Credit Markets in Developing Countries

Theory

- Credit market - links savers to investors
- All forms of financial intermediation
- What is so special about credit markets?
  - Matches talents and skills with resources
  - Helps in formation of skills

- Otherwise, your economic outcome dependent on how much wealth you start out with, not innate talent.

- So credit markets important for individuals and economies to rich their full potential

- Otherwise can have poverty traps, as we saw in Lecture 1

- Another way of looking at this: a "class" system can emerge due to credit market imperfections

  - See “Why Are Capitalists The Bosses?” (Eswaran & Kotwal), Economic Journal, March 1989, 162-176.

  - It is a form of an entry barrier, so there could be other factors, such as legal or social restrictions (discrimination)

- Why are they particularly likely to be imperfect?
  - The act of buying & paying up separated in time
  - When the time comes people may be
    - Unable to repay
    - Unwilling to repay
  - Taking people to court is costly.
  - Also, limited liability - legal limits to how much you can punish (not true in pre-capitalist economies)

- Anticipating this, lenders are more careful than other sellers. They
  - Screen (corresponds to adverse selection)
  - Monitor (corresponds to moral hazard)
  - Threaten to cut out future loans (corresponds to enforcement or commitment problems)
  - Obtain collateral (like a "hostage")
  - Implications: Credit markets don't function as the textbook model implies.

Stylized facts

- High interest rates in LDCs (see Banerjee 2004): rural areas 52%, urban areas 28-68%. Compare to US rates: 6-14% during 1980-2000.
  - Can't be explained by default (explains at most 7-23% of level of the interest rates)
- Presence if informal sector
  - Timberg and Aiyar, 1984: informal lenders supply 20-30% of capital needs of small scale firms in urban/semi-urban areas in India

– In rural areas, a study (Dasgupta, 1989) professional moneylenders provide 45% of credit

- A wide range of interest rates prevailing in the same area with no apparent arbitrage

  - Siamwalla et al (World Bank Economic Review, 1990): study of rural credit markets in Thailand, found informal sector annual interest rate to be 60% whereas formal sector rate ranged from 12-14%.

- Borrowers are able to borrow only up to a limit for a given interest rate, and are not given a larger loan even if they are willing to offer a higher interest rate. The very poor are unable to borrow at any interest rate (Credit rationing)

- Evans and Jovanovic (Journal of Political Economy, 1989), found that even in the US entrepreneurs on average are limited to a capital stock no more than one and one-half times their wealth when starting a new venture, & the very poor are unable to borrow at any interest rate

- Not consistent with standard supply-demand model of credit market with interest rates adjusting to clear market

- One explanation: monopoly.
  - Can explain different interest rates (price discrimination)
  - However, why charge high interest rates since that kills loan demand?
  - What is the informal sector doing?
  - Also, public sector banks are present so monopoly power is restricted

- More convincing answer - transactions costs creates natural entry barriers

  - See Aleem, 1990, WBER for evidence from Pakistan

  - Also, in their study of Vietnamese firms McMillan and Woodruff (1999) report:

"... trade credit tends to be offered when (a) it is difficult for the customer to find an alternative supplier; (b) the supplier has information about the customer's reliability through either prior investigation or experience in dealing with it; and (c) the supplier belongs to a network of similar firms, this business network

providing both information about customers' reliability and a means of sanctioning customers who renege on deals. Social networks, based on family ties, also support relational contracting, although the evidence for their efficacy is weaker than for business networks.

Macro-level Evidence

1. The Debt Recovery Tribunals in India (Visaria, 2007):

- In India a bank trying to recover a secured non-performing loan must obtain a court order allowing the sale of collateral so that it can recover its dues. Delays are a part of life in the Indian legal system. In 1997 there were 3.2 ml. civil cases pending in district level courts of which 34% were pending for more than 3 years. More than 40% of the asset liquidation cases had been pending for more than eight years.

- In 1993 the government introduced DRTs that designed a streamlined procedure aimed at speeding up the process by which the bank liquidates the borrowers collateral. According to Visaria, if a case was filed in the court, summons would be issued on average after 431 days, whereas after the DRT, it was 56 days, which is significant at the 1% level.

- Debt Recovery Tribunals reduced delinquency by 6-11 percentage points (a decline of 10-20 percent). New loans sanctioned after DRTs have interest rates that are lower by 1-2 % points (7-15 percent). (Visaria, 2007)

2. Cross country evidence (Djankov, McLiesh, and Shleifer, 2006)

- Why do some countries have much bigger capital market than others?

- Study 129 countries over a 25 year period finds that legal rights of lenders (ability to force repayment, grab collateral) is positively correlated with the ratio of private credit to GDP.

- Changes in this measure are associated with an increase in the ratio of private credit to GDP.

- Study formal models of the borrower-lender relationship subject to the following problems:

  - Enforcement: Borrower can default even when he is able to repay.

  - Moral Hazard: The action of borrower that affects repayment prospects cannot be costlessly observed.

  - Adverse Selection: Borrower knows more about his type than the lender does

Enforcement Problems

- Suppose the producer uses a production technology $F(L) = \sqrt{L}$ converting loans into output.

- The production function has the standard features of positive but diminishing marginal returns.

- Let $\hat{\rho}$ be the interest rate. If he was self-financed he would solve

$$\max F(L) - (1 + \hat{\rho})L$$

- First-order condition

$$F'(L) = \frac{1}{2\sqrt{L}} = 1 + \hat{\rho}$$

or

$$L^* = \frac{1}{4\,(1+\hat{\rho})^2}.$$

- But suppose people can simply refuse to repay even when they are able to.

- Can use collateral:

$$F(L^*) - (1+\hat{\rho})L^* \geq F(L^*) - c$$

- So c has to be as high as $(1+\hat{\rho})L^*$

- Otherwise, can borrow up to your assets a

- By definition rationed, as $a < (1 + \hat{\rho})L^*$

- Marginal products will vary, and will exceed interest rates

- Dynamic issues

- If there are future periods where the borrower could again need a loan, the threat of credit denial in the future might make him behave properly.

- We show even in this case credit rationing will typically arise. Let v be the per period outside option or reservation payoff of a borrower, which indicates what he will receive if he does not receive loans. Let $R = (1 + \hat{r})L$ denote the amount he needs to pay back, principal plus interest. Let δ be the discount factor. He will want to repay if

$$F(L) + \frac{\delta}{1-\delta} v \leq \frac{F(L) - R}{1-\delta}$$

- The left hand side is the payoff from defaulting and the right hand side is the payoff from repaying. This can be simplified as

$$R \leq \delta \left[F(L) - v \right].$$

- The lender will break even so long as

$$z = R - (1 + \hat{\rho})L = 0.$$

- It is easy to see in Figure 1 that typically, credit rationing will arise. The zero profit constraint and the incentive compatibility constraint will be satisfied at some level of loan $\tilde{L}$ which will typically be less than the efficient level of loan, L^*.

- There could be multiple solutions, but $\tilde{L}$ Pareto dominates the others.

- It is easy to see that the higher is the outside option of the borrower and the lower is δ, his discount factor, the greater will be the extent of rationing.

- On the other hand for low levels of the outside option of the borrower, and high values of the discount factor, it is possible $\tilde{L} > L^*$ in which case L^* will be chosen (it would have been chosen in the first-best, and so it becomes feasible in the second-best people should still choose it).

