

Joint Liability Lending in Microcredit Markets with Adverse Selection: a Survey*

Alessandro Fedele[†]

November 2005

Abstract

This paper reviews recent literature on joint liability lending in microcredit markets characterized by adverse selection. This mode of lending consists of granting individual loans to wealthless borrowers provided that they form groups: if a group does not fully repay its obligations, then the microlender cut off all members from future credit until the debt is repaid. Joint liability lending is able to extract information through a peer selection mechanism, with the effect of raising both repayment rates and welfare with respect to individual lending.

JEL codes: D82, L31, O12, O16.

Keywords: microcredit, underdeveloped economies, joint liability lending.

*I would like to thank Enrico Minelli for useful comments and suggestions. I gratefully acknowledge financial support from University of Milano-Bicocca. The usual disclaimer applies.

[†]Department of Statistics, University of Milano-Bicocca, Via Bicocca degli Arcimboldi 8, 20126 Milano, Italy; email: alessandro.fedele@unimib.it.

1 Introduction

The term microcredit denotes the activity of financial organizations that employ nonconventional methods to lend to poor.

The pioneering microfinancial institution was Grameen Bank, founded in 1976 by Muhammad Yunus and located in Bangladesh. The idea of microcredit has now spread globally, with replications in Africa, Latin America, Asia, and Eastern Europe, as well as in richer economies like Norway, the United States, France and England. Empirical evidence shows that these unconventional lenders have a reasonable degree of financial self-sufficiency and repayment rates even if they target poor people whom no ordinary commercial bank would want as customers because of their lack of assets to be put up as collateral. One of the reasons for this success, especially in the rural underdeveloped economies, is the application of joint liability: this scheme of lending captured the interest of researchers since it mitigates informational problems in credit markets without requesting any pecuniary collateral.

The current survey focuses on joint liability as an instrument to improve discrimination among borrowers of different types and is based on Ghatak (1999), Morduch (1999), Ghatak and Guinnane (1999), Ghatak (2000), Gangopadhyay and Lensink (2001) and Gangopadhyay et al. (2001).

Joint liability lending works as follows: borrowers, who work on independent projects, self-select into groups to get the loan. If the group does not fully repay its obligations, then the microlender cut off all members from future credit until the debt is repaid. Joint liability induces borrowers, who have perfect information about the type of each other for they belong to small rural communities, to choose partners of the same type: this is called peer selection.

The remainder of the paper is organized as follows. A model of individual lending with no collateral is laid out in Section 2. We consider a microcredit market characterized by adverse selection à la Stiglitz and Weiss (1981). Two types of wealthless borrowers, risky and safe, are present: risky ones repay with lower probability but their returns are higher in the case of success. Projects

of both types of borrowers are assumed to be socially profitable; yet, only risky ones do receive funding when lending is individual because their presence drives the break-even interest rate of the microlender too high: the market displays underinvestment. Section 3 shows that when joint liability lending is implemented the microcredit institution is able to separate risky borrowers from safe even if the latter ends up with lower profits. As a consequence, both repayment rate and welfare, defined as the sum of expected values of projects, increase with respect to individual lending because safe borrowers do apply for the loan. Section 4 contains concluding remarks.

2 Individual Lending

Consider a rural community in which there are two types of wealthless borrowers. Borrowers of type r propose projects which yield A^r with probability p_r and zero otherwise. Projects of type s borrowers yield A^s with probability p_s and zero otherwise. Let $1 > p_s > p_r > 0$ and $p_r A^r = p_s A^s = A$: the type r project is riskier but in the case of success is more remunerative; moreover, the projects have the same expected value. Type r borrowers are called risky and type s ones are called safe. Each borrower needs one unit of capital to implement the project and applies for a loan. There is a single microcredit institution which knows the fraction $0 < \lambda < 1$ of risky borrowers and the fraction $1 - \lambda$ of safe borrowers in the population, but ignores which specific borrower is of which type. Borrowers, though, have perfect information about each other. The opportunity cost of labor is equal to \bar{u} , while $\rho > 1$ is the opportunity unit cost of capital. The two values represent the reservation utility of borrowers and microlender, respectively.

