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Adverse selection and moral hazard in group-based lending

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Chapter 9 Summary and Recommendations for Further Research

9.1 Introduction

The last two decades have witnessed the emergence of financial institutions to reach low-income producers with affordable credit and suitable mechanisms. The origin of these institutions lies in Asia and Latin America and has now reached other parts of the world. They are called microfinance institutions, since they provide micro-loans to those members of societies who do not have access to credit from formal financial institutions.

Although we observe different models of microfinance that are operating in different parts of the world, they do have certain characteristics in common. One of the main common characteristics is their ability to curb problems that arise from asymmetry of information. MFIs can be broadly divided into group-based and individual-based lending. In this thesis we have focused on group-based lending.

Group-based lending requires individuals to organize themselves into groups to get access to financial services. Normally, in group-based lending loans are made out to individuals. However, all members of the group are held responsible for loan repayment – i.e. the joint liability principle.

Group-based lending contracts effectively make a borrower's neighbors cosigners to loans, mitigating problems that are created by informational asymmetries such as adverse selection, moral hazard, and enforcement of repayment. Thus, in group-lending programs, the functions of screening, monitoring, and enforcement of repayment are to a large extent transferred from the creditor to group members.

Several theories have emerged explaining how group-based lending mitigates adverse selection, moral hazard and enforcement problems

(Stiglitz, 1990; Ghatak, 1999; Besley and Coate, 1995). Yet, there are very few empirical studies to substantiate these theories. Most of the existing empirical works on group-based lending concentrate on poverty alleviation, outreach, sustainability and repayment performance of these programs (Hulme and Mosley, 1996; Morduch, 1999).

The aim of this thesis has been to investigate whether theoretical models explaining how group-based lending mitigates asymmetric information problems can be supported by empirical evidence. In particular, we have investigated the following research questions.

- a) Is repayment performance of group-based lending programs positively influenced by monitoring activities of individual group members? Does it matter who these individuals are?
- b) Do monitoring activities and social ties help to mitigate moral hazard behavior among individual members of groups in group-based lending programs? Does it matter who is monitoring and/or who has these social ties?
- c) Do group members match homogeneously or heterogeneously in risk during the process of group formation?

These research questions have been addressed in the context of two group-based lending programs in Eritrea for which we have detailed data on screening, monitoring and enforcement activities, as well as information on personal characteristics of individual group members. The remainder of this chapter presents conclusions and recommendations for further research on the basis of the findings of the empirical chapters of this thesis. Although our conclusions are based on the experience in Eritrea alone, we feel that our findings may be of importance to understanding the functioning of group-based lending programs in other less developed countries.

9.2 Conclusions from the empirical investigations and suggestions for further research

9.2.1 Repayment performance and social ties of individual group members

In chapter 6 of this thesis we have investigated the determinants of repayment performance of groups. Several theories indicate that repayment performance is related to the screening, monitoring and enforcement of group members; and several earlier empirical studies show that repayment performance of groups is indeed determined by the screening, monitoring, and enforcement activities of its members. Some studies also show that social ties may matter. We have extended the existing empirical literature by emphasizing that it does matter who is carrying out these activities within the group when analyzing repayment performance of groups. In particular, we investigate whether differences in monitoring activities of group leaders versus other group members make a difference to the repayment performance of groups.

Most empirical studies use data of one individual member as a representative of his group and test group repayment performance. In our analysis, we use data of at least two group members: the group leader and at least one other member of the group. This permits us to separate the data into two parts: that is, variables describing the activities and characteristics of the group leader, and variables related to members other than the group leader. Consequently, we are able to test whether there are differences with respect to the role of the monitoring activities and social ties of group leaders vis-à-vis these activities and ties of other group members in reducing repayment problems of groups.

As has been explained in previous chapters, we have focused on the differences in behavior between the group leader versus the other group members, because when we visited the group-based lending programs in Eritrea, we noticed that group leaders in the Eritrean MFIs performed a lot of activities on behalf of the other group members. Therefore, we wanted to investigate whether their activities have a different impact on group

performance as compared to the same activities yet performed by other group members.