Moral Hazard

- Project return can take on two values, R ('high' or 'success') and 0 ('low' or 'failure') with probability e and $1 - e$ respectively.

- The borrower chooses e, ('effort'), which costs him $c(e) = \frac{1}{2}ce^2$.

- Opportunity cost of funds ρ (principal plus interest rate)

- Opportunity cost of labor, u.

First-Best (Effort Observable)

- The entrepreneur will solve the following profit maximization problem:

$$\max_{\{e)} \pi = eR - \frac{1}{2}ce^2 - \rho - u$$

  - Yields

$$e^* = \frac{R}{c} < 1.$$

- Now consider the case where he has no cash but some illiquid asset worth w.

- The lender faces a limited liability constraint: pay r when the project return is high and $-w$ when the project return is low.

- This means that the borrower's payoff is

$$\pi^b = e\,(R - r) - (1 - e)w - \frac{1}{2}ce^2 - u$$

and the lender's expected payoff is

$$\pi^l = er + (1 - e)w - \rho.$$

If the lender could observe his effort level then what they should do is find a contract that maximizes their joint expected payoff:

$$\pi^b + \pi^l = eR - \frac{1}{2}ce^2 - \rho - u$$

which is exactly the expected payoff of a self-financed entrepreneur.

- Naturally, the effort they will mutually agree to choose will be

$$e^* = \frac{R}{c}.$$

Second-Best (Effort Unobservable)

- Now the borrower will choose e so as to maximize his private payoff.

- The incentive-compatibility constraint (IC) :

$$e = \arg \max_{e \in [0,1]} \left\{ e(R - r) - (1 - e)w - \frac{1}{2} c e^2 - u \right\}$$

which yields

$$e = \frac{R - r + w}{c} \in (0, 1).$$

The IC can be rewritten as

$$r = w + R - ce.$$

- The underlying environment is that of competition: lenders compete for borrowers which drives their profits to zero.

- The optimal contracting problem:

$$\max_{e,r} e(R-r) - (1-e)w - \frac{1}{2}ce^2$$

subject to

$$er + (1-e)w - \rho \geq 0$$

$$r - w = R - ce.$$

- The expected payoff of a borrower:

$$e\{R-(r-w)\} - w - \frac{1}{2}ce^2 = \frac{1}{2}ce^2 - w.$$

- Combine the IC and the ZPC to obtain:

$$e\,(r - w) + w - \rho = e\,(R - ce) + w - \rho = 0.$$

- This yields a quadratic equation in e :

$$ce^2 - eR + (\rho - w) = 0$$

- Solution is the bigger root, i.e.,

$$e^*(w) = \frac{R + \sqrt{R^2 - 4c(\rho - w)}}{2c}.$$

- Corresponding to e^*, the equilibrium interest rate is

$$r^*(w) = w + \frac{R - \sqrt{R^2 - 4c(\rho - w)}}{2}$$

- Once again, notice that if $w = \rho$, then e is at the first-best level.

- Otherwise, the effort level is increasing in w.

- As the borrower's equilibrium payoff is increasing in e, this means that social surplus is increasing in w.

- Also, the interest rate is decreasing in w for $w \leq \rho$

- Corresponding to e^*, the equilibrium interest rate is

$$r^*(w) = w + \frac{R - \sqrt{R^2 - 4c(\rho - w)}}{2}$$

- Notice that

$$\frac{dr^*(w)}{dw} = 1 - \frac{c}{\sqrt{R^2 - 4c(\rho - w)}}$$

- This is negative as

$$1 > \frac{\sqrt{R^2 - 4c(\rho - w)}}{c}$$

  - This follows from the fact that $e^*(w) = \frac{R+\sqrt{R^2-4c(\rho-w)}}{2c} < 1$.

  - But $\frac{\sqrt{R^2-4c(\rho-w)}}{c} < \frac{R+\sqrt{R^2-4c(\rho-w)}}{2c}$ as $R > \sqrt{R^2 - 4c(\rho - w)}$ (which follows from $w \leq \rho$).

- Therefore, $\frac{\sqrt{R^2-4c(\rho-w)}}{c} < 1$

- This result has several implications:

  - In equilibrium different interest rates will be charged, and still no arbitrage will be possible even thought the credit market is competitive with free entry. In particular, richer borrowers will face more favorable interest rates and will undertake projects that will succeed more on average.

  - The effort level will be less than the first-best level. That means default rates higher than first-best

– Any policy that increases the collateralizable wealth of the borrower (which could result from redistribution, or by improving the legal system that makes titling assets cheaper) will increase the equilibrium effort level.

- For wealth level sufficiently low it may be impossible to satisfy the zero profit condition of the lender and the participation constraint of the borrower in which case very poor borrowers will not receive loans. This is another form of inefficiency due to moral hazard. A necessary & sufficient condition for this to occur is if $\frac{1}{2}c\{e^*(0)\}^2 < \bar{u}$.

- Effort, and hence expected surplus is decreasing in the opportunity cost of capital. This means capital-scarce economies are more likely to be subject to inefficiencies in the credit market which suggests a vicious circle - because of these inefficiencies, income and hence savings are going to be low, and so capital will remain scarce. A subsidy to the interest rate would help in this model.

Adverse Selection

- Two types of borrowers characterised by the probability of success of their projects, p_r and p_s, where

$$0 < p_r < p_s < 1.$$

- Henceforth they will be referred to as 'risky' and 'safe' borrowers, exist in proportions θ and $1 - \theta$ in the population.

- The outcomes of the projects are assumed to be independently distributed.

- The rest similar to above section.

- Full information case: from the bank's zero-profit constraint

$$r_i^* = \frac{\rho}{p_i}, \quad i = r, s$$

- Adverse Selection: Charging separate interest rates to the two types borrowers would not work. A risky borrower would have an incentive to pretend to be a safe borrower.

- The expected payoff to borrower of type i when the interest rate is r is

$$U_i(r) \equiv p_i R_i - \ rp_i, i = r, s.$$

- Stiglitz and Weiss (1981) : risky and safe projects have the same mean return, but risky projects have a greater spread around the mean, i.e.,

$$p_s R_s = p_r R_r \equiv \bar{R}$$

- Assume that these projects are socially productive in terms of expected returns given the opportunity costs of labour and capital :

$$\bar{R} > \rho + \bar{u}. \qquad (A1)$$

- Under asymmetric information, if the bank charges the same nominal interest rate r then safe borrowers will have a higher expected interest rate:

$$p_s(R^s - r) < p_r(R^r - r).$$

- Pooling contract: $r = \theta p_r + (1 - \theta)p_s$. If

$$\bar{R} < \frac{p_s}{\overline{p}}\rho + \bar{u}. \qquad (A2)$$

a pooling contract does not exist that attracts both types of borrowers.

- Under-investment problem in credit markets with adverse selection (Stiglitz and Weiss, 1981).

- Solutions:

  - Collateral: not feasible if borrowers are poor.

  - Probability of granting loans as a screening device. Advantage over pooling debt contracts is that some safe borrowers will obtain credit at the full-information interest rate. Hence both welfare and repayment rates will be higher.

