contract may contain operational costs, since the small loans can only be dealt with on a group basis. It is an empirical question whether the group loan contract will lead to lower operational costs and higher profitability. Therefore, we include the cost aspects in the analysis, but refrain from hypotheses. To our knowledge, these relationships have not been investigated earlier.

We study the cost consequences of the group loan in a simple cost function setting, using stochastic frontier analysis, and assuming a Cobb-Douglas functional form. In the basic formulation, the SFA estimating function is written (Coelli et al., 2005):

$$\ln OPX_{it} = \beta_0 + \beta_1 \ln W_{it} + \beta_2 \ln FA_{it} + \beta_3 \ln BR_{it} + \varphi \ln CC_{it} + \theta \ln CV_{it} + v_{it} + u_{it}$$

when we specify a cost function. Here, the subscripts show the MFI number (i) and the year (t), OPX is the operational costs, W is wages, FA is fixed assets on all assets, BR is the borrowing rate, CC is our product measure, the number of credit clients, and CV are a set of control variables. v is a random variable with expectation zero and a fixed variance, and u is a non-negative measure of cost inefficiency.

We can incorporate the loan contract in the cost equation in two ways (Coelli et al., 2005). The first is to insert the variable directly into the cost function, the second is to save the inefficiency measure for each MFI from the basic cost function estimation, use it as a dependent variable, and posit the loan contract among the independent variables. An argument for using the first procedure is that if one really believes the loan contract influences the MFI's distance to the cost frontier, it should be among the variables determining this frontier. Thus, this is a missing variables problem. However, the object here is not to find the perfect representation of the cost frontier for MFIs, but a reasonable one, so that we can to discover how the loan contract impacts the MFI's costs. We choose first to run the basic cost function regression, and study how the loan contract (instrumented or not) impacts the frontier. Second, we see how the loan contract impacts the inefficiency measure.

We choose the simple Cobb-Douglas functional form for two reasons. One is that the MFI's operations are themselves fairly simple. The MFIs are mainly lending institutions, transforming borrowed and own funds into loans, and with little or no operations outside of this, such as letting property. The second is that the alternative, the translog specification (Christensen et al., 1973), may induce multicollinearity among explanatory variables due to the squared terms of each variable in the estimations, as well as cross terms. But the translog is a much used procedure. For instance, Hermes et al. (2011) use this formulation in their study of outreach in microfinance institutions.

## 3 DATA AND VARIABLE DEFINITIONS

We use observations of 379 rated MFIs from 73 countries. Third-party organisations perform the standardised ratings and outside organisations subsidise parts of the costs involved (www.ratingfund.org). A main motive behind submitting to a rating is the improved access to external funding. The data cover both financial and outreach data, that is the income and balance reports and data on key outreach aspects. At each rating four years of data are usually obtained, ranging from one year to six. The ratings are performed in the period 2001 to 2009, which means that we have data from 1998 to 2009. Most data are from the period 2001 to 2007. Only six observations occur in 1998 and 17 in 2009. This data setting enables more general conclusions to be drawn than case studies (Hishigsuren, 2007) or geographically limited studies (Ahlin and Townsend, 2007a, 2007b; Karlan, 2007).

The third-party and standardised collected MFI data from the rating agencies must be judged more reliable than self-reported data. No database is perfectly representative of the microfinance field. In particular, our data set contains relatively fewer of the megasized MFI, and it does not cover the virtually endless number of small savings and credit cooperatives. The former are rated by such agencies as Moody's and Standard and Poor, while the latter are not rated. Compared to the Mixmarket MFIs (www.themix.org) the MFIs in our sample are younger, smaller, have a higher operating expense/loan portfolio ratio, and are more risky (Mersland 2009, p. 14-16). Nevertheless, the practical difference need not be very large, for instance, the median average outstanding loan is nearly equal (USD 456 in Mixmarket vs. USD 433 in our sample). Thus, our sample seems to be representative for MFIs taking the first steps towards bringing professional banking services to the poor. With higher reliability

and satisfactory representativity our data are superior to alternative data sources, such as self-reported data or questionnaire data.

Different inflation rates in 73 countries make comparisons difficult. We solve this by converting the monetary variables into USD amounts at the going exchange rate, and adjust all monetary variables by the IMF's purchasing power parity GDP per capita. Table 1 gives an overview of the variables used in the analysis.