The results of our study suggest that there is evidence to support the hypothesis that there is a negative relationship between social ties of the group leader on the one hand, and the occurrence of repayment problems of individual group members on the other hand. We do not find any relationship between ties and repayment problems when we look at the social ties of other group members. These results suggest that group leaders really make use of existing social ties to improve repayment performance of their group, whereas this is not necessarily true for regular group members. Alternatively, the results may suggest that social ties of group leaders are effective in reducing repayment problems of groups, whereas this does not hold for the ties of other group members.

To the best of our knowledge, our research is the first attempt to empirically investigate differences in behavior of different group members and their effect on group performance. The study shows it is important to take into account differences in behavior of different types of members in a group when investigating monitoring activities and their effects on group performance. It may also question the value of existing theoretical models on group-based lending, since these models explain how these programs work by assuming that all group members perform the same kind of monitoring activities. According to our study this is clearly not the case – at least not in Eritrea. Future research should focus on carrying out similar empirical investigations in other program and/or country contexts to see whether our results are more generally valid.

9.2.2 Moral hazard behavior and monitoring activities of individual group members

The aim of chapter 7 has been to test whether monitoring and social ties of different types of group members reduce moral hazard behavior of members. Joint liability lending theories present models that illustrate how the group-based lending mechanism reduces moral hazard problems. Individuals come together of their own free will to form borrowing groups

and they promise to be jointly liable for each other. In order not to end up paying for a defaulting member, each member monitors the other members' investment behavior. Thus, group-based lending programs delegate costly monitoring activities to group members, which may help these programs to reduce their lending costs.

While there are plenty theoretical studies on the relationship between group monitoring and moral hazard behavior, very few empirical tests have been conducted to determine the validity of these theoretical claims. We have investigated whether monitoring and the social ties of different types of group members reduce the occurrence of moral hazard in the two group-based lending programs in Eritrea. As shown in chapter 6, we studied this by dividing the sample data into variables related to group members other than the group leader and variables related to group leaders only. The rationale for this approach has been explained in previous chapters.

We have found support for the fact that monitoring activities and social ties of group leaders may help to reduce moral hazard behavior of group members. In particular, our results indicate that regular contact and a short physical distance between the group leader and the other group members help to reduce misuse of loans by individual group members. Moreover, if the group leader has known the other group members before forming the group, and if he has not changed groups in the past, this reduces the probability of moral hazard within the group. We have found no link between monitoring activities and the social ties of other group members other than the group leader and the occurrence of moral hazard within the group.

The empirical findings in chapter 7 are in line with the findings in chapter 6. As discussed, in chapter 7 we have found that monitoring and social ties of the group leader may help to mitigate moral hazard behavior of group members. Similarly, chapter 6 shows that social ties of the group leader help to reduce the repayment problems of individual group members. These findings support the presumption that if monitoring

reduces moral hazard behavior among group members, this indirectly improves the repayment performance of groups.

The findings in both chapters 6 and 7 point out that it is important to take into account differences in behavior of different types of group members. The results reported in both chapters raise a number of issues that could also be studied. Most importantly, further analysis is needed to find out whether the structure of group-based lending in Eritrea, in which group leaders seem to be the ones who contribute most to the reduction of the probability of moral hazard and to improving repayment performance, is an effective one. This structure seems to put much emphasis on the role of just one individual, i.e. the group leader, while the rest of the group members can free-ride on his efforts. This may not be informationally efficient. On the other hand, although the literature explaining monitoring within groups normally assumes that everybody is monitoring everybody else, some papers have pointed out that this may also not be informationally efficient, since the costs of monitoring become too high in such a model. Armendáriz De Aghion (1999) has called the above type of monitoring – where each member of the group is always monitored by all of his peers – the mutual monitoring structure. The mutual monitoring structure obviously leads to duplication of efforts and a waste of time and resources. Armendáriz De Aghion (1999) suggests another model called the rotating pyramid structure. According to this structure, in each period a different member at the top of the pyramid monitors his peers at the bottom of the pyramid. Rotating monitoring avoids duplication of efforts by members and minimizes monitoring costs.