Evidence

Macro-level Evidence - Financial development & growth performance across countries

- The size of the domestic credit market is strongly positively correlated with per capita income across countries (as suggested by Figure 1 taken from Rajan-Zingales 1998)

- However, the causality could be the other way round: richer countries have larger markets for everything, including credit.

- Also, both per capita income and size of the credit market could be driven by other factors, such as good government policies, so that this correlation does not necessarily suggest a causal relationship

- Cross country evidence for the period 1960-1989 by King & Levine (1993) suggests that controlling for many country & policy characteristics, higher levels of financial development are associated with faster rates of contemporaneous & future (next 10-30 years) economic growth.

- Rajan & Zingales (1998) point out that this study could have two potential limitations.

  - Both financial development & growth could be driven by a common omitted variable such as the propensity to save.

  - Financial development may simply be a leading indicator of future development & not a causal factor - anticipating future growth financial institutions lend more.

- They propose an alternative test - do industries that are technologically more reliant on external finance (e.g., Drugs & Pharmaceuticals as opposed to Tobacco) grow faster in countries that are more financially developed?

- Roughly speaking, they are comparing the growth performance of industry A and industry B in US vs. India where A and B

vary in terms of how credit-dependent they are

- Any common country level factor is taken out using the inter-industry comparison

- They find a strong positive evidence on financial development on growth of industries that are more credit-dependent. Moreover, decomposing industry growth into that due to expansion of existing firms, & entry of new firms, they find financial development has a much larger (almost double) effect on the latter.

- Still problems of interpretation remain

- Country level factors could affect different industries differentially, in which case the "cross-country" criticism resurfaces

- For example, the regression results could be interpreted as showing contract enforcement matters, not credit constraints per se: those industries that are credit-dependent also are R&D intensive and are more likely to be affected by institutional quality

- Also, US might have a comparative advantage in credit-dependent industries, which means they have more innovations (notice that this argument does not apply for levels, only growth rates)

Individual level: Does wealth affect transition from worker to entrepreneur?

- If credit markets were perfect, the only thing that should affect your ability to become an entrepreneur is your ability

- Regression runs probability of becoming an entrepreneur on measures of ability (x) & wealth (w):

$$y_i = \alpha + \sum_{j=1}^{n} \beta_j x_{ij} + \gamma w_i + \varepsilon_i$$

- Wealth seems to matter. Panel data studies from the US (Evans & Leighton, AER 1989) and the UK (Blanchflower & Oswald, JLE 1998) that studied the same cohort of young men over several years

- Obviously, hard to control for all measures of ability & wealth could capture some of this omitted ability variables (families that save more work harder, families that save more earn more & so are more able etc.)

- Blanchflower & Oswald considered effects of wealth shocks which could be assumed to reasonably independent of ability - gifts & bequests.

- Wealth still seems to matter.

Firm level

- Interest rates are very high in developing countries - but could reflect scarcity.

- There are big differences in interest rates that are not being equalized by arbitrage, but that could be because the underlying risk-profiles of the borrowers and the costs of financial intermediation are different.

- You might say that rates of return to capital in firms estimated using data on firm earnings and capital stock are high, and exceed significantly the formal or informal interest rates available.

- If returns from capital significantly exceed its cost, firms should be expanding their capital stock, and if they aren't that means they are credit constrained.

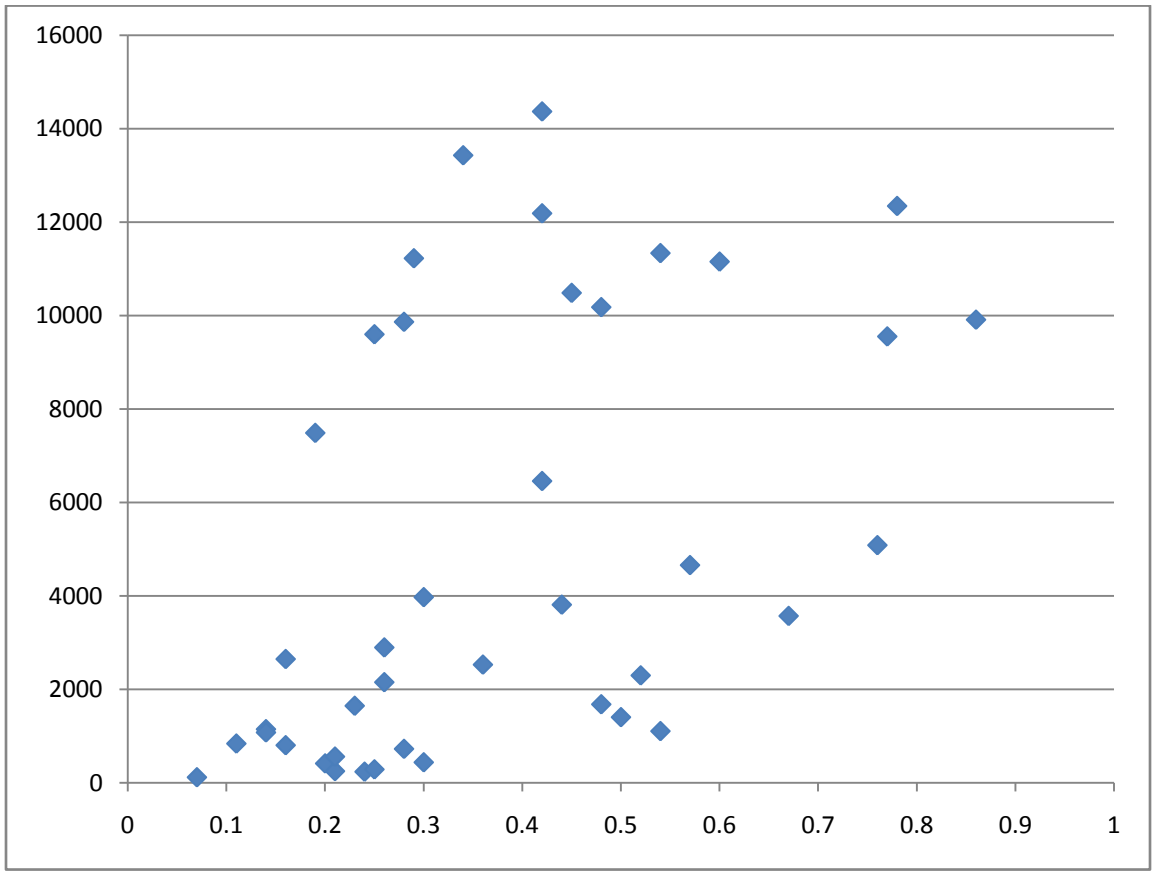
- Not necessarily, critics will say.

- The ability of entrepreneurs affect both the choice of the capital stock, and the rate of return (for example, smart guys need less capital and can generate more returns), and without controlling for it, these are biased estimates.

- In particular, we don't know whether we are measuring the returns to ability or to capital and whether the capital stock is optimally chosen given the entrepreneur's ability, or the firm is credit-constrained.

- OK, since ability is notoriously hard to measure, you would think that this is the point at which economists would give up.

- Several approaches to overcome this.



