SCREENING BY THE COMPANY YOU KEEP: JOINT LIABILITY LENDING AND THE PEER SELECTION EFFECT

Author: Maitreesh Ghatak

Presented by: Kosha Modi

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Introduction

- In an economic environment where collateral does not exist or is low, this paper talks about solving the problem of adverse selection using the information that borrowers have about each other as a screening device.
- Joint liability contracts induces a positive assortative matching in group formation,i.e., safe borrowers will end up with safe borrowers as partners, and risky borrowers with risky partners. This local information can be used as a screening device.
- The success of the Grameen Bank also depends on this peer selection. According to Muhammad Yunus (1994), the founder of the Grameen Bank, 'Usually it takes quite a bit of time for the members to identify each other and consult each other before announcing they wish to form a group.

The Model

- Consider a one-period model of a credit market under adverse selection.
- **Technology and Preferences**: All agents live in a village with a large population normalised to unity and are endowed with one unit of labour and a risky investment project. The project requires one unit of capital and one unit of labour. Agents do not have personal wealth and need to borrow to launch their projects. The outcomes of the project are Success (S) and Failure (F). There are two types of borrowers, risky (r) and safe (s), characterized by the probability of success of their projects, p_r and p_s respectively where $0 < p_r < p_s < 1$: Risky and safe borrowers exist in proportions θ and $1 - \theta$ the population. The outcomes of the projects are independently distributed for the same type as well as across different types.

- The return of a project of a borrower of type i is $R_i > 0$ if successful and 0 if it fails. Assume that risky and safe projects have the same mean return, that is, $p_r R_r = p_s R_s = \bar{R}$, but risky projects have a greater spread around the mean. Borrowers are risk-neutral and maximize expected returns (second order stochastic dominance). Borrowers of both types have an reservation payoff $\bar{u}$:
- The lending side is represented by risk-neutral banks whose opportunity cost of capital is $\rho \geq 1$ per unit. We assume that the village is small relative to the credit market, and so the supply of loans is perfectly elastic at the rate ρ

- **Information and Contracting**: The type of a borrower is unknown to the lenders. However, borrowers know each other's types. There is no moral hazard and agents supply labour to the project inelastically. The outcome of a project (whether it is a success or a failure) is observable by the bank; so the credit contracts are contingent on the outcomes. There is a limited liability constraint: in case their projects fail, borrowers are liable up to the amount of collateralisable wealth they posses, w. For simplicity we take $w = 0$.
- Let us assume that the project is socially productive in terms of expected returns and oppurtunity costs of labour and capital i.e.

$$\bar{R} > \rho + \bar{u}$$

Individual Liability Framework

- If a bank has full information about a borrower's type, then by the zero profit constraint of the banks, a borrower of type i, $i \in r, s$, will be charged the interest rate

  $$r_i* = \rho/p_i$$

  Thus, the safe borrowers will be charged a lower interest rate. The average repayment rate will be given by $\bar{p} = \theta p_r + (1-\theta)p_s$
- Since the lender cannot identify the borrower's type , the risky borrowers have an incentive to mimic being the safe borrowers so as to be charged a lower interest rate. In this case, the banks thus have to charge a single interest rate to all borrowers.
- If both types of borrowers borrow in equilibrium, then the optimal pooling contract satisfying zero profit constraint, $r = \rho/\bar{p}$. .

- Clearly, under asymmetric information, it is less profitable now for the safe borrowers because they are being charged a higher interest rate. Suppose it becomes so unprofitable for the safe borrowers that they are driven out of the credit market i.e., the expected returns from the project are lesser than the expected costs

$$\bar{R} < p_s r + \bar{u}$$

or

$$\bar{R} < p_s \rho / \bar{p} + \bar{u}$$

- In such a case, only the risky borrowers will stay in the credit market. This is a problem of underinvestment (or the lemons problem) due to adverse selection. The interest rate charged will be $r = \rho / p_r$ and the average repayment rate will be given by p_r

Joint Liability Lending

- In a joint liability contracts, credit is given in groups. There is an individual liability component r,and a joint liability component c. As in standard debt contracts, if the project of a borrower fails then owing to the limited-liability constraint, she pays nothing to the bank. But if a borrower's project is successful then apart from repaying her own debt r to the bank she has to pay an additional joint liability payment c per member of her group whose projects have failed. Here, for simplicity we take groups of two.
- PROPOSITION 1. Joint liability contracts lead to positive assortative matching in the formation of groups. In our setup, this means that a safe borrower will partner with a safe one, and a risky borrower with a risky one.