**Table 1**

We comment on a selected set of variables. In our sample the loan contract covers MFIs that lend mainly to individuals, to solidarity groups, and to village banks. The individual lender uses a standard bilateral lending contract. In the solidarity group the loan is given to individuals as well, but now the group carries a joint liability for the loan. The group will normally have three to ten members. In the village bank a group of 15-50 members in the village make up the group, and the MFI yields different degrees of autonomy to the village bank. The solidarity group and the village bank are included in the group lending schemes in our sample. From the records we construct a lending methodology variable with the three categories individual lending only, individual and group lending, and group lending only. The new variable has ordinal scale with higher values representing more group loans.

The repayment risk is specified by two variables, the portfolio at risk (PaR30), which measures the portfolio fraction 30 days overdue, and the write-off portfolio fraction. The first gives a measure of the *potential loss*, the second the *realised loss*. Given the weight given to the repayment issue, these measures should reveal the variable's impact in the choice of loan methodology.

Our social cohesion (or outreach) variables are average loan, gender, rural, and the number of credit clients. The rural category belongs to the MFI's main market served variable, and the two other choices are the rural category and the mixed urban and urban markets. The gender variable is gauged as the MFI's deliberate gender bias as indicated in the rating reports. An obvious alternative is the fraction of female borrowers, which is 70 per cent in our sample. However, many MFIs do not report this information, and too many MFIs would have dropped from the sample by its inclusion.

The competition measure is a 1 to 7 point scale, based on the MFI's judgement of competitive pressures in its market. The higher is the number, the stronger is competition. Thus, it is a subjective measure.

## 4 DESCRIPTIVE EVIDENCE

Can we find evidence that group and individual lender MFIs differ on overall statistics? In table 2 we present main statistics on variables used in the following analysis distributed on the three categories of group and individual lending and an ANOVA test for the equality in means for the three categories.

**Table 2**

The table overwhelmingly supports the notion that group and individual loans have different characteristics. Moreover, we find that the differences are as expected. This is perhaps most obvious for the outreach variables, but also for the cost and profitability measures. For instance, the gender bias among individual only MFIs is about 15 per cent, but nearly 75 per cent for group only MFIs. We also note that the normalised average loan in individual only MFIs is more than three times higher than in the group only category. Thus, group loans tend

to be used to reach female borrowers, borrowers in rural areas, and borrowers with a need for small loans. On the other hand, the repayment hypothesis finds only partial support in the table, since the write-off variable is not significantly different between loan types. For the self-reported competition measure we find significant differences, as competition is experienced to be higher in individual only MFIs than in group only. The fact that the highest felt competition is in the mixed category is also logical since MFIs operating in more competitive conditions will have to offer a broader range of products to attract customers.

Aware of possible multicollinearity among explanatory variables we present simple bivariate correlations in table 3.

**Table 3**

A striking property of the correlations is that they are so low. Correlations among explanatory variables need not be serious until they reach 0,70 (Kennedy, 2008). Apart from the high correlations between the financial sustainability variables ROA, OSS1, and OSS2 none of the correlations in table 3 reaches this level, the highest being -0.48 between operational costs of the portfolio and ROA. This implies that multicollinearity among explanatory variables is unlikely to invalidate regressions with the variables in the table.

## 5 ECONOMETRIC METHODS

Our two-step procedure is a simple extension of the Heckman (1979) endogenous dummy variable method to an ordered logit model. It starts with the estimation of relationships in the endogenous loan contract regressions. Lending methodology is specified as an ordinal variable so that MFIs giving only individual loans are in the lowest category, those MFIs giving only group loans in the highest, and the MFIs giving both in the middle. Thus, we have

three outcomes, and the higher the outcome is, the more group based the loans are. The best method to estimate the relationship between lending methodology and explanatory variables is the ordered logit model. Thus we have that in an m-alternatives ordered model:

$$y_i = j \text{ if } \alpha_{j-1} < y_i^* \leq \alpha_j,\ j = 1,\ldots,m \tag{1}$$

We have $m = 3$ categories for the latent variable $y_i^*$. The aim of the estimation is which category the explanatory variables predict. This entails the estimation

$$\Pr(y_i = j) = F\left(\alpha_j - X_i'\beta\right) - F\left(\alpha_{j-1} - X_i'\beta\right) \tag{2}$$

Here, $F(\cdot)$ is the distribution function, $X_i$ is the set of explanatory variables, and $\alpha_j$ is the threshold level *j* for category *j*. The number of threshold levels is $m-1$. We choose the logistic distribution and estimate with maximum likelihood.