Source: Rajan and Zingales (1998)

Size of the Credit Market and Per Capita Income Across Countries

Per Capita Income(US 1980 $) on vertical axis
Domestic credit to Private Sector over GDP on horizontal axis

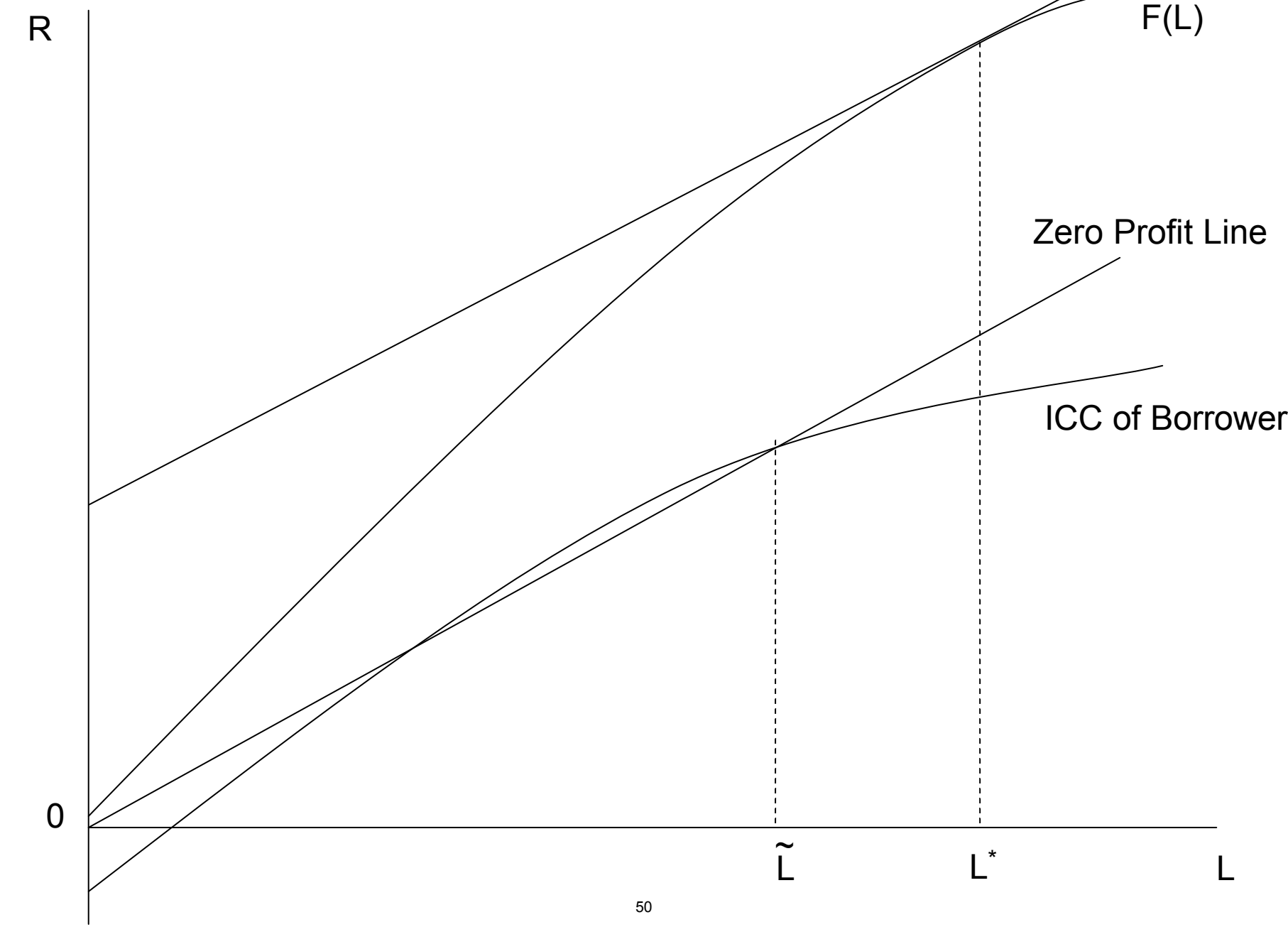


Figure 1

Microfinance

1. INTRODUCTION

- Because of transactions costs (screening, monitoring and enforcement) credit markets are imperfect, and these are more severe in developing countries.
- Standard solution (in the absence of non-monetary punishments) is to use collateral.
- Two problems
    - A large fraction of the population in developing countries is poor & do not own *any* assets - poverty trap
        - Policy Implication: Credit subsidy, redistribution
    - Even those who own assets, do not necessarily have formal titles, and also foreclosing on collateral is costly because of inefficient judicial system
        - Policy Implication: Titling, rewriting bankruptcy codes, legal reform
- The evidence on subsidized lending is not very encouraging
        - Low repayment rates: 30% in Pakistan, 41% in India (IRDP), 51% in Bangladesh
        - Debts expected to be written off due to political reasons & also, captured by the rich

- The evidence on titling is mixed: some find large effects on credit supply (see Feder and Feeny, World Bank Economic Review 1991 for land titling programme in Thailand) while Fields and Torrero (2005) find moderate effects in urban housing titles in Peru
- More generally, like asset redistribution (we will look at land reform in the next lecture) titling involves significant political and administrative costs
- Easier way out – convert "social capital" that exists in social networks in close-knit societies into "invisible" collateral
- Members of a community know more about one another than an outside institution such as a bank.
- While a bank cannot apply financial or non-financial sanctions against poor people who default on a loan, their neighbors may be able to impose powerful non-financial sanctions at low cost.
- An institution that gives poor people the proper incentives to use information on their neighbors & to apply non-financial sanctions to delinquent borrowers can out-perform a conventional bank.
- Achieve goals of both efficiency & equity (conventional lending programs being merely redistributive)

2. MICROFINANCE

- The Grameen Bank of Bangladesh Lends to about two million people, most of whom are rural, landless women, operates in 36,000 villages, or about half of all villages in the country.

- Worldwide, 13 ml clients were served in 2000 with other major MF organizations being FINCA, BANCOSOL, BRI, BKD, ACCION, and BRAC

- Small loans for self-employment projects (e.g., poultry, paddy husking, handloom weaving, grocery or tea shops, dairy farming)

- No collateral is charged, interest rates though high are less than those charged by moneylenders

- Borrowers organize themselves into self-selected groups of five people from the same village

- Loans are given for individual project, but group is jointly liable for each other's loans - if any member of a group defaults, all members are ineligible for credit in the future

- Stands out compared to conventional lending approaches in terms of (a) Reaching Target Groups and (b) Loan Repayment
  - The IRDP in India : on average, percentage of ineligible beneficiaries 15-26%, the highest reported being 50%. In contrast, for the Grameen Bank, only 5% borrowers were outside the target group
  - IRDP repayment rates 41% for India as a whole (Pulley, 1989). For the Grameen Bank, even according conservative estimates (Morduch, 1999) it is 92%.

- A role model for other micro-credit programs.

- Economists argue that joint liability induces borrowers to monitor each other ("peer monitoring"), put pressure on delinquent group members ("peer pressure") and induce better group selection ("peer selection")

Theoretical Models

(based on Ghatak-Guinnane 1999)

All parties are risk-neutral.