Assumption 1 $\max \left\{ \frac{2p_s}{p_r(2-p_r)}\rho, \frac{p_s(2-p_s)}{p_r(2-p_r)}\rho + \bar{u} \right\} \leq A < \frac{p_s}{\bar{p}}\rho + \bar{u}$,

where $\bar{p} = \lambda p_r + (1 - \lambda)p_s$ is the average expected probability of repayment. Assumption 1 implies that projects of both types of borrowers are socially

profitable.¹

The microlender proposes a contract in which the following limited liability constraint is specified for the borrowers: when the project succeeds they have to repay an amount that cannot exceed the realized returns, $0 < R^i \leq A^i$, where $i = r, s$, while if returns are zero nothing is repaid. With no loss of generality the optimal contracting problem is posed as follows. The microlender chooses R^i such that his unitary expected profits are zero because he represents a not-for-profit organization, provided that the incentive compatibility and limited liability constraints of the borrowers are satisfied:

$$\lambda p^r R^r + (1 - \lambda) p^s R^s = \rho \quad (1)$$

s.t.

$$A - p_r R^r \geq A - p_r R^s, \quad (IC^r)$$

$$A - p_s R^s \geq A - p_s R^r, \quad (IC^s)$$

$$R^i \leq A^i,$$

where $IC^{r(s)}$ is the incentive compatibility constraint of type $r(s)$. Solution to (1) is $R = R^r = R^s = \frac{\rho}{\bar{p}}$, where \bar{p} , defined above, is the average expected probability of repayment. Risky borrowers end up with $A - \frac{p_r}{\bar{p}}\rho$ and safe borrowers with $A - \frac{p_s}{\bar{p}}\rho$. Safe borrowers have lower expected profits because they repay the same amount $\frac{\rho}{\bar{p}}$ with higher probability. Under Assumption 1 $A - \frac{p_s}{\bar{p}}\rho$ is lower than \bar{u} , hence safe borrowers do not participate. The microlender anticipates that if R is set equal to $\frac{\rho}{\bar{p}}$ only risky borrowers will apply for the loan. This represents the adverse selection effect and the new contracting problem takes thus the following features:

$$\begin{cases} p^r R = \rho, \\ R \leq A^r. \end{cases} \quad (2)$$

The solution to (2) is $R = \frac{\rho}{p_r}$. At equilibrium the repayment rate is p_r , risky borrowers end up with $A - \rho$ while equilibrium profit of safe borrowers

¹See the Appendix for remarks.

is \bar{u} . Welfare, defined as the sum of expected values of projects, amounts to $\lambda A + (1 - \lambda)(\rho + \bar{u})$. We sum up these findings in the following

Proposition 1 *Under Assumption 1, only risky borrowers apply for the loan if individual lending is implemented: repayment rate is p_r and welfare is $\lambda A + (1 - \lambda)(\rho + \bar{u})$.*

The economy is characterized by underinvestment because socially profitable projects of safe borrowers do not receive funding.

3 Joint liability lending

In this section we introduce group lending with joint liability. Borrowers are asked to form groups in which each member implements his own project and project returns are statistically independent. Joint liability is modeled in the following way: members as a whole, if successful, have to pay an additional amount equal to $c > 0$ for any default of a partner.

3.1 Peer Selection

We first show that group formation exhibits peer selection. Consider for simplicity groups of two members. When a borrower succeeds and the partner fails, the former is charged the sum of individual and joint liability payments. Again the financial agreement specifies a limited liability constraint: the amount to be repaid cannot exceed the value of the successful return, $R^i + c^i \leq A^i$. If a contract $\{R, c\}$ is accepted, expected profit of a borrower i when partner is risky or safe, respectively, is equal to

$$A - p_i [R + (1 - p_r)c], \quad (3)$$

$$A - p_i [R + (1 - p_s)c]. \quad (4)$$

Given that $p_s > p_r$, type s is preferred when liability is joint for she reduces the probability of paying c . It follows that safe borrowers will form groups among

them, while risky borrowers will try to attract preferred safe borrowers. If risky borrowers are allowed to make transfers to a safe one to have her as a partner, such a transfer must at least equalize loss of a safe borrower from having a risky partner:²