The group structure that seems to work in the Eritrean group-based lending programs may be just one of many alternatives. We recommend further theoretical and empirical research in this direction, as we believe that it would improve the understanding of the monitoring mechanism in group-based lending programs. Closely related to this, we would like to recommend that new models are developed, in which delegated monitoring theory is incorporated. Delegated monitoring in this context means that lending institutions, rather than using a mutual monitoring structure, introduce mechanisms in which the monitoring function is

delegated to an individual. The delegate can be a village chief, a village administrator, a locally stationed loan promoter, etc.¹ The group structure in Eritrea appears to have clear similarities with such a delegated monitoring structure.

Apart from further investigating the theoretical implications of the group structure we have seen in Eritrea, we may consider a number of other issues that may be studied in the future. First, we have to investigate whether the difference in the impact of monitoring and social ties of group leaders vis-à-vis other group members on moral hazard and repayment performance of groups is also found elsewhere, i.e. in group-based lending programs outside Eritrea. Second, we need to elaborate on the theoretical foundation explaining why an individual wants to become a group leader, given the fact that this position may be quite burdensome and responsible, and given the fact that other group members may try to free-ride on the monitoring efforts of the group leader. Third, further research is needed on how group leaders in Eritrean credit programs are chosen and why some individuals are willing to take up the burdensome tasks of being a group leader.

9.2.3 Adverse selection, risk behavior and group formation

The aim of chapter 8 has been to provide new insights into the empirical relevance of the homogeneous matching hypothesis in theoretical models of group-based lending. These models can be categorized into two groups. A first group of papers claims that groups match homogeneously in risk, which means safe borrowers match with safe borrowers and risky borrowers with risky ones. Thus, homogenous matching allows the lender to identify different groups on the basis of their risk level. This permits lending programs to mitigate adverse selection problem.

Alternatively, some papers have demonstrated that groups match heterogeneously in risk, which leads to risk pooling (Sadoulet, 1999). This group of papers challenges the homogenous matching theory and

¹ For similar studies see Warning and Sadoulet (1998) and Fuentes (1996).

illustrates that heterogeneous matching emerges as a rational response to the lack of insurance markets. Sadoulet and Carpenter (2001) confirm the heterogeneous matching theory in an empirical study on group-lending schemes in Guatemala.

An important part of the methodology we have used in our analysis in chapter 8 to test for homogeneous matching consists of estimating risk behavior of borrowers of the Eritrean MFIs. Our estimates suggest that among borrowers from the microfinance programs in Eritrea there is a non-linear relationship between income and risk taking. Below a certain threshold level of income an increase in income will lead to less risky behavior, whereas an increase in income will increase risk taking above the threshold level. We also find that group leaders take more chances than regular group members, that better educated borrowers take more chances, and that those borrowers who have had repayment problems in the past will take more chances. Moreover, we find evidence that borrowers in larger groups will take more chances than borrowers in smaller groups.

With respect to the homogeneous matching hypothesis, which states that group-based lending leads to homogenous matching among group members and consequently permits lenders to mitigate the adverse selection problem, our results strongly indicate that groups are formed heterogeneously in risk. Most importantly, we do not find support for the matching frictions hypothesis, in the sense that even if we control for matching frictions, credit groups in Eritrea do not seem to consist of borrowers of a similar risk type. This finding suggests that the commonly held assumption of homogeneous matching of groups in group-based lending cannot be confirmed for the case of Eritrea. Therefore, based on the results we have found we suggest that theoretical models that explain the homogenous matching hypothesis should be reconsidered and adjusted.

Given that our results show that groups in Eritrea are formed heterogeneously, an important issue then is to examine why this is so. A possible reason brought forward in some recent papers is that risky and

safe borrowers may provide insurance to each other. Members of heterogeneous group can help each other by transferring the safe borrowers' lower absolute risk to risky partners in exchange for a payment. Sadoulet and Carpenter (2001) observe that risky members make regular weekly payments of a certain sum to safe group members. In exchange for this payment, safe members agree to cover for the risky members if they fail to repay their weekly repayments during bad business weeks.