Need 1 unit of capital to start a project, but have no money

Opportunity cost of capital **ρ** & opportunity cost of borrower's labor, **u**

The bank can only collect money from you when output is high (limited liability)

Project returns of borrowers are uncorrelated

Focus on groups of size 2

Standard debt contract: If you are able to repay, pay **r**

Joint liability Contract **:** If you are able to repay, pay **r** for yourself **AND** in addition

c if your partner fails

0 if your partner succeeds

Adverse Selection (Ghatak, Van Tassel, Armendariz-Gollier)

2 types of borrowers in the population, safe & risky

Differ only in their probabilities of getting high output, $\mathbf{p_s}$ & $\mathbf{p_r}$

Output can be high ($\mathbf{R_i}$) or low (**0**) with probabilities $\mathbf{p_i}$ & $\mathbf{1-p_i}$

Projects have same mean return $\mathbf{p_i R_i = R}$

Assumption: Projects are socially profitable $\mathbf{R > \rho + u}$

Bank can't tell who is who, but borrowers know each other's types

If you charge the same interest **r** then risky borrowers could borrow, raising the interest rate & reducing the surplus of safe borrowers

Joint Liability: Ask borrowers to select own partner

Expected payoff of borrower of type i when partner is type j

$$EU_{ij}(r,c) = p_i p_j (R_i - r) + p_i (1 - p_j)(R_i - r - c)$$

Naturally, everyone would like to have a safe borrower as partner

If I fail, I don't care what my partner's type is, but if I succeed, my expected gain from having a safe partner is $(\mathbf{p_s - p_r) * c}$ whatever is my type

But before I know whether I am successful or not, my *expected* gain from having a safe partner is $EU_{ss} - EU_{sr} = \mathbf{p_s}*(\mathbf{p_s - p_r) * c}$ if I am safe & $EU_{rs} - EU_{rr} = \mathbf{p_r}*(\mathbf{p_s - p_r)* c}$ if I am risky

Safe borrowers value safe partners more than risky borrowers do

Given that they have risky partners, risky borrowers dislike joint liability more than safe borrowers

Offer two contracts one individual liability & the other joint liability

Safe borrowers will select the latter & risky ones the former

Repayment rates would improve, & welfare go up

Moral Hazard (Stiglitz; Banerjee-Besley-Guinnane)

Borrower can take actions that are costly for the bank to monitor, which affect the probability of success **p**

The harder you work, the more you are likely to succeed but working hard is costly for you, say, $\mathbf{1/2*\gamma p^2}$

If you used your own money, you would choose the efficient level of effort

Maximize $\mathbf{pR - 1/2*\gamma p^2}$ with respect to **p** which yields $\mathbf{p^* = R/\gamma}$ (Assume $\mathbf{R < \gamma}$)

The reasons why you would choose an effort level that is less than the efficient level are (a) unobservability of **p** and (b) the fact that you cannot pay anything when output is low.

The interest rate needs to be paid only when you succeed, not when you fail, & so this reduces the attractiveness of success:

Maximize $\mathbf{p(R-r) - 1/2*\gamma p^2}$ with respect to **p**, which yields $\mathbf{p = (R-r)/\gamma < p^*}$

Since repayment rates are low, interest rates will be high

Under joint-liability suppose your partner chooses an effort level $\mathbf{p'}$

Maximize $p(R-r) - cp(1-p') - 1/2*\gamma p^2$ with respect to p, which yields $p = (R- r - c) /\gamma + c/\gamma * p'$

The higher is the partner's effort level, the more you want to choose a higher effort level, since the expected "tax'' on your success output is less

If borrowers don't recognize this externality & behave non-cooperatively, then in a symmetric Nash-equilibrium

$\mathbf{p = (R- r - c) / (\gamma - c)}$

If borrowers recognize this externality & cooperatively choose their effort levels to solve

$Max_p\ p(R-r) - cp(1-p) - 1/2*\gamma p^2$

We get $\mathbf{p = (R- r - c) /(\gamma - 2c),}$ i.e., a higher effort level

In the paper by Ghatak-Guinnane (1999) there is a proof that if the borrowers don't recognize the externality then the repayment rate will be the same as in a standard IL loan. Basically, you have to use to bank's zero profit condition.

Enforcement (Besley-Coate)

Alter the above framework in the following ways:

There are no screening or monitoring problems

Output **R** is continuous

Borrowers risk-averse - concave utility function **u(.)**

Legal enforcement is very costly & banks need to use threats of denying loans in the future

B is the PDV of the benefits of receiving future loans

Consider first a regular loan contract

A borrower will repay if & only if

$u(R) - u(R - r) < \text{or} = B$

We can solve **R(r)** when the above holds with equality.

The greater is **r**, the higher will be **R(r)**

Borrowers repay only when **R>R(r).**

Consider joint-liability lending such that **r=c**

Then a borrower repays her own & her partner's loan if & only if

u(R) – u (R – 2r) < or = B

That is, if R>R(2r).

Two cases:

If one member is unwilling or unable to repay & the other is willing to repay both loans (i.e., **R>R(2r)**) , then JL is better than standard loans

If one member is unwilling or unable to repay & the other is willing to repay her own loan but not both loans (i.e., **R(r)<R<R(2r)** then JL is worse than standard loans

Depending on which states are more likely, which depends on the probability distribution of output, JL could have higher or lower repayment rates than standard loans

However, default by one borrower when she was able but unwilling to repay her loan (**r < R < R(r)**) hurts her partner who is willing to repay her own loan, the community might punish the former – Social Capital.

The focus so far has been mostly on joint liability (JL)

Recently there is some focus away from it: keep the group structure, but have individual liability (IL)

In his book Yunus talks about several other mechanisms:

1. Sequential (first one borrower is given a loan, and upon satisfactory performance the next one in the group)
2. Group Fund
3. Frequent Repayment

Today, want to talk about the first-two and their interaction

First we present a simplified version of Roy Choudhury, JDE 2005 of sequential lending

Aniket (2003) is a related contribution.

Suppose a borrower can choose an action $x \in \{0,1\}$ which is subject to *ex ante* moral hazard.

$x = 1$ is the good action which yields an output of H

x=0 is the bad action that yields a benefit b to the borrower (say, blowing it on drinks)

No uncertainty.

The opportunity cost of capital is r (exogenously given)

Borrowers have no wealth, and there is limited liability

Lender wants to break even (zero-profit condition)
Borrowers can perfectly monitor each other at cost φ

We assume no distortions other than ex ante moral hazard, and so once a monitor sends a signal to lender, an action-contingent contract can be enforced

Under JL, the borrower has to pay H-2r

Suppose they choose monitoring decision simultaneously with M denoting they monitor, and D denotes they don't

1 \ 2	M	D
M	H-r-φ, H-r- φ	b- φ, H-2r
D	H-2r, b- φ	b,b

The payoffs from (M,M) and (D,D) are self-evident

Consider (D,M): switching from M to D, 1 knows that 2 will default but he will not as 2 continues to monitor
So he is going to have to pay H-2r to the bank while 2 will get b- φ

If $r > \varphi$ then game has two Nash equilbria (M,M) and (D,D)

(If $r < \varphi$ then monitoring is so costly, it is easier paying back the partner's loan - not plausible)

Strategic complementarities in monitoring effort.

If you know the other guy is shirking, no point putting in the monitoring effort.