The logistic distribution has somewhat fatter tails than the standard normal distribution. Two common assumptions are made for the logistic regressions by means of maximum likelihood. The first is that the lending methodology variable is independently distributed across time *t* conditional on the explanatory variables and unobserved firm heterogeneity. The second assumption is that unobserved firm heterogeneity is normally distributed with zero mean and a fixed standard deviation.

We have panel data, that is, multiple observations for each MFI. However, lending methodology is observed only once and assumed to be invariant over the period for which we have other observations for the MFI. This precludes panel data estimations. The pooled data therefore includes the country identifier HDI and time dummies in order to remove as much as possible of MFI heterogeneity (Wooldridge, 2010). As a check for the validity of this approach, we also run regressions with the rating year observations only.

The consequences of the loan contract for the repayment are estimated with the instrumental variables (IV) method and also with random effects panel data method. In the IV regressions we use the predicted probability that the loan contract is individual from the loan contract estimations as an instrument for the endogenous loan contract. The loan contract is an ordered categorical variable. This means that our procedure is an extension of the Heckman (1979) dummy endogenous variable method to the three categories' case. The extension is straightforward. For this method to work, the residual needs to be uncorrelated with the generated instrument and the regressors (Wooldridge, 2010, p. 939). The standard errors and test statistics are asymptotically valid. The method is robust to the specification of the model predicting the loan contract. Specifically, the generated instrument can be partially correlated with the other regressors. This is an advantage over the model where a generated prediction of the loan contract supplants the loan contract itself in the regression. For this alternative to hold, the prediction model needs to correctly predict the loan contract.

We specify operational costs in a constant elasticity function and estimate the efficient cost frontier with stochastic frontier analysis (SFA), as we have explained earlier, first by including the loan contract among the regressors in the determination of the cost frontier, and then by including the loan contract among the explanatory variables in the inefficiency residual . Controls include the MFI's age, the Human Development Index (HDI) developed by the UN, and year indicators. In the  The SFA is much used in the study of banking. In the Berger and Humphrey (1997) survey of 130 papers on efficiency frontier analysis in the banking sector about 60 papers use the SFA.

## 6 ECONOMETRIC EVIDENCE

We start by running logit regressions for the likelihood of loan contract choice, and then turn to the analysis of repayment and operational costs given the choice of loan contract.

### 6.1 The loan contract choice

In table 4 we present econometric evidence from four ordered logit regressions using the MFI's outreach objective and institutional variables as right hand side variables. The first three regressions vary the financial sustainability variable on the full sample, and the fourth uses the rating years only.

**Table 4**

All regressions in table 4 have satisfactory goodness of fit measures, and the measures are on the same level. The likelihood ratio statistic is a test if all coefficients can be zero. Obviously, they cannot. Furthermore, we notice that except for the OSS2 result in the rating year only regression, the coefficient values are of the same sign for each right hand side variable in all regressions, and also that the coefficient values are close. Thus, we need only comment on the results variable by variable.

Table 4 shows that the MFI's outreach objective is a strong predictor for the group loan. We find that the group loan is preferred in rural areas and when the MFI has a gender bias. When the average loan in the MFI increases, the bank is more likely to prefer individual loans. The reverse of this is of course that group loans are preferred for small loans. Our results confirm findings in Ahlin and Townsend (2007a, 2007b), Hermes et al. (2005), Karlan (2007), and Zeller (1998), who find that the group loan is the common loan contract in communities with

high social cohesion, that is, in rural, low-income (thus low average loan), and gender biased lending schemes.

Financial sustainability is also related to the loan methodology. The higher the financial sustainability is, the less likely the MFI is to be group only lending institution. Thus, the two main goals for the MFI, outreach and financial sustainability, have opposite implications for the choice of a loan contract.

We find that the international founder MFI strongly predicts the group loan. The international founder has a strong preference for the group loan. This may be rooted in the conviction that the group loan is better suited to reach out to the poorest segments of the population. Ghatak and Guinnane (1999) predict that competition increases the use of individual loans. We cannot confirm this hypothesis. However, the competition may influence the operational costs or repayments. Thus the final judgement on the relationship between competition and the use of the group loan must be postponed.

The Human Development Index HDI has a negative sign. Thus, with a higher development level, the individual loan becomes more likely. HDI measures income, education (literacy among others), and health in the population. Probably, all three aspects enable the individual to better shoulder an individual loan. Thus, we should expect the individual loan to be more preferred when the development level increases.

The overall conclusion of these findings is that the results are reasonable and in conformance with the hypotheses we make. From the regression (3) we extract the probability that the MFI chooses the individual loan, given the characteristics in the right hand side variables. We choose regression (3) since OSS2 is the measure that gives the cleanest representation of the MFI's sustainability, and because the coefficients are almost the same as in the sample with

only rating year observations in (4). The saved probabilities, or the instrumented loan contract, will be used in the consequence regressions that follow.