The models behind the homogeneous matching hypothesis assume that borrowers are risk neutral and that project returns do not covary. This implies that in these models there is no possibility to gain from economies of risk pooling. However, if borrowers are risk averse and project returns are not independent, then a borrower may gain by grouping with another borrower if the project returns of the two borrowers are negatively correlated. This may then imply that heterogeneous matching is the optimal outcome. Thus, further research of homogeneous versus heterogeneous matching should be aimed at developing new theoretical models with risk aversion rather than risk neutrality. Finally, further research is needed to see whether our results with respect to homogenous versus heterogeneous matching can also be found in MFIs in other contexts and countries.

9.3 Limitations of the econometric analyses

In chapters 6, 7 and 8 we have used various econometric techniques to examine whether theoretical models explaining how group-based lending mitigates asymmetric information problems can be supported by empirical evidence. In this section we discuss the limitations of the econometric analysis presented in this thesis. In particular, we focus on the following problems:

- Endogeneity problems and measurement errors
- Problems of low variability in the data
- Omitted and irrelevant variables
- Stability of the results

9.3.1. Endogeneity problems and measurement errors

A crucial assumption in the basic regression model is that the right-hand-side variables are independent of the error term. However, this assumption may be violated if the right-hand-side variables are endogenous or measured with error. The regression analyses presented in chapters 6, 7 and 8 may suffer from this.

Endogeneity between two or more variables arises when these variables are mutually or simultaneously determined. For instance, in the income determination model consumption and income are both determined by the interaction between the consumption function and income identity. Ignoring such simultaneous effects causes the presence of correlation between the regressors and the error terms, thereby resulting in inconsistent and biased estimators and thus violating assumptions underlying the basic regression model. This also holds for the logit models we have used in our empirical applications in this thesis.

We acknowledge that the ways we have set up some of our empirical models are partially problematic, since some of the right-hand-side variables may be endogenous, which may bias the estimation results. For example, in chapter 6 we investigate which variables influence the repayment performance of groups. We use a logit model to estimate the effects of independent variables in reducing the incidence of repayment problems. These independent variables are grouped into measures of peer screening and group formation, peer monitoring, social ties, and peer pressure and other control variables. Yet, group formation (the group selection process) and group monitoring may be endogenous variables. Using these variables without accounting for endogeneity may lead to erroneous conclusions about their impact on repayment performance of groups.

In chapter 7 we investigate whether peer monitoring and social ties play a role in mitigating moral hazard problems in the context of the two Eritrean group-based lending programs. The dependent variable in the analysis is a dummy variable that measures the occurrence of moral

hazard behavior within a group. We use a logit model to estimate the effects of a number of independent variables measuring social ties and peer monitoring within groups in reducing moral hazard behavior of group members. Again, however, social ties and monitoring may be endogenous variables and using these variables without accounting for endogeneity may bias the outcomes of the regression analysis.

Chapter 8 we empirically test whether groups match homogeneously or heterogeneously in risk. We estimate the relationship between individual risk and level of risk heterogeneity in the individual groups. Likewise, here also, there may endogeneity of group formation, group characteristics and borrowers' choice of project risk.

Another econometric problem we are faced with is that several variables in our analyses may be measured with error. Measurement errors may particularly occur in case of constructed variables, such as the proxies for risk and heterogeneity we have used in Chapter 8. Constructed variables are almost by definition measured incorrectly or measured with error. Variables that are measured with error may cause correlation between the right-hand-side variables and the error terms. This means that when we use variables that are measured with error in estimating a relationship, the values of these variables differ from the correct values and this may cause serious estimation problems.

To illustrate our previous discussion, let us assume that the true regression model is presented by:

$$Y_i = \beta X_i + \varepsilon_i \tag{1}$$

Assume that X_i is replaced by X_i^* in which $X_i = X_i^* + v_i$, where X_i is the true value and X_i^* is the observed value therefore the actual regression run is:

$$Y_i = \beta X_i^* + (\varepsilon_i - \beta v_i) = \beta X_i^* + \varepsilon_i^* \tag{2}$$

In this case the error term ε_i^* and the independent variable X_i^* are correlated (have a non-zero covariance), in particular:

$$\text{Cov}(\varepsilon_i^*, X_i^*) = -\beta\sigma_{vi}^2 \quad (3)$$

Thus the regression parameters will be biased and inconsistent as a result of the measurement error in the independent variable.