1 \ 2	M	D
M	H-r-φ, H-r- φ	b- φ, H-2r
D	H-2r, b- φ	b,b

Notice that (D,D) Pareto-dominates (M,M)

So assuming borrowers can coordinate, there is no monitoring

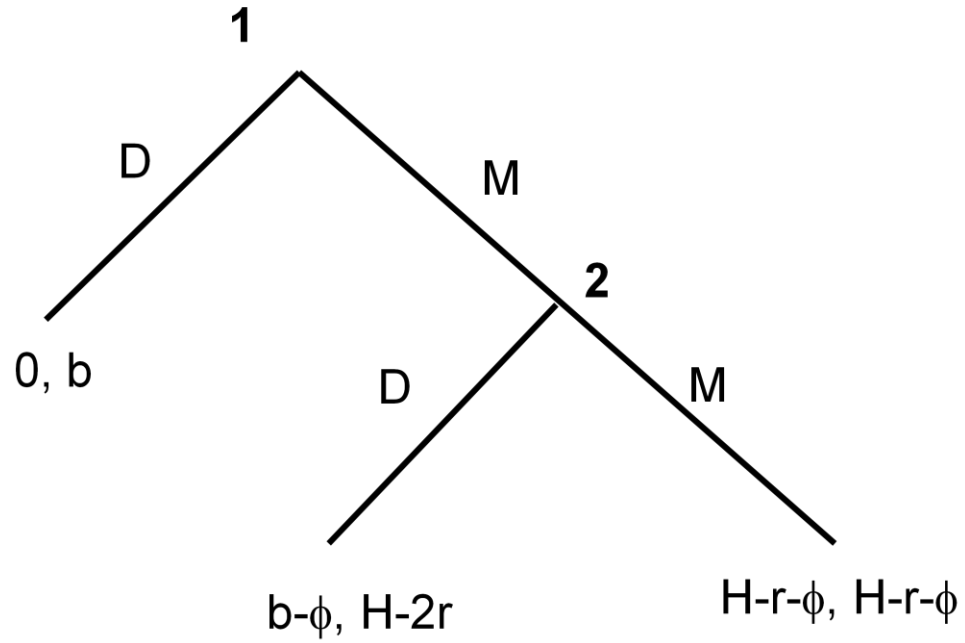
Now convert this to a sequential game

Borrower 2 gets a loan first, and 1 can choose to monitor or not

If 2 chooses the good project then the success revenue is held in an escrow account (e.g., “group fund”)

(Otherwise lender might have a temptation to take it using some excuse)

Then 1 gets his loan, and 2 decides to monitor or not



2 will choose M as $r > \varphi$

Knowing this, 1 will choose M as well.

Actually, M is a dominant strategy for 1 as $b - \varphi > H - r - \varphi > 0$

The problem of being stuck in the bad equilibrium is gone

Roy Choudhury's conclusion is this shows sequential lending induces monitoring

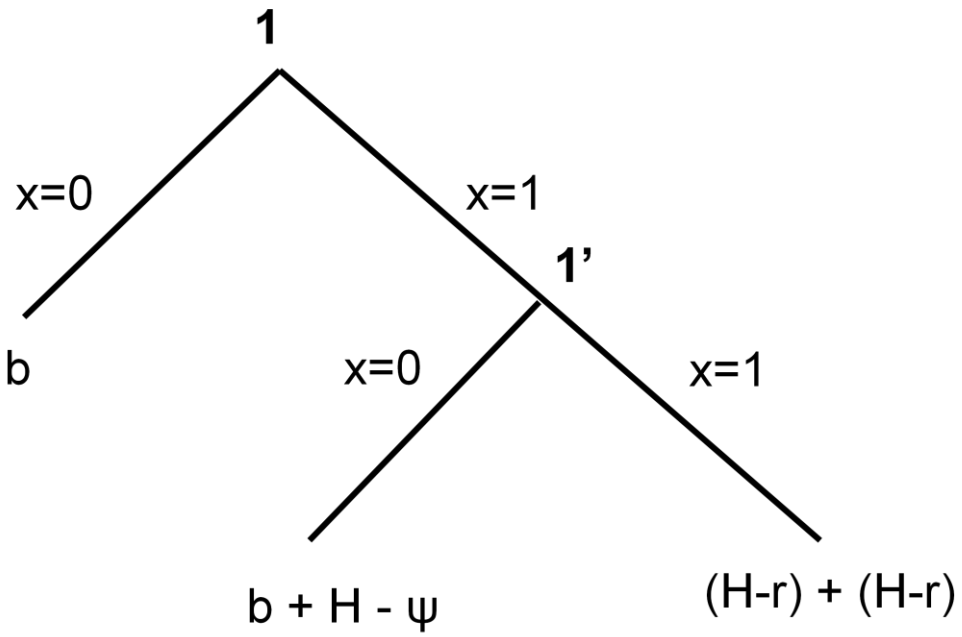
Two issues with this

He implicitly assumes an escrow account. This is what is effectively creating collateral here.