### 6.2 The repayment and operational cost consequences of the group loan

One prediction from theory is that the group loan should improve customers' repayment record. A perhaps more prosaic prediction for the group loan is that operational costs are lower because of lower collection costs. We test for these effects here. Table 5 contains regressions when portfolio at risk (Par30) is regressed on the loan contract, outreach variables, and control variables, first with instrumental variables and then with random effects. The Par30 is significantly different among loan contracts in table 3, unlike the rival writeoff variable.

**Table 5**

Table 5 shows satisfactory goodness of fit statistics. The regressions have very close coefficients on the common variables. In the instrumental variables regressions the residuals are uncorrelated with instrument and the explanatory variables as is evident in the extremely low R sqrd.

The repayment argument, inspired by the early very high repayment rates in the Grameen bank and noted in the first theoretical models (Stiglitz, 1990; Varian, 1990), find in fact only a weak confirmation in the first random effects regression in table 5. Thus, the more "groupish" the loan contract, the more likely the default rate will fall. The signs are in the same direction in all regressions, but only one yields a significant result. A more reasonable interpretation

seems to be that one cannot differentiate between individual and group loans in term of repayment probabilities.

Furthermore, we can confirm the d'Espallier et al. (2012) result that female borrowers are more likely to repay than male. Table 5 also shows that the default rate increases with the MFI age, but it falls with the MFI being internationally founded and the higher the development level of the country. These results are as expected. The MFI is likely to be more lenient in its collection practices with time, probably seeing that sometimes a little patience can give better repayment over the long-term customer relationship than a strict, no bargaining, no extension, collection practice.

We also run a robustness check with the variable writeoff as a dependent variable. The loan contract is not significant in this specification either.

In tables 6 and 7 we investigate the loan contract's association with operational costs exploiting the stochastic frontier analysis SFA in table 6 by including the loan contract in the SFA equation, and in table 7 by using the loan contract to as an explanatory variable for

**Table 6**

**Table 7**

We note that the overall likelihood ratio (LR) statistic is very satisfactory in table 6, and that most of our hypothesized coefficients are significant and of the expected sign. When we introduce the loan contract into the regression, coefficients are little disturbed. This means that the analysis in table 6 as well as the inefficiency analysis in table 7 are meaningful.

We find that the group loan is associated with higher operational costs. Thus, the cost savings from servicing many borrowers at the time are outweighed by the high costs of small loans.

We also find that operational costs fall with the number of credit clients, our measure of the product in the constant elasticity regression specification in table 6. Thus, the operational costs fall with broader outreach. Furthermore, the costs fall with the number of years the MFI has been in business, indicating that the MFI is on a learning curve for the operational efficiency. Lastly, the higher value on the development index HDI, the higher the operational costs, reflecting that costs are higher in more developed countries. This is also a reasonable result.

Table 7confirms the results from table 6. This time we have the technical efficiency as the dependent variable. This is a measure of the distance from the efficient frontier. The larger the distance, the more technical inefficient the MFI is. The first regression in table 6 gives us the technical inefficiency term for each MFI. Thus, the loan contract is positive here, a common result for both IV and OLS regressions. We note also that the distance to the efficient frontier decreases with a larger average loan, and also with competition. Thus, granting larger loans allows the MFI to be more cost efficient. A stiffer competition forces the MFI to be more cost efficient.

## 7 CONCLUDING REMARKS

Although the group loan is seen as a defining characteristic of microfinance, the supply of financial services to the poor, MFIs in fact grant individual loans on at least the same scale. In this article, we seek explanations for the MFI's *choice* of either individual or group loan as well as the consequences for repayment and operational costs that follow when a given loan contract is chosen. Thus, we see the loan contract as endogenous. The data are pulled from

rating reports covering 379 MFIs from 73 countries with up to six years of data for each. We are unaware of similar testing for a large global sample of MFIs.

We find that the more the MFI favours outreach to the poorest segments among borrowers, the more likely it is that the group loan is chosen. We also find a strong element of an international push towards the group loan, since this loan contract is preferred by international founders. A stronger competition, on the other hand, tends to bring forth the individual loan. Thus, repayment risk cannot alone explain why the MFI chooses to offer a group loan rather than an individual. Instead, the MFI's outreach to rural market, to female customers, and generally to small-loans customers predicts the choice of loan contract. Thus, the main market orientation (urban or rural) and gender bias confirm results in a number of earlier empirical studies, such as Hermes et al. (2005) and Zeller (1998).