The most popular way to get around endogeneity problems, as well as problems caused by measurement errors in the right-hand-side variables is the use of instrumental variables and/or instrumental variables regression techniques, such as for instance GMM.

The method of instrumental variables involves the search for a new variable that is both highly correlated with the independent variable X and at the same time uncorrelated with the error term in the equation. The instrumental variable estimation technique thus controls for the fact that the explanatory variables are likely to be correlated with the error term and in this way deals with possible endogeneity problems.

However, the use of instrumental variables is not without problems. Very often it is difficult to find instruments that are uncorrelated with the error term and at the same time highly correlated with the relevant endogenous variable. In many cases, variables that are potentially available to be used as instruments are in fact performing poorly in reducing endogeneity problems. There is a voluminous literature that argues that one should be extremely careful in using instrumental variables. It is, for instance, well-known that if the correlation between the instruments and the endogenous variable is low, this instrumental variable estimator is inconsistent. It is also known that in finite samples instrumental variable estimators are biased in the same direction as the OLS estimators. This all implies that it is not unlikely, especially in situations where it is very difficult to find the right instruments, that the cure is worse than the disease.

Notwithstanding these problems related to the instrumental variables method, we should still care about the endogeneity and measurement

problems in our study. Yet, the most important limitation of the current version of the dataset with respect to handling the endogeneity and measurement problems is that it is not rich enough to successfully use the instrumental variables method. This means that one of the most important areas for further research on group-based lending in Eritrea is the improvement of the dataset, including the development of good instruments. One obvious extension of our data is to redo the questionnaire. This will allow us to construct a panel dataset. Right now, the dataset is cross-sectional, without any time-series information. With time-series information about the main variables in the analysis we may reduce endogeneity problems by using lagged, instead of contemporaneous right-hand-side variables. This also allows us to use lagged endogenous variables as instruments. As is known from the literature, under certain conditions, lagged levels can be used as instruments for the contemporaneous differences and lagged differences as instruments for the contemporaneous levels.

To conclude the discussion on problems of endogeneity and measurement errors: we realize that these problems may bias our empirical results. Ideally, therefore, we should have corrected the estimations by using instrumental variables. Given the current dataset this is not possible, however. Future research should aim at enriching the information about group lending in Eritrea in such a way that useful instruments for variables such as group formation and monitoring are included. At this stage of the research, the only thing we can do is to clearly express that our results must be interpreted with care, given the econometric problems described above.

9.3.2 Omitted and irrelevant variables

Another problem our estimates may suffer from is that some relevant variables are not included in the regressions and that some irrelevant variables are included.

Even with sound economic principles and logic, it is possible that in our models important variables are omitted and/or irrelevant variables are

included. To introduce the omitted variable problem in the context of our studies, suppose for instance that the repayment problems (RP) of a group member in group based lending program depends his income (I), amount of credit (A) allotted to him, and his creditworthiness (W), such that we can write the model as follows:

$$RP = \alpha_1 + \alpha_2 I_t + \alpha_3 A_t + \alpha_4 W_t + e_t \quad (4)$$

However, suppose that data on creditworthiness of a candidate are not easily available, so instead, we may estimate the model:

$$RP = \alpha_1 + \alpha_2 I_t + \alpha_3 A_t + e_t \quad (5)$$

By estimating (5) we are imposing the restricting $\alpha_4 = 0$ when it is not true. The logit estimator for α_1 and α_2 will generally be biased, although it will have lower variance. It may not be biased if the omitted variable (W_t) is uncorrelated with the included variables (I_t and A_t). However, uncorrelated explanatory variables are rare.

Thus, in order to avoid the omitted-variables bias one should include all relevant variables even if one is interested only in the impact of one of the individual regressors on the dependent variable. It also means that, if an estimated equation has coefficients with unexpected signs, or unrealistic magnitudes, a possible cause of this strange result is the omission of an important variable.

