Group lending, repayment incentives and social collateral

Authors: Timothy Besley, Stephen Coate

Presented by: Kosha Modi

February 16, 2017

Introduction

- We study the effects of joint liability on repayment rates in a framework where banks are limited sanctions against delinquent borrowers. *Joint liability* says that all group members are treated as being in default if any one member of the group does not repay his loan.
- In the case of the Grameen bank, if any one group member defaults, the whole group is cut away from loans in the future. This is the only penalty that banks can impose upon the poor borrowers with no collateral (and limited liability constraints).
- The effects of joint liability are both positive and negative. The positive effect results from the possibility that a successful borrower may repay the loan of a partner who obtains a bad return on his project. The negative effect arises if the entire group defaults, when at least some members would have repaid had they not been saddled with the weight of liability for their partners' loans.
- We will also see how *social sanctions* can help mitigate these negative effects.

The model

- A borrower has a project that requires one unit of capital. The project lasts for one period and yields units of income. Prior to undertaking the project, the borrower does not know . He does, however, know that is distributed on $(\underline{\theta}, \bar{\theta})$;according to the continuous distribution function F(θ): We assume throughout that the borrower is risk-neutral.
- A bank lends the borrower one unit of capital to undertake the project. The loan is due at the end of the period and the amount to be repaid, inclusive of interest, is $r > 1$: After the project return is realized, the borrower must decide whether or not to repay his loan. We assume that repayment is an all or nothing decision; that is, the borrower either repays r or nothing. The borrower's repayment decision will hinge on comparing the gain from consuming an extra r units of income with the consequences of default.

- The bank is assumed to have some sanctions against delinquent borrowers. The penalty it can impose on the defaulting borrower is described by a function p(θ). This function is assumed to be continuous and increasing.

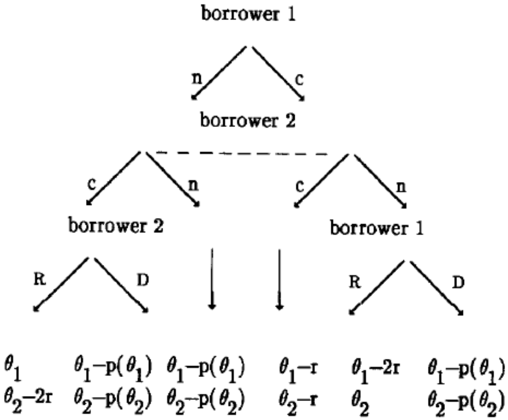
Individual Lending

- An individual will repay his loan only if $r \leq p(\theta)$. Let us take the inverse of p(.) to be the function ϕ. Since p is an increasing function, the inverse ϕ is also an increasing function. Thus the individual will repay if and only if $\theta \geq \phi(r)$. What is the probability of repayment in this case?
- $\Pi_I(r) = 1 - F(\phi(r))$. Thus, the repayment rate is decreasing in r.
- We further assume that the banks sanctions are incomplete. This is formalized by the assumption $\phi(1) > \underline{\theta}$. Thus even if the borrower could obtain a loan with a zero interest rate, he would fail to repay his loan were his project return very low. It follows that the repayment rate is less than 100% for all positive interest rates, i.e. for all $r > 1$.

Group Lending

- Consider a group composed of two ex ante identical borrowers referred to as borrowers 1 and 2, respectively. At the beginning of the period, the group is granted a loan of two units of capital, one for each borrower. Each invests this in a project whose returns are independent. The loan is due at the end of the period, and the amount to be repaid (inclusive of interest) is 2r. Once again, we assume that repayment or 2r is an all or nothing decision; that is, the group repays 2r or nothing. The bank has the same penalties available to it as earlier. Thus if the group defaults when the two borrowers receive returns θ_1 and θ_2 respectively, the bank imposes penalties p(θ_1) on borrower 1 and p(θ_1) on borrower 2 respectively.