We are then able to follow a two-step procedure for testing the consequences of the loan contract, building upon the Heckman (1979) dummy endogenous variable model. Thus, we test if the group loan ensures better borrower contract fulfilment than the individual loan. Arguably, this is the upshot from theoretical contributions in microfinance (Stiglitz, 1990; Varian, 1990; Besley and Coate, 1995; Armendàariz de Aghion, 1999; Ghatak, 1999, 2000; Chowdhury, 2005, 2007), although critical contributions exist (Rai and Sjöström, 2004). From the choice regression we are able to generate an instrumented loan contract, that is, a variable where its endogeneity is taken into account. We find that the group loan is not a strong predictor of better repayment, but that the group loan brings forth larger operational costs.

We also investigate whether the loan contract has any consequences for operational costs in a stochastic frontier analysis (SFA) framework. The analysis allows us to study cost consequences both by including the loan contract in the SFA directly, but also by extracting the technical efficiency of each MFI, and then using this as a dependent variable with the loan

contract as the main independent. In both cases it turns out that the group loan is associated with higher operational costs. We also show that the results are consistent, whether we use the loan contract or its instrumented version in regressions. Furthermore, we find that competition is negatively related to cost efficiency, that is, competition brings about lower operational costs, confirming a hypothesis in Ghatak and Guinnane (1999). Thus, the screening, monitoring, auditing, and enforcement advantages group loans are supposed to have over individual (Ghatak and Guinnane, 1999) simply cannot be the full story, and in any case, the advantages are likely to be temporary.

More than half of the MFIs in our sample offer both individual and group loans. However, we are unable to ascertain the percentage of individual loans in the MFI's portfolio. This should not invalidate our results, but an interesting question is whether our results apply to more detailed lending methodology data as well. This requires data on the individual MFIs loan portfolio and its development over time.

These results are important for the microfinance industry. First of all, we may expect the MFIs to grant more individual loans in the future, since with higher competition the costs of supplying the group loan becomes more and more difficult to uphold, and since the customer seems to prefer the individual loan. Thus, the MFI needs to take account of these shifts in market conditions when setting up or maintaining its lending schemes. This migration into individual loans is parallel to a similar transition in the north Atlantic countries from about 1850 (Cull et al, 2006). Thus, the group loan can perhaps be seen as a step in the integration of poor people into the market economy, and that further development will ensue from individual loans. Second, the improvement of the economic state of a region is likely to induce greater income differences, that is, greater heterogeneity among potential group loan members. This will further stimulate individual lending.

The finding that group loans indeed is the most chosen model to reach the poorest customers while market conditions may drive MFIs towards individual lending should stimulate new research efforts into the interplay between outreach to the poor and MFI sustainability. In this regard greater attention to mechanisms that are suited for individual loans in microfinance, such as dynamic incentive models of the type discussed in Rajan (1992) and Sharpe (1990) is needed.

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# TABLES

Table 1: Definitions of variables and their hypothesised sign with respect to the lending methodology dependent variable

| *Variable* | *Explanation* |
|---|---|
| Loan contract | An ordinal variable with categories for individual only (1), individual and group (village bank and solidarity group) (2), and group only (3) |
| Portfolio at risk (PaR30) | The fraction of the portfolio with more than 30 days in arrears |
| Write-off | The fraction of the portfolio written off in the year |
| Operational expenses | (Operating expenses)/( loan portfolio) |
| Average loan | (Loan portfolio)/(Credit clients) GDP per capita adjusted |
| Gender bias | A binary variable with the value 1 if the MFI states a preference for granting loans mainly to women |
| Urban main market | A binary variable with the value 1 if the market served is urban mainly |
| Credit clients | The (logarithm) of the total number of credit clients |
| ROA | Return on average value of assets, inflation adjusted |
| OSS1 | Operational self-sufficiency: Revenue divided by expenses |
| OSS2 | Operational self-sufficiency: Revenue divided by operational costs |
| Competition | A self-constructed measure of the local level of competition based on raters' information |
| International founder | A binary variable being 1 if the MFI was founded by an international organisation |
| Ownerrship type | A binary variable being 1 if the MFI is a shareholder owned company |
| MFI age | Years of experience as an MFI |
| Firm size | The natural logarithm of assets  GDP per capita adjusted |
| Wages | Personnel costs divided by employees GDP per capita adjusted |
| Fixed expenses | Fixed assets divided by all assets |
| Borrowing rate | Interest and commission expenses divided by total borrowings adjusted for purchasing power parity |
| HDI | Human Development Index, an index covering income level, health, and education of a country |
| Time dummies | An indicator variable for each year |