$$p_s (p_s - p_r) c, \quad (5)$$

where $(p_s - p_r)$ is the increased probability of paying c . On the contrary, gain of a risky borrower from having a safe partner amounts to

$$p_r (p_s - p_r) c, \quad (6)$$

where $(p_s - p_r)$ is the reduced probability of paying c . Given that (5) is higher than (6), risky borrowers cannot compensate safe ones with a side transfer to have them as partners and simultaneously end up with a positive return: groups arise with either all risky or safe borrowers. The intuition is as follows: safe borrowers value safe mates more than risky borrowers because they repay with higher probability, thereby being more likely to realize gains of having a safe mate.

3.2 Zero-Profit Condition for the Microlender

We verify that the size of joint liability of safe borrowers c^s is greater than the extent of their individual liability R^s when optimal separating joint liability contracts are, with no loss of generality, restricted to the offer of the pair $\{R^r, c^r\}$ and $\{R^s, c^s\}$ such that unitary expected profits of the microlender are zero and incentive compatibility constraints of both type of borrowers are satisfied. Recall that expected profit of risky borrowers is $A - p_r [R + (1 - p_r)c]$, while safe ones get $A - p_s [R + (1 - p_s)c]$. In symbols

$$p_r (R^r + (1 - p_r) c^r) = \rho, \quad (7)$$

$$p_s (R^s + (1 - p_s) c^s) = \rho \quad (8)$$

s.t

²Since borrowers are wealthless such transfers cannot be interpreted in strictly monetary terms. They rather consist, for example, of providing free labor services.

$$R^r + (1 - p_r)c^r \leq R^s + (1 - p_r)c^s, \quad (IC'^r)$$

$$R^s + (1 - p_s)c^s \leq R^r + (1 - p_s)c^r. \quad (IC'^s)$$

By substituting the values of R^r and R^s derived by (7) and (8), respectively, into (IC'^r) and (IC'^s) , respectively, it is possible to conclude that the pair of contracts $\{R^r, c^r\}$ and $\{R^s, c^s\}$ which satisfies both the zero-profit conditions of the microlender and the IC constraints of the borrowers is such that

$$\begin{cases} c^r \leq \frac{\rho}{p_r p_s} \leq c^s, \\ R^s \leq \frac{\rho}{p_r p_s} (p_r + p_s - 1) \leq R^r. \end{cases} \quad (9)$$

The peer selection property allows the microlender to screen borrowers ‘by the company they keep’ because risky borrowers are less willing than safe borrowers to accept an increase in the extent of joint liability.

Yet, it is worth noting that solution (9) prescribes $c^s > R^s$. Therefore, when a safe borrower succeeds and the other fails, the former has to pay her own R^s plus the joint liability cost c^s . Given that $R^s + c^s > 2R^s$, it is then in her interest to transfer an amount R^s to the failed partner who can repay her obligations and pretend to have been successful. If the microlender offered such a contract he would not break even. Furthermore, solution (9) does not ensure that the limited liability constraints are satisfied.

3.3 Ex Post Truth-Telling Constraint

The analysis proceeds by studying what happens to optimal separating joint liability contracts when we impose the additional condition

$$c^i \leq R^i, \quad (10)$$

which we refer to as the ex post truth-telling constraint.

Since the violation of (10) derives by condition (8), we relax the latter so that the microlender makes positive profits out of safe borrowers. The new contracting problem is defined as follows: the microlender chooses R^s and c^s

to minimize his own profits on contract $\{R^s, c^s\}$ subject to conditions (IC^r) , (IC^s) , (7), (10) and the limited liability constraints. In symbols

$$\begin{aligned} \min_{R^s, c^s} p_s [R^s + (1 - p_s) c^s] & \quad (11) \\ \text{s.t.} & \\ R^r + (1 - p_r) c^r \leq R^s + (1 - p_r) c^s, & \\ R^s + (1 - p_s) c^s \leq R^r + (1 - p_s) c^r, & \\ p_r (R^r + (1 - p_r) c^r) = \rho, & \\ c^i \leq R^i, & \\ R^i + c^i \leq A^i. & \end{aligned}$$