The game


borrower 1
n
c
borrower 2
c
n
c
n
borrower 2
borrower 1
R
D
R
D
θ_1
θ_2-2r
$\theta_1-p(\theta_1)$
$\theta_2-p(\theta_2)$
$\theta_1-p(\theta_1)$
$\theta_2-p(\theta_2)$
θ_1-r
θ_2-r
θ_1-2r
θ_2
$\theta_1-p(\theta_1)$
$\theta_2-p(\theta_2)$

- Consider the extensive form game depicted in Figure previously. At the time the game is played, the returns from both borrowers' projects are assumed to have been realized. These returns are denoted by θ_1 and θ_2 and are assumed to be common knowledge. The game has two stages. At the first, each borrower decides simultaneously whether or not to contribute his share, r, of the total amount due (which is 2r). We label these two options as c - 'contribute' and n - 'not contribute'. If the two borrowers make the same decisions, then the outcome is straightforward. If both contribute their share, then the loan is repaid and payoffs are $(\theta_1 - r, \theta_2 - r)$. Alternatively, if both borrowers decide not to contribute, then the loan is not repaid and the bank imposes its penalties. The payoffs are then given by the vector $(\theta_1 - p(\theta_1), \theta_2 - P(\theta_2))$.
- If the borrowers choose different strategies at the first stage, then the borrower who has played c must decide whether or not to repay the whole loan himself.

- Thus at the second stage of the game, he faces a decision between R - ' repay' and D - 'default'. If borrower 1, for example, chooses to repay when his partner plays n at the first stage, then the payoffs are $(\theta_1 - 2r, \theta_2)$. Alternatively, if he decides to default, then the payoffs are $(\theta_1 - p(\theta_1), \theta_2 - p(\theta_2))$. Clearly, borrower 2 would prefer his partner to repay, since then he incurs no penalties from the bank.
- We shall focus on Sub-game Perfect Nash Equilibrium.
- *Proposition*1. Under group lending the loan will be repaid if at least one borrower receives a return in excess of $\phi(2r)$. It may be repaid if both borrowers have returns between $\phi(r)$ and $\phi(2r)$. It will not be repaid otherwise.

- Consider the following cases:
  - Case 1: $\theta_i > \phi(2r)$, i=1,2
  - Case 2: $\theta_1 > \phi(2r)$, $\theta_2 < \phi(2r)$
  - Case 3: $\theta_2 > \phi(2r)$, $\theta_1 < \phi(2r)$
  - Case 4: $\theta_i \in (\phi(r), \phi(2r))$, i=1,2
  - Case 5: $\theta_i < \phi(r)$, i=1,2
  - Case 6: $\theta_1 \in (\phi(r), \phi(2r))$, $\theta_2 < \phi(r)$
  - Case7: $\theta_2 \in (\phi(r), \phi(2r))$, $\theta_1 < \phi(r)$
- Proof: To be discussed in class
  - Case 1: [n,(c,R)], [(c,R),n]
  - Case 2: [(c,R),n]
  - Case 3: [n,(c,R)]
  - Case 4: [n,n], [(c,D),(c,D)]
  - Case 5: [n,n]
  - Case 6: [n,n]
  - Case 7: [n,n]
- In cases 1,2,3 joint liability does better than individual liability because repayment for both the individuals occur even if one's project does not fare well.

- In case 6,7 joint liability does worse than individual liability, because one of the individuals could have paid their own loan at least, but the burden of paying his partner's loan causes a default for both of them.
- The average repayment rate in this case is given by:

$$\Pi_G = [1 - F^2(2r)] + [F(2r) - F(r)]^2$$

- The first term shows the probability that at least one of the borrowers has $\theta \geq \phi(2r)$, while we assume that in case 4 the players coordinate and reach the good equilibrium of repaying their loan, so that the second term represents the case 4 probability.