Table 2: Main statistics of variables used in the analysis distributed by loan contract together with an ANOVA test for their difference in means.

| Var: | Individual | | | Mixed | | | Group loan | | | ANOVA |
|---|---|---|---|---|---|---|---|---|---|---|
| | Avg | Std | N | Avg | Std | N | Avg | Std | N | P |
| Avg.loan | 0.83 | 1.37 | 413 | 0.54 | 0.75 | 810 | 0.25 | 0.42 | 244 | 0.00 |
| gender | 0.20 | 0.40 | 401 | 0.50 | 0.50 | 787 | 0.76 | 0.43 | 241 | 0.00 |
| urban | 0.39 | 0.49 | 413 | 0.28 | 0.45 | 810 | 0.20 | 0.40 | 244 | 0.00 |
| Cred.cli. | 5645 | 9090 | 411 | 14985 | 28946 | 801 | 17435 | 33802 | 243 | 0.00 |
| ROA | 0.04 | 0.07 | 405 | 0.00 | 0.13 | 787 | -0.02 | 0.16 | 233 | 0.00 |
| OSS1 | 1.28 | 0.63 | 404 | 1.10 | 0.70 | 766 | 0.97 | 0.47 | 223 | 0.00 |
| OSS2 | 1.85 | 0.98 | 404 | 1.43 | 0.98 | 765 | 1.19 | 0.67 | 223 | 0.00 |
| PaR30 | 0.07 | 0.08 | 396 | 0.06 | 0.10 | 768 | 0.05 | 0.09 | 217 | 0.02 |
| Writeoff | 0.02 | 0.06 | 392 | 0.02 | 0.10 | 738 | 0.02 | 0.07 | 177 | 0.91 |
| Opxport | 0.21 | 0.25 | 410 | 0.30 | 0.30 | 799 | 0.39 | 0.34 | 238 | 0.00 |
| Assets | 5969 | 19303 | 410 | 9032 | 25617 | 804 | 5113 | 14056 | 241 | 0.01 |
| Own. | 0.35 | 0.48 | 412 | 0.36 | 0.48 | 810 | 0.22 | 0.42 | 244 | 0.00 |
| Int.found. | 0.21 | 0.41 | 408 | 0.47 | 0.50 | 806 | 0.46 | 0.50 | 242 | 0.00 |
| Compet. | 4.31 | 1.63 | 407 | 4.50 | 1.48 | 796 | 3.97 | 1.35 | 207 | 0.00 |
| MFI age | 10.20 | 7.91 | 410 | 9.24 | 6.11 | 810 | 8.56 | 6.93 | 240 | 0.01 |
| HDI | 0.68 | 0.10 | 413 | 0.59 | 0.13 | 809 | 0.56 | 0.14 | 244 | 0.00 |
| Wage | 4.37 | 4.32 | 401 | 5.04 | 6.02 | 764 | 4.24 | 5.01 | 226 | 0.05 |
| Fix.ass. | 0.05 | 0.06 | 405 | 0.05 | 0.05 | 787 | 0.05 | 0.04 | 232 | 0.07 |
| Borr.r. | -0.01 | 0.07 | 403 | -0.02 | 0.07 | 770 | -0.03 | 0.06 | 225 | 0.00 |

Table 3: Bivariate Pearson correlations between MFI and country explanatory variables.