Solution to problem (11) is³

$$\begin{cases} c^{js} = R^{js} = \frac{\rho}{p_r(2-p_r)}, \\ c^{jr} \leq \frac{\rho}{p_r(2-p_r)}, R^{jr} \geq \frac{\rho}{p_r(2-p_r)}. \end{cases} \quad (12)$$

At equilibrium safe borrowers are given $\{\frac{\rho}{p_r(2-p_r)}, \frac{\rho}{p_r(2-p_r)}\}$ and end up with $A - \frac{p_s(2-p_s)}{p_r(2-p_r)}\rho$; risky ones end up with $A - \rho$. Solution (12) suggests that joint liability of borrowers may actually consist of repaying the debt of the partner who fails, otherwise they are denied access to future credit.⁴

Assumption 1 ensures that participation constraints of all borrowers are satisfied, hence both risky and safe ones participate in the microcredit program. At equilibrium, repayment rate rises to \bar{p} and welfare to A . These findings are summarized in the following

³See the Appendix for calculations. Note that $\min c^s - c^{js}$, where $\min c^s = \frac{\rho}{p_r p_s}$ is the minimum amount of c^s in solution (9), is positive and that $R^{js} - \max R^s$, where $\max R^s = \frac{\rho}{p_r p_s} (p_r + p_s - 1)$ is the maximum amount of R^s in solution (9), is higher than $(1 - p_s) (\min c^s - c^{js})$: solution (12) prescribes lower joint liability and higher repayment for safe borrowers with respect to solution (9) and it also satisfies the ‘peer selection property’, i.e. (5) – (6) > 0, given that $c^{js} \geq c^r$.

⁴To see this, assume that a successful safe borrower who does not pay c^s bears an opportunity cost equal to FB , where FB represents the discounted benefit of a continued lending relationship. If $FB > c^s$, then the borrower indeed repays when successful.

Proposition 2 *Under Assumption 1, joint liability lending raises repayment rates and welfare with respect to individual liability lending for also safe borrowers apply for the loan.*

A traditional separating contract with individual liability plus collateral, i.e. a contract for which c is paid in the case of failure of the borrower, is not implementable because borrowers are poor and have no money when they fail. With joint liability, though, c is paid by partners in the case of (their) success. This overcomes the problem of the absence of collateral; furthermore, peer selection enables the microlender to separate riskier clients from safer with the effect of increase repayment rate and welfare.

4 Conclusion

This survey reviews literature on joint liability lending as an instrument to improve discrimination among poor borrowers of different riskiness.

The standard method for separating good risks from bad risks is to ask borrowers to put up collateral. Risky borrowers are likely to fail more often and lose their collateral. If the microlender offers two different contracts, one with high interest rates and low collateral and the other with the opposite, risky borrowers select the former and safe borrowers the latter. But poor people by definition do not have collateral, meaning that microlenders have to seek alternative ways to separate good risks from bad.

The current survey shows that if joint liability contracts are offered, ‘ex post guarantees’ are pledged by partners in the case of their success, thereby overcoming the problem of the lack of collateral: thanks to peer selection mechanism, safe borrowers will select the contract with higher joint liability and lower interest rates, while risky borrowers the one with lower joint liability and higher interest rate. As a consequence, the repayment rate and welfare rise under joint liability contracts with respect to conventional individual liability contracts because the former is able to exploit the information borrowers have

about each other.

5 Appendix

(Remarks on Assumption 1). When $\max \left\{ \frac{2p_s}{p_r(2-p_r)}\rho, \frac{p_s(2-p_s)}{p_r(2-p_r)}\rho + \bar{u} \right\} = \frac{p_s(2-p_s)}{p_r(2-p_r)}\rho + \bar{u}$, i.e.

$$\bar{u} > \frac{p_s^2}{p_r(2-p_r)}\rho, \quad (13)$$

the interval defined in Assumption 1 is nonempty if the following condition holds

$$\bar{p} < \frac{2-p_r}{2-p_s}p_r. \quad (14)$$

Note that $p_r < \frac{2-p_r}{2-p_s}p_r < p_s$. Contrarily, when $\max \left\{ \frac{2p_s}{p_r(2-p_r)}\rho, \frac{p_s(2-p_s)}{p_r(2-p_r)}\rho + \bar{u} \right\} = \frac{2p_s}{p_r(2-p_r)}\rho$, i.e.