His argument can be applied even with individual lending

Consider the variation in the extensive form game

Let ψ be the penalty for choosing the bad project at t=2

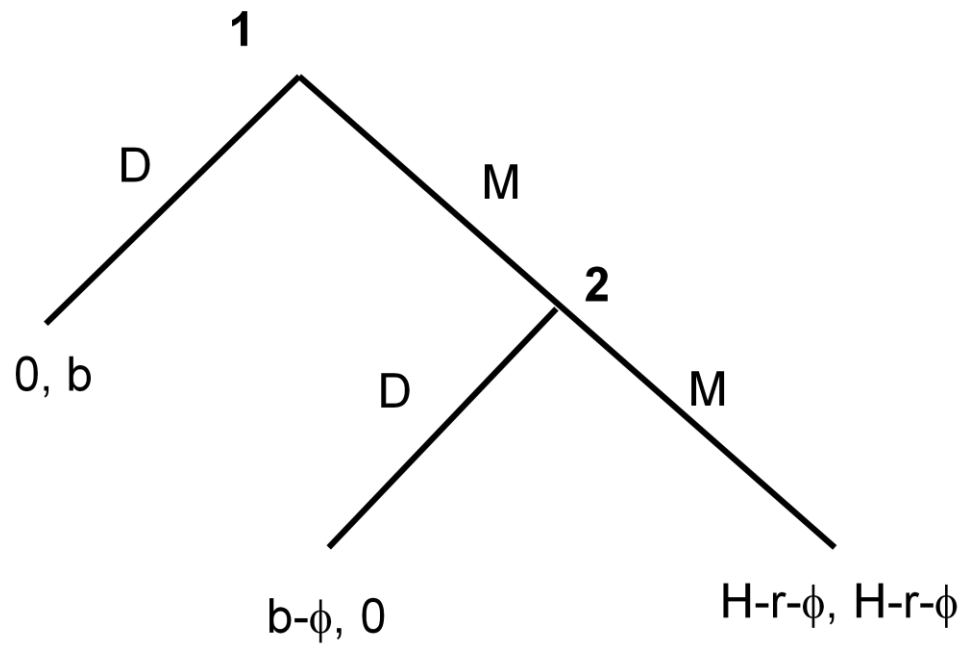


Recall b>H-r and so ψ has to be bigger than r

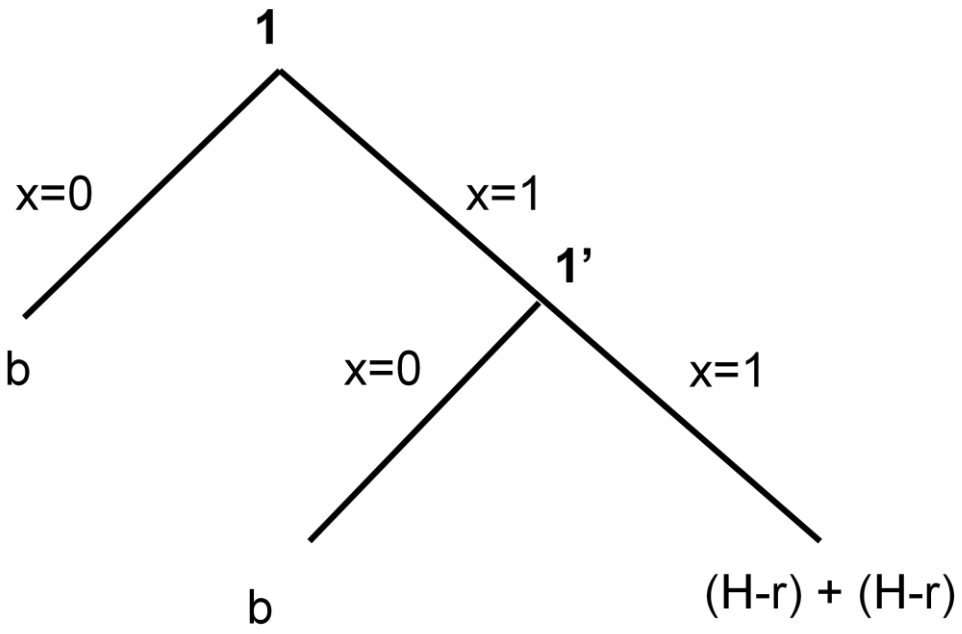
Actually, that is the assumption of Roy Choudhury (2005): even with group lending, he assumes H- 2r < 0 and so the bank keeps H if both borrowers default.

Lets set ψ=H and see the comparison

Sequential group lending



Sequential individual lending



Now, will choose good project is second period if 2H-2r>b

Will choose good project in first period if $2\delta(H-r)>b$

This will hold only if δ not too low

In group lending the condition is (H-r)> φ

The condition for sequential individual lending to dominate sequential group lending is:

$$\varphi > H - r > \frac{b}{2\delta}$$

The key mechanism therefore is creation of collateral & creation of inter-temporal incentives.

The group aspect works only if monitoring costs are low.

Another Mechanism: Repayment Frequency

- In Grameen, one-year loans are given out which are paid in equal weekly installments, and repayment starts one week after the loan

> "..it is hard to take a huge wad of bills out of one's pocket and pay the lender. There is enormous temptation from one's family to use that money to meet immediate consumption needs...Borrowers find this incremental process easier than having to accumulate money to pay a lump sum because their lives are always under strain, always difficult." Muhammad Yunus, *Banker to the Poor*, p. 114

- Theoretically puzzling

A Model (Based on Fischer-Ghatak 2009)

- Consider a two-period model of debt repayment
- In period 0 receive a loan of amount L at *periodic* gross interest R
- You can pay it back in period 2
- Alternatively you can pay it in installments in periods 1 and 2
- At the end of period 2 you receive a payoff of V if you repay and 0 if you default
- This can be the continuation value, or the punishment you avoid (including forfeiting some collateral)

- $M_1 = LR^2$ is the periodic payment for a loan with a single periods

- What would be the equivalent per period payment if it is paid in two equal installments?

- Suppose M_2 is the installment.

- If I pay M_2 tomorrow then day after tomorrow it is worth M_2R

- I also pay my second installment day after tomorrow, which is M_2

- The total must be the same as a one-period loan by assumption

- Therefore,

$$M_2 + RM_2 = LR^2$$

- Therefore, $M_2 = LR^2/(R+1)$ is the periodic payment for two payments

- The loan is being fully amortized here (i.e., you are saving some interest costs since you are paying some of it back a bit earlier)

- Suppose the person receives certain income w in periods 1 and 2 (exogenous)

- To simplify the world, assume risk-neutrality, no savings, and $w \geq LR^2$

- Therefore, in principle, can pay back the loan in any period

- Consider a β-δ discounter (quasi-hyperbolic with all future periods discounted by β)

- For now we make the simplifying assumption that $R = 1$, i.e., the interest rate is 0

With single repayment in period two

- The repayment constraint is simply to repay iff

$$w - L + \beta\delta V \geq w$$

- So the incentive compatibility constraint for a single repayment period is

$$L \leq \beta\delta V \equiv \overline{L^1}$$

Now consider splitting the repayment in two

- Note that it would never makes sense for borrower to repay in first period if she was planning to default in the second

- We can focus on decision utility in period 1

- Repay iff

$$w - \frac{L}{2} + \beta\delta(w - \frac{L}{2}) + \beta\delta^2 V \geq w + \beta\delta w$$

- So the incentive compatibility constraint for multiple repayment is

$$L \leq \frac{2\beta\delta^2}{1 + \beta\delta} V \equiv \overline{L^2}$$

- Compare this to traditional constraint

$$\overline{L^1} = \beta\delta V$$

Compare the two constraints

- Compare the maximum incentive compatible loan size

$$\overline{L^2} = \frac{2\delta}{1+\beta\delta}\overline{L^1}$$

- If individuals are not present-biased, i.e., $\beta = 1$,

$$\overline{L^2} < \overline{L^1} \quad \forall\ \delta < 1$$

- **For classical (exponential) discounters it is harder to satisfy repayment constraint when payments are split**

When borrowers are present-biased

- **Proposition 1:** The maximum incentive compatible loan size is greater under more frequent repayments iff $\beta < 2 - \frac{1}{\delta}$

- That is, if borrowers are sufficiently tempted and not too impatient

- Here we are assuming $\delta \geq \frac{1}{2}$

- Otherwise, for $\beta = 1$, $\overline{L^2} < \overline{L^1}$

- For non-zero interest rate ($R > 1$), this condition becomes

$$\overline{L^2} > \overline{L^1} \Leftrightarrow \beta < (R+1) - \frac{1}{\delta}$$

- **Note, when $R\delta = 1$, this holds for all present-biased borrowers**

Intuition

- Recall that the IC for the one-period loan is

$$\begin{aligned} w - L + \beta\delta V &\geq w \\ \text{or, } -L + \beta\delta V &\geq 0 \end{aligned}$$

- For the two-period loan, the IC is:

$$\begin{aligned} w - \frac{L}{2} + \beta\delta(w - \frac{L}{2}) + \beta\delta^2 V &\geq w + \beta\delta w \\ \text{or, } -\frac{L}{2}(1 + \beta\delta) + \beta\delta^2 V &\geq 0 \end{aligned}$$

- If $\beta = \delta = 1$ then they are equivalent

- If $\beta = 1$ then they are, respectively:

$$\begin{aligned} -L + \delta V &\geq 0 \\ -\frac{L}{2}(1+\delta) + \delta^2 V &\geq 0 \end{aligned}$$