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Contract | | | | | | | | | | |
| 2 | Avg.loan | -0.20 | | | | | | | | | |
| 3 | gender | 0.37 | -0.19 | | | | | | | | |
| 4 | urban | -0.14 | 0.03 | 0.07 | | | | | | | |
| 5 | Cred.cli. | 0.16 | -0.08 | 0.04 | -0.10 | | | | | | |
| 6 | ROA | -0.17 | 0.05 | -0.01 | 0.09 | 0.10 | | | | | |
| 7 | OSS1 | -0.16 | 0.05 | -0.07 | 0.05 | 0.10 | 0.43 | | | | |
| 8 | OSS2 | -0.23 | 0.10 | -0.12 | 0.03 | 0.08 | 0.38 | 0.86 | | | |
| 9 | PaR30 | -0.07 | 0.14 | -0.10 | 0.04 | -0.10 | -0.27 | -0.11 | -0.06 | | |
| 10 | Writeoff | 0.00 | 0.05 | 0.03 | 0.04 | -0.06 | -0.28 | -0.10 | -0.07 | 0.29 | |
| 11 | Opxport | 0.19 | -0.17 | 0.08 | 0.00 | -0.07 | -0.48 | -0.28 | -0.36 | 0.00 | 0.19 |
| 12 | Assets | 0.00 | 0.16 | -0.07 | -0.05 | 0.68 | 0.06 | 0.10 | 0.09 | 0.00 | 0.00 |
| 13 | Own. | -0.07 | 0.07 | -0.26 | -0.08 | 0.09 | -0.05 | -0.03 | -0.05 | -0.04 | -0.03 |
| 14 | Int.found. | 0.20 | -0.02 | 0.19 | -0.03 | 0.04 | -0.03 | -0.04 | -0.13 | -0.17 | 0.04 |
| 15 | Compet. | -0.04 | 0.02 | -0.12 | -0.03 | 0.04 | 0.03 | 0.05 | 0.04 | 0.07 | 0.01 |
| 16 | MFI age | -0.08 | -0.01 | -0.02 | -0.03 | 0.11 | 0.08 | 0.02 | 0.05 | 0.18 | 0.01 |
| 17 | HDI | -0.33 | -0.23 | -0.09 | 0.12 | -0.20 | 0.22 | 0.16 | 0.19 | -0.09 | -0.08 |
| 18 | Wage | 0.01 | 0.23 | 0.02 | -0.03 | -0.01 | -0.06 | -0.09 | -0.10 | 0.07 | 0.14 |
| 19 | Fix.ass. | -0.02 | -0.06 | 0.04 | -0.04 | -0.07 | -0.18 | -0.14 | -0.12 | 0.06 | 0.10 |
| 20 | Borr.r. | -0.11 | -0.03 | 0.03 | 0.03 | 0.01 | 0.03 | 0.04 | 0.10 | 0.08 | 0.03 |

| | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|
| 12 | Assets | -0.10 | | | | | | | | |
| 13 | Own. | 0.04 | 0.17 | | | | | | | |
| 14 | Int.found. | 0.13 | 0.01 | 0.06 | | | | | | |
| 15 | Compet. | -0.04 | 0.05 | -0.04 | -0.09 | | | | | |
| 16 | MFI age | -0.11 | 0.16 | -0.12 | -0.16 | 0.05 | | | | |
| 17 | HDI | -0.08 | -0.27 | -0.16 | -0.10 | 0.04 | 0.01 | | | |
| 18 | Wage | 0.17 | 0.07 | 0.11 | 0.12 | 0.14 | 0.04 | -0.31 | | |
| 19 | Fix.ass. | 0.20 | -0.04 | -0.07 | -0.01 | -0.03 | 0.08 | -0.08 | 0.00 | |
| 20 | Borr.r. | -0.09 | -0.01 | -0.01 | -0.04 | 0.18 | 0.05 | 0.10 | 0.02 | 0.01 |

"opexpass" is operational costs per assets; "urban" signifies that urban customers are the MFI's main market; "gender" is the MFI's gender bias in its lending practice; "avglppp" is the MFI's average loan, adjusted for purchasing power parity (PPP) differences; "compet" is the MFI's perception of competition in its area; "MFIage" is the MFI's age; "lnassppp" is the logarithm of the MFI's assets PPP-adjusted; "gdpppcap" is the country GDP per capita PPP-adjusted; "gdpgro" is the percentage growth rate in the country's GDP; "curracc" is the country's current account as a percentage of its GDP; "heritage" is the Heritage Foundation index of economic liberty.

Table 4: The choice of lending methodology and MFI characteristics. Ordered logistic estimation when individual lending only is 1, individual and group lending is 2, and group lending only is 3. Year indicator variables are included in each regression.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Average loan | -0.767*** | -0.781*** | -0.749*** | -0.709*** |
| Gender | 1.329*** | 1.355*** | 1.352*** | 1.384*** |
| Urban | -0.486*** | -0.418*** | -0.410*** | -0.346 |
| ROA | -0.733** | | | |
| OSS1 | | -0.266** | | |
| OSS2 | | | -0.452*** | -0.179 |
| Ownership type | -0.217* | -0.151 | -0.148 | -0.087 |
| International founder | 0.659*** | 0.733*** | 0.695*** | 0.681*** |
| Competition | 0.014 | 0.019 | 0.024 | 0.042 |
| MFI's age | -0.017* | -0.015 | -0.014 | -0.002 |
| HDI | -5.978*** | -5.879*** | -5.566*** | -6.099*** |
| Pseudo R sqr | 0.189 | 0.193 | 0.197 | 0.188 |
| LR chisqr p-value | 0.000 | 0.000 | 0.000 | 0.000 |
| Observations | 1325 | 1292 | 1293 | 422 |