$$\bar{u} < \frac{p_s^2}{p_r(2-p_r)}\rho, \quad (15)$$

the interval is nonempty for

$$\bar{p} < \frac{p_r p_s (2-p_r) \rho}{2p_s \rho - p_r (2-p_r) \bar{u}}. \quad (16)$$

Notice that $p_r < \frac{p_r p_s (2-p_r) \rho}{2p_s \rho - p_r (2-p_r) \bar{u}}$ if and only if

$$\frac{p_s}{2-p_r}\rho < \bar{u} < \frac{p_s^2}{p_r(2-p_r)}\rho. \quad (17)$$

(Optimal separating joint liability contracts when $c^s \leq R^s$). We solve condition (7) by c^r to get

$$c^r = \frac{\rho - p_r R^r}{p_r(1-p_r)}. \quad (18)$$

We then substitute (18) into (IC^r) and we solve it by c^s . We get

$$c^s \geq \frac{\rho - p_r R^s}{p_r(1-p_r)}. \quad (19)$$

The objective function of the problem is increasing in R^s and c^s , hence the microlender sets them as low as possible in equilibrium. It follows that c^s is

chosen equal to $\frac{\rho - p_r R^s}{p_r(1-p_r)}$ for any given R^s . If we substitute $c^s = \frac{\rho - p_r R^s}{p_r(1-p_r)}$ into the objective function, the problem becomes as follows:

$$\min_{R^s} p_s \frac{p_r (p_s - p_r) R^s + (1 - p_s) \rho}{p_r (1 - p_r)} \quad (20)$$

s.t.

$$R^s + (1 - p_s)c^s \leq R^r + (1 - p_s)c^r,$$

$$c^i \leq R^i,$$

$$c^i + R^i \leq A^i.$$

The function to be minimized is increasing in R^s , hence the microlender sets it as low as possible in equilibrium, by taking into account the ex post truth-telling constraint of safe borrowers. We get $R^s = c^s = \frac{\rho - p_r R^s}{p_r(1-p_r)}$ and, solving by R^s ,

$$R^s = c^s = \frac{\rho}{p_r(2 - p_r)}. \quad (21)$$

This solution is incentive compatible for safe borrowers if and only if

$$\frac{\rho}{p_r(2 - p_r)} + (1 - p_s) \frac{\rho}{p_r(2 - p_r)} \leq R^r + (1 - p_s) \frac{\rho - p_r R^r}{p_r(1 - p_r)}. \quad (22)$$

Solving by R^r , one gets

$$R^r \geq \frac{\rho}{p_r(2 - p_r)}. \quad (23)$$

Substituting this interval in (18) and solving by c^r , one gets

$$c^r \leq \frac{\rho}{p_r(2 - p_r)}. \quad (24)$$

References

- [1] Gangopadhyay, S. and R. Lensink (2001), “Joint Liability Lending: A Note”, *mimeo*.
- [2] Gangopadhyay, S., Ghatak, M. and R. Lensink (2001), “On Joint Liability Lending and the Peer Selection Effect”, forthcoming in *The Economic Journal*.
- [3] Ghatak, M. (1999), “Group Lending, Local Information and Peer Selection”, *Journal of Development Economics*, 60, pp. 27-50.
- [4] Ghatak, M. (2000), “Screening by the Company You Keep: Joint Liability Lending and the Peer Selection Effect”, *The Economic Journal*, 110, pp. 601-631.
- [5] Ghatak, M. and T. W. Guinnane (1999), “The Economics of Lending with Joint Liability: Theory and Practice”, *Journal of Development Economics*, 60, pp. 195-228.
- [6] Morduch, J. (1999) “The Microfinance Promise”, *Journal of Economic Literature*, 37, pp. 1569-1614.
- [7] Stiglitz, J. and A. Weiss (1981), “Credit Rationing in Markets with Imperfect Information”, *The American Economic Review*, 71, pp. 393-410.