Similarly, if we add an irrelevant variable to an equation we will end up inflating the variances of the estimates. Suppose the correct specification is the above equation (4):

$$RP = \alpha_1 + \alpha_2 I_t + \alpha_3 A_t + \alpha_4 W_t + e_t \quad (6)$$

but we estimate the model:

$$RP = \alpha_1 + \alpha_2 I_t + \alpha_3 A_t + \alpha_4 W_t + \alpha_5 H + e_t \quad (7)$$

where H is height of a group member, where $\alpha_5 = 0$. Thus, H is an irrelevant variable. The inclusion of an irrelevant variable does not make the estimator biased, but the variances of α_1 , α_2 , α_3 and α_4 will be greater than those obtained by estimating the correct model. The variances of α_1 , α_2 , α_3 and α_4 will not be exaggerated if the H is not correlated with the other explanatory variables.

One method for assessing whether a variable or a group of variables should be included in an equation or not, is to perform significant tests, such as the t-test or F-test. However, there are two possible reasons for a test outcome not to reject a zero null hypothesis:

- The corresponding variables have no influence on the dependent variable and can be excluded from the model.
- The corresponding variables are important ones for inclusion in the model, but the data are not sufficiently good to reject H_0 .

It is possible for a relevant variable to have a zero estimate in a particular sample, for example because of excessive multicollinearity or due to unfortunate sampling. Similarly, an irrelevant variable may have a non-zero slope estimate in a particular regression. It is only under conditions of repeated sampling that an irrelevant variable yields coefficient estimates that, on average, are equal to zero.

To conclude the discussion on omitted and irrelevant variables, a caveat of our analysis may be that we have not included all relevant variables in our models and that this affects our estimates. For instance we do not have information in our data on group members' creditworthiness before the formation of the group. This is because most of the time it is difficult to get such information from informal credit sources on which members were dependent before joining group-based lending programs.

9.3.3 Problems of low variability in the data

A next problem with respect to the empirical analyses in this thesis is that of the low variability of the variables in our dataset. Some of the binary variables in our dataset have means close to one or zero. This seems to be common in datasets with a lot of binary variables. The low variability of these binary variables implies that the sample variation for these variables arises from just a few observations. This may affect the reliability of the results. As already indicated in chapter 6, because of problems multicollinearity and lack of variation of some of these variables we decided not to use these variables in the empirical analysis. Instead, based on extensive data analysis (the results of which are reported in the appendix tables of Chapter 6) we carefully selected a sub-set of variables from the dataset for our empirical studies. Nevertheless, we admit that there may still exist some problems related to the low variability of some variables used in the empirical analysis.

9.3.4 Stability of the results

Finally, our empirical investigations may suffer from problems related to the stability of the results. In order to test the stability of the results we estimated several different specifications of the models in all our empirical chapters. The econometric approach we followed to test the stability of our results is known as the general-to-specific approach. Another way of approaching the econometric modeling is to take the specific-to-general (bottom-up) approach, which starts from a small model, including only theoretically correct variables and then test various specifications of this smaller model. There is on going discussion about which of these two approaches is preferred (Brooks, 2002). One of the advantages of the approach we have taken is “that the statistical consequences from excluding relevant variables are usually considered more serious than those from including irrelevant variables” (Brooks, 2002, pp.209-210). Nevertheless, the data set we have is not rich enough to allow us to do further stability tests. We hope that in the future, when a new data set may be available, further stability tests will be possible.

9.3.5 Concluding remarks

The discussion of the potential econometric problems with the results we presented in Chapters 6, 7 and 8 has made one thing clear: in order to obtain stronger and more convincing answers to questions concerning how group-based lending mitigates asymmetric information problems, we need to solve these problems and one important way forward to accomplish this is to enrich our dataset. Perhaps the most serious econometric problem we have to cope with in future research is the endogeneity problem. As was suggested in section 9.3.1, one obvious extension of our dataset is by redoing the questionnaire so that we are able to create a small panel dataset. This would allow us to use lagged variables as instruments. Another important extension of the dataset would be to include questions in the questionnaire that provide information on variables that can be used as instruments in the estimations, next to the lagged variables in the regression models.

The theme of our study is a relatively new area on which there is very little empirical evidence. Therefore, we strongly believe that this area deserves further research. We have gained some experience from this endeavor and we have the intention to do further research, taking similar issues on how group-based lending programs work in other countries. At this juncture we invite also others to show interest in this area and make relevant studies, which could enrich our knowledge on group-based lending mechanism in developing countries.