Coefficient significance is indicated with * (10%), ** (5%), and *** (1%).
The Pseudo $R^2$ is defined as $R^2$ = 1-ln $L_{fit}$/ln $L_0$, where ln $L_0$ is the log likelihood of the intercept-only model, and ln $L_{fit}$ is the likelihood of the fitted model.
The Likelihood ratio test is a test if all variables have zero influence upon loan methodology.
The LR (likelihood ratio) test is a test for the embedded model 1 represents the full model 2.
Low p-values reject the hypothesis.

Table 5: Default rate (portfolio at risk – 30 days) estimation with endogenous loan contract as independent variable. Estimation with instrumental variables where the instrument for the loan contract is the probability, taken from column (3) in table 4, that the MFI gives individual loans and mixes between individual and group loan. Random effects estimation. The loan contract is defined as 1 if the MFI gives only individual loans, 2 if lending is mixed between individual and group loans, and 3 if the MFI grants only group loans. In column (1) the loan contract is the instrumented loan contract drawn from regressions in table 4. The instrumented loan contract is the probability that the loan contract is either 1 or 2, given the explanatory variables in table 4, with 3 as the reference category.

| | Instrumental variables | | Random effects | |
|---|---|---|---|---|
| Loan contract | -0.009 | -0.002 | -0.009* | -0.003 |
| Average loan | | 0.003 | | 0.003 |
| Gender | | -0.021*** | | -0.020*** |
| Urban | | 0.001 | | 0.003 |
| Assets | 0.000 | 0.000* | 0.000*** | 0.000*** |
| MFI age | 0.027*** | 0.029*** | 0.026*** | 0.028*** |
| Ownership type | -0.004 | -0.009 | -0.003 | -0.008 |
| International founder | -0.022*** | -0.019*** | -0.021*** | -0.019*** |
| Competition | 0.001 | 0.000 | 0.001 | 0.001 |
| HDI | -0.045*** | -0.043*** | -0.046*** | -0.046*** |
| Constant | -0.032 | -0.033 | -0.031 | -0.034 |
| Year indicators | Yes | Yes | Yes | Yes |
| R sqrd | 0.103 | 0.118 | 0.096 | 0.109 |
| Residuals Rsqrd test | 0.001 | 0.001 | | |
| Observations | 1230 | 1230 | 1310 | 1278 |
| MFIs | 340 | 340 | 348 | 341 |

The Residuals Rsqrd test runs the

Table 6: Estimation of MFIs' efficient cost frontier by means of the stochastic frontier analysis. All continuous variables are in natural logarithms.

| | (1) | (2) |
|---|---|---|
| Loan contract | | 0.353*** |
| Credit clients | -0.206*** | -0.285*** |
| Wage | 0.399*** | 0.411*** |
| Fixed assets | 0.195 | 0.193 |
| Borrowing rate | -0.132*** | -0.082*** |
| MFI's age | -0.168*** | -0.135*** |
| HDI | 0.533*** | 0.829*** |
| Constant | -2.042*** | -3.192 |
| Year indicators | Yes | Yes |
| LR chisqr p-value | 0.000 | 0.000 |
| Observations | 1173 | 1172 |
| MFIs | 334 | 333 |

Table 7: OLS regressions of cost efficiency on loan contract and control variables.

| | Instrumental variables | | OLS | |
|---|---|---|---|---|
| Loan contract | 2.189*** | 1.975*** | 2.130*** | 1.909*** |
| Average loan | | -0.447** | | -0.464** |
| MFI age | 0.713* | 0.678* | 0.725 | 0.686* |
| Stock company | -0.701 | -0.692 | -0.436 | -0.432 |
| International founder | 0.404 | 0.449 | 0.333 | 0.380 |
| Competition | -0.498*** | -0.500*** | -0.502*** | -0.503*** |
| Assets | 0.000 | 0.000 | 0.000 | 0.000 |
| HDI | 5.477*** | 4.938*** | 5.774*** | 5.213*** |
| Constant | 5.061** | 2.945 | 5.403*** | 5.816*** |
| Year indicators | Yes | Yes | Yes | Yes |
| R sqrd | 0.194 | 0.203 | 0.158 | 0.1653 |
| Residuals Rsqrd test | 0.023 | 0.008 | | |
| Observations | 422 | 422 | 433 | 433 |