- There are two effects: the gains ($\delta^2 V$) are postponed which is bad, but costs are less because of amortization

- Since the former kicks in two periods later (from the point of view of period 1) the former effect dominates

- If $\beta < 1$ then the balance is partially restored since now both the gain and the loss are discounted by the present-bias β *equally*

- No discrimination between tomorrow and day after tomorrow

Framework for Interpreting Existing Evidence

- Support for folk wisdom and repayment experience of many MFIs

- Field & Pande (2008)
  - Randomized evaluation did not find effect of repayment frequency on default
  - Repayment rates nearly perfect for all groups
  - Suggests ICs not binding ($L < \overline{L^n}$)
  - Future work exploring effects with larger loan sizes where ICs likely to bind

Adding transaction costs

- Consider moving towards a multi-period model
- The basic intuition continues to hold: for present-biased borrowers, more frequent repayment relaxes the IC constraint
- Transaction costs are the balancing force
- Amend the previous model such that each payment costs the borrower t
  - Could also model as cost to lender that is capitalized into loan principal

Repayment constraint for single-payment contract with transaction costs

- Borrower's IC constraint in period 2 is

$$LR^2 + t \leq \beta\delta V$$

- Following prior notation

$$\overline{L^1}(t) = \frac{\beta\delta - t}{R^2}$$

Repayment constraint for two-payment contract

- Borrower's IC constraint in period 1 (the decision period) is

$$-(M_2 + t) - \beta\delta(M_2 + t) + \beta\delta^2 V \geq 0$$

- Therefore

$$\overline{L^2}(t) = \frac{R+1}{R}\frac{\beta\delta^2 - t(1+\beta\delta)}{(1+\beta\delta)}$$

- **Proposition 3:** If Condition 1 ($\beta < (R+1) - 1/\delta$)) holds (and hence $\overline{L^2}(0) > \overline{L^1}(0)$), $\exists t^* > 0$ such that $\overline{L^2}(t^*), \overline{L^1}(t^*) > 0$ and $\overline{L^1}(t) > \overline{L^2}(t)\ \forall t > t^*$.

- From policy perspective, allows calibration of optimal repayment frequency

Welfare Approach (**optional material**)

- Evaluation of welfare under time-inconsistent preferences remains open question

- We follow long-run perspective of Akerloff (1991) and O'Donoghue and Rabin (1999)
  - Consider the agent's utility from a fictitious period 0
  - Agent makes no decisions and weight utility as if she were time consistent

Welfare, Single-period Repayment

- Lifetime welfare of the borrower under **single-period** repayment is

$$W^1 = L - \delta^2 L R^2 + \delta^3 V$$

- Evaluate at $\overline{L}^1 = \frac{\beta\delta V}{R^2}$ and normalize V to 1

$$W^1 = \frac{\beta\delta}{R^2} + (1-\beta)\delta^3$$

- Measure of present-bias, β, reappears due to its effect on the maximum incentive compatible loan size

Welfare, Two-period Repayment

- Lifetime welfare of the borrower under **two-period** repayment is

$$W^2 = L - \delta L\frac{R^2}{R+1} - \delta^2 L\frac{R^2}{R+1} + \delta^3 V$$

- Evaluate at $\overline{L}^2 = \frac{\beta\delta^2(R+1)}{R^2(1+\beta\delta)}V$ and normalize V to 1

$$W^2 = \frac{\beta\delta^2(1+R)}{(1+\beta\delta)R^2} - \frac{\beta\delta^3}{(1+\beta\delta)} - \frac{\beta\delta^4}{(1+\beta\delta)} + \delta^3$$

Comparative Welfare

- Comparing welfare under the two repayment schedules

$$\begin{aligned}\Delta W &\equiv W^2 - W^1 \\ &= \frac{\beta\delta}{R^2}\frac{\delta R - (1-\delta) - \beta\delta}{1+\beta\delta} - \frac{\beta\delta^4}{1+\beta\delta}(1-\beta)\end{aligned}$$

Comparative Decision Utilities

- Evaluating relative utilities at the maximum incentive compatible loans sizes

$$\begin{aligned}U^1 &= \frac{\beta\delta}{R^2} - \beta^2\delta^3 + \beta\delta^3 \\ U^2 &= L - \beta\delta L\frac{R^2}{R+1} - \beta\delta^2 L\frac{R^2}{R+1} + \beta\delta^3 V\end{aligned}$$

- Comparing the decision utility of the two repayment schedules

$$\begin{aligned}\Delta U &\equiv U^2 - U^1 \\ &= \frac{\beta\delta}{R^2}\frac{\delta R - (1-\delta) - \beta\delta}{1+\beta\delta} - \frac{\beta^2\delta^4}{1+\beta\delta}(1-\beta)\end{aligned}$$

Welfare (cont)

- We focus our attention on R in the interval $\left[1, \frac{1}{\beta\delta}\right]$
  - If $R \geq 1$, no one will lend.
  - When $\beta\delta R > 1$ even present-biased borrowers will not want to borrow.

- Let

$$A(R) \equiv \frac{\beta\delta}{R^2}\frac{\delta R - (1-\delta) - \beta\delta}{1+\beta\delta}$$

and

$$B \equiv \frac{\beta\delta^4}{1+\beta\delta}(1-\beta)$$

- We can then write

$$\begin{aligned} \Delta W &= A(R) - B \\ \Delta U &= A(R) - \beta B \end{aligned}$$

Welfare Proposition

- This leads us to **Proposition 2**:

  1. If the single-period loan is preferred by the agent it is also the welfare maximizing contract, and conversely, if the individual's welfare is higher with a two-period loan, he will prefer it.

  2. If $\delta > \frac{1}{2(1-\beta)}$ then: (i) for all $R \in [\frac{1}{\delta}, \frac{1}{\beta\delta}]$ the agent prefers the loan in which repayment is split

into two periods; however, welfare is reduced relative to the single-period repayment loan; (ii) there exists $R' \in \left[1, \frac{1}{\delta}\right]$ such that $A(R) \geq B$ for $R \in [1, R']$ two-period loans are welfare enhancing and will be chosen by the borrower.

3. If $\frac{1}{2-\beta} < \delta \leq \frac{1}{2(1-\beta)}$ then there exists $R'' \in [\frac{1}{\delta}, \frac{1}{\beta\delta}]$ such that two period loans are welfare enhancing and will be chosen by the borrower.

Welfare Proposition

- Implicitly assumed loan proceeds available for consumption
  - Risk-neutral, hyperbolic discounters consume entire loan immediately

- Highlights tension between credit rationing and welfare costs of present bias

  - Applicable to increasingly prevalent consumption loans

- Consider opportunity for indivisible investment of fixed size $\underline{k}$

- If $\overline{L}^1, \overline{L}^2 \geq \underline{k}$, all excess proceeds, $\overline{L}^n - \underline{k}$, consumed immediately: ΔU and ΔW unchanged

- When $\overline{L}^2 > \overline{L}^1$, there is possibility that $\underline{k} \in (\overline{L}^1, \overline{L}^2)$

  - Alleviation of credit constraints can lead to potentially large welfare gains

  - We retain assumption that w is sufficient to make any periodic loan payment; the repayment feasibility constraint never binds