- PROOF: The expected payoff of a borrower of type i when her partner is type j from a joint liability contract (r, c) is:

$$U_{ij}(r, c) = \bar{R} - [p_i r + p_i(1 - p_j)c]$$

  Note here that the higher the probability of success of your partner, $p - j$, the higher is your expected payoff, for $c > 0$. Thus, both type of borrowers would want to team up with the safe type.

- The net expected gain of a risky borrower from having a safe partner is $U_{rs} - U_{rr} = p_r(p_s - p_r)c$. Similarly, the net expected loss of a safe borrower from having a risky partner is $U_{ss} - U_{sr} = p_s(p_s - p_r)c$. Thus, $U_{ss} - U_{sr} > U_{rs} - U_{rr}$ or $U_{ss} + U_{rr} > U_{sr} + U_{rs}$. The latter implies assortative matching maximises aggregate expected payoff of all borrowers over different possible matches.

- The intuition is simple. The benefit of having a safe rather than a risky partner is realised only when a borrower herself has succeeded. Hence a safe borrower is much more concerned about the type of her partner than a risky borrower, although both would prefer a safe partner. Hence, a risky borrower cannot afford a high enough side payment that will convince the safe type to team with him.
- Now given that same type of borrowers will team up, the expected payoff function for the borrower of type i is given by

$$U_{ii} = \bar{R} - [p_i r - p_i(1 - p_i)c]$$

- The indifference curve of a borrower of type i in the (r, c) plane is represented by the line $rp_i + c(1 - p_i)p_i = k$ (where k is some constant) which also represents an iso-profit curve of the bank when lending to a borrower of type i. The only difference of course is that the higher is k the lower is the expected payoff of a borrower and higher is the expected profit of the bank.

- The slope of the indifference curve is given by

$$\frac{dc}{dr}\mid_{U_{ii}=const} = -\frac{1}{1-p_i}$$

Which type of borrower's indifference curve is steeper?

- The intuition is that to receive a small reduction in the interest rate, safe borrowers would be willing to pay a higher amount of joint liability than risky borrowers because having safe partners they do not have to pay joint liability payments very often. Thus indifference curves have "single crossing property".

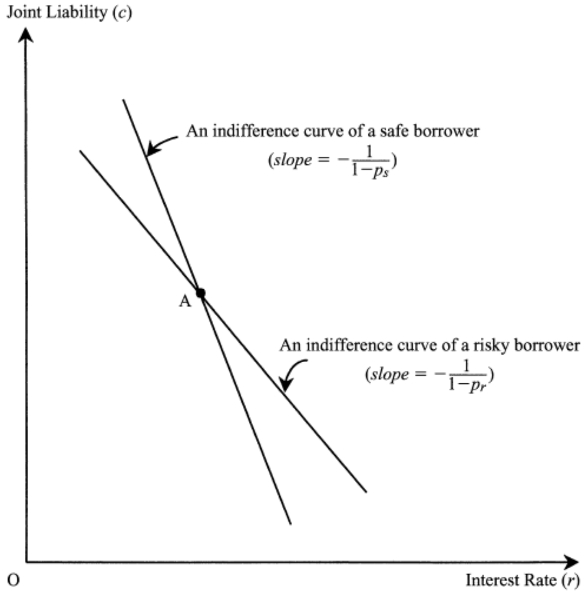

Fig. 1. *Indifference Curves of Safe and Risky Borrowers Under Joint Liability*

Optimal Joint Liability Contracts

- The contracting problem is the following sequential game: first, the bank offers a finite set of joint liability contracts $(r_1, c_1), (r_2, c_2), \ldots$; second, borrowers who wish to accept any one of these contracts select a partner and do so; finally, projects are carried out and outcome-contingent transfers as specified in the contract are met. Borrowers who choose not to borrow enjoy their reservation payoff of $\bar{u}$. Let us look at contracts $C^{JL} = [(r, c)|r, c \geq 0]$.
- Suppose the bank offers two contracts $[(r_r, c_r), r_s, c_s]$ designed for risky and safe borrower groups respectively. We are essentially looking at a separating equilibrium.