- The difference between the repayment rates of group and individual lending is given by:

  $$\Pi_G - \Pi_I = F(\phi(r))[1 - F(\phi(2r))] - [F(\phi(2r)) - F(\phi(r))]F(\phi(r))$$

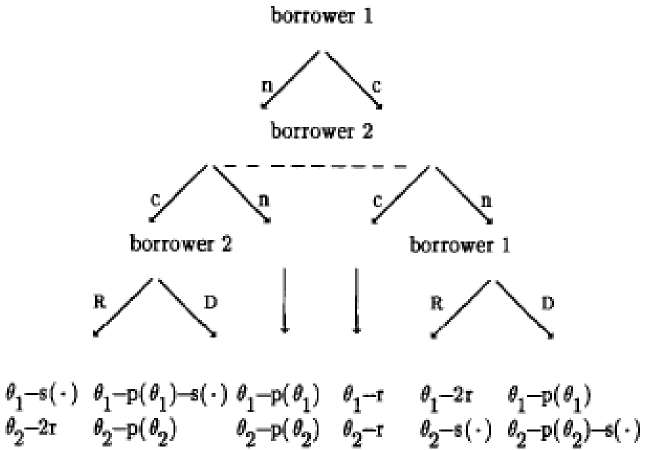
- This expression crystallizes the trade-off faced by lenders who are considering the adoption of group lending to improve repayment rates. The first term is the probability that one borrower will have a return above $\phi(2r)$, when the other has a return below $\phi(r)$. This term favors group lending. Under individual lending, default would occur if a borrower had a return below $\phi(r)$. However, this is not the case under group lending if the other borrower has a return in excess of $\phi(2r)$. The borrower with the successful project will pay the share of his less fortunate partner.
- The second term represents the probability that one borrower has a return between $\phi(r)$ and $\phi(2r)$ when the other has a return below $\phi(r)$. This term reduces the repayment rate under group lending relative to individual lending.

Under individual lending, a borrower with a return between $\phi(r)$ and $\phi(2r)$ will repay, while under group lending repayment will not take place if the other borrower has a return below $\phi(r)$. Thus the loan is not repaid, even though one group member would have repaid if he had not been saddled with the weight of liability for his partner's share.

- Under the presence of social sanctions
  - A contributing group member imposes penalties on a partner who does not contribute his share.
  - The loss suffered by a contributing member is given by $L(\theta, r) = min(p(\theta) - r, r)$.
  - The social penalty function, denoted by s(.), is assumed to have two key properties. First, penalties depend upon the extent of harm inflicted by the non-contributing member on his partner and second, they depend upon the reasonableness of the decision not to contribute. If the non-contributing group member's project had a return of θ', the social penalty that he faces would be given by $s(L(\theta, r), \theta')$.

- The social penalty function s(.)is assumed to be smooth and to satisfy:
  - For all $\theta' \in [\underline{\theta}, \bar{\theta}], s(L, \theta') = 0$ for all $L \leq 0$
  - For all $L \geq 0, s(L, \underline{\theta'}) = 0$
  - For $L > 0, \theta' \in (\underline{\theta}, \bar{\theta})$, we have $s_1, s_2 > 0$
- Part (i) of this assumption says that there will be no social sanctions if an individual's decision not to contribute imposes no loss on his partner. Part (ii) implies that an individual will not be sanctioned if he fails to contribute when he receives the lowest possible return. The final part of the assumption implies that the social penalty is increasing in the loss imposed on the contributor and in the return on the non-contributor's project.
- We can show that the cases 6 and 7 where joint liability performs worse than individual lending can be improved upon in the case of social sanctions.

The game


borrower 1
n
c
borrower 2
c
n
c
n
borrower 2
borrower 1
R
D
R
D
θ1−s(·) θ2−2r
θ1−p(θ1)−s(·) θ2−p(θ2)
θ1−p(θ1) θ2−p(θ2)
θ1−r θ2−r
θ1−2r θ2−s(·)
θ1−p(θ1) θ2−p(θ2)−s(·)