- The bank's objective is to choose $(r_r, c_r), (r_s, c_s)$ such that the utility of a representative consumer is maximised i.e.,

$$\theta U_{rr} + (1-\theta) U_{ss}$$

subject to the following constraints
(1) The zero profit constraint of the bank requires that the expected repayment from each loan is at least as large as the opportunity cost of capital,

$$r_r p_r + c_r p_r (1 - p_r) \geq \rho$$

$$r_s p_s + c_s p_s (1 - p_s) \geq \rho$$

(2) The participation constraint given by

$$U_{ii} \geq 0 for i = r, s$$

- (3) The limited liability constraint requires that a borrower cannot make any transfers to the lender when her project fails, and that the sum of individual and joint liability payments, r + c, cannot exceed the realised revenue from the project when it succeeds:

$$r_i + c_i \leq R_i for i = r, s$$

  (4)The incentive-compatibility constraint for each type of borrower requires that it is in the self-interest of a borrower to choose a contract that is designed for her type since that is private information:

$$U_{rr}(r_r, c_r) \geq U_{rr}(r_s, c_s)$$

$$U_{ss}(r_s, c_s) \geq U_{ss}(r_r, c_r)$$

- LEMMA 1. If (r_r, C_r) and (r_s, c_s) satisfy the incentive-compatibilityc onstraints then they will induce assortative matching in the group formation stage.

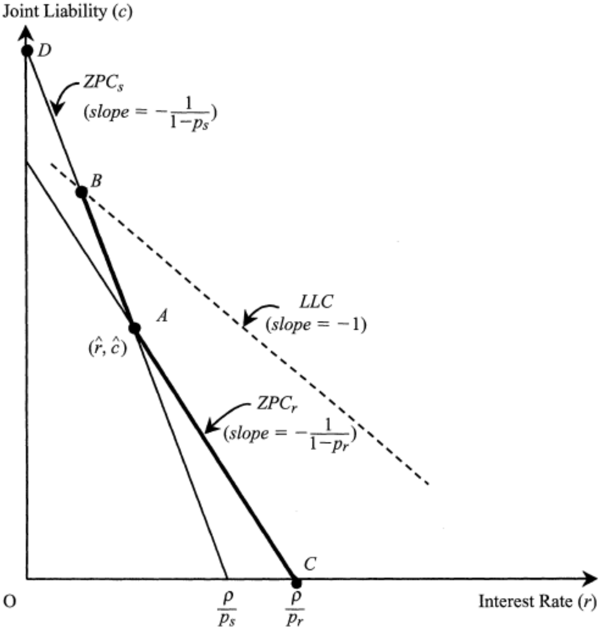

Fig. 2. *Optimal Separating Joint Liability Contracts*

- Since the objective is to maximise the borrower's utility, the zero profit constraint will hold with equality. Now if we simultaneously solve the two zero profit equality constraints, we get $\hat{r} = \rho(p_r + p_s - 1)$ and $\hat{c} = \rho/p_r p_s$. We assume $\hat{r}$ is greater than 0.
- In the diagram, The line DA and Ac are the zero profit lines. Can you guess the region where incentive compatibility holds?
- Let us assume that limited liability constraint is fulfilled for $\hat{r}, \hat{c}$, i.e.,

$$\bar{R} \geq \rho(1 + \frac{p_s}{p_r})$$

- Note that the limited liability constraint has a slope=-1, i.e., it is flatter than the indifference curves. Thus, if the limited liability constraint is fulfilled for $(\hat{r}, \hat{c})$, it automatically is fulfilled for the (r_r, c_r). Thus we only consider the LLC to be binding for the safe borrowers. This is shown in the diagram.

- Note that since the zero profit constraint is fulfilled,

$$U_{ii} = \bar{R} - \rho > \bar{u}$$

  (by assumption of social productiveness of the project). Thus the participation constraint is fulfilled for both the types.
- Since both the types continue to exist in the credit market, the problem of underinvestment is solved. The average repayment rate is again $\bar{p}$ which is the average probability of success of the project in the economy, and welfare levels are $\bar{R} - \rho$ of the two types of borrowers as was in the full information case.

- For the pooling equilibrium, the same (r,c) is offered to both the types. Check: The zero profit, limited liability and participation constraint stay the same, and the incentive compatibility constraint is vacuously true. Here $\hat{r}, \hat{c}$ would be a pooling equilibrium. Does it satisfy the zero profit, limited liability and participation constraint?
- Again, both the types continue to exist in the credit market, the problem of underinvestment is solved. The average repayment rate is again $\bar{p}$ which is the average probability of success of the project in the economy, and welfare levels are $\bar{R} - \rho$ of the two types of borrowers as was in the full information case.