

# Credit Markets

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# 1 The neo-classical model of the capital market

- Everyone faces the same interest rate, adjusted for risk. i.e. if there is a  $d\%$  risk of default then  $dr$  (where  $r$  is the gross interest rate) is a constant.
- The interest rate paid to depositors is equal to  $dr$  less some small change for the cost of operating a bank.
- The expected marginal product of capital should be equated to  $dr$ .

## 2 Facts about Credit Markets

1. Sizeable gap between lending rates and deposit rates within the same sub-economy:

Ghatak (1976) reports data on interest rates paid by cultivators in India from the *All India Rural Credit Survey* for the 1951-2 to 1961-2 period: The average rate varies between a maximum of 18% (in 1959-60) and a minimum of about 15% (in 1961-62). These numbers are, however, slightly misleading: around 25% of the borrowing reported in these surveys were zero-interest loans, usually from family members or friends. These should be seen as gifts/insurance rather than loans. If these were left out, the average rates in these surveys would be above 20%. We are not told what the comparable rates for depositors were in this period, but Ghatak reports that the bond rate in this period was around 3% and the bank deposit rate was probably about the same.

Timberg and Aiyar (1984) report data on indigenous style bankers in India, based on surveys that they carried out. They report the gap between the average rate charged to borrowers and the average rate to depositors by Finance Companies was 16.5%. The same gap for financiers from the Shikarpuri community was 16.5%, 12% for financiers from the Gujarati community, 15.5% for the Chettiars, 11.5% for the Rastogis, etc.

The “Summary Report on Informal Credit Markets in India” (Dasgupta, 1989) reports results from a number of case studies that were commissioned by the Asian Development Bank and carried out under the aegis of the National Institute of Public Finance and Policy. For the rural sector, the data is based on surveys of 6 villages in Kerala and Tamil Nadu, carried by the Centre for Development Studies. The average interest rate charged by professional

money-lenders (who provide 45.61% of the credit) in these surveys is about 52%, while the average deposit rate is not reported, the maximum from all the case studies is 24% and the maximum in four out of the eight case studies is no more than 14%. For the urban sector, the data is based on various case surveys of specific classes of informal lenders: For Finance Corporations they report that the maximum deposit rate for loans of less than a year is 12% while the minimum lending rate is 48%. For hire-purchase companies in Delhi, the deposit rate was 14% and the lending rate was at least 28%. For auto-financiers in Namakkal, the gap between the deposit rate and the lending rate was 19%. For handloom financiers in Bangalore and Karur, the gap between the deposit rate and the lowest lending rate was 26%.

Aleem (1990) reports data from a study of professional moneylenders that he carried out in a

semi-urban setting in Pakistan in 1980-1981. The average interest rate charged by these lenders is 78.5%. The bank rate in that year in Pakistan was 10%. However, it is possible that depositors in this area may not have been depositing in the banks, so an alternative measure of the gap can be obtained by using the Aleem's numbers for the opportunity cost of capital to these money-lenders, which is 32.5%.

2. Extreme variability in the interest rate within the same sub-economy:

Timberg and Aiyar (1984) report that the rates for Shikarpuri financiers varied between 21% and 37% on loans to members of local Shikarpuri associations and between 21% and 120% on loans to non-members (25% of the loans were to non-members and another 50% were loans

through brokers). On the other hand, the Gujarati bankers charged rates of no more than 18%. Moreover, the rates faced by established commodity traders in the Calcutta and Bombay markets were never above 18% and could be as low as 9%.

The “Summary Report on Informal Credit Markets in India” (Dasgupta, 1989) reports that Finance Corporations offer advances for a year or less at rates between 48% per year and the utterly astronomical rate of 5% per day. The rates on loans of more than a year varied between 24% and 48%. Hire-purchase contracts offer rates between 28% to 41% per year. Handloom Financiers charge rates between 44% and 68%. Yet the Shroffs of Western India offer loans at less than 21% and Chit Fund members can borrow at less than 25%.

The same report tells us that among rural lenders, the average rate for professional money-lenders

(who in this sample give about 75% of the commercial informal loans) was 51.86%, whereas the rates for the agricultural money-lenders (farmers who also lend money) who supply the rest was 29.45%. Within the category of professional money-lenders, about half the loans were at rates of 60% or more but another 40% or so had rates below 36%.

The study by Aleem (1990) reports that the standard deviation of the interest rate was 38.14% compared to an average lending rate of 78.5%. In other words, an interest rate of 2% and an interest rate of 150% are both within two standard deviations of the mean.

Swaminathan (1991) reports on a survey of two villages in South India that she carried out: The average rate of interest in one village varied between 14.8% for loans collateralized by immovable assets (land, etc.) and 60% for

loans backed by moveable assets. The corresponding rates in the other village were 21% and 70.6 %. Even among loans collateralized by the same asset—gold—the average rate in one village was 21.8% but it went up to 58.8% when the loans were to landless laborers.

Ghate (1992) reports on a number of case studies from all over Asia: The case study from Thailand found that interest rates were 2-3% per month in the Central Plain but 5-7% in the north and north-east (note that 5 and 7 are very different).

Gill and Singh (1997) report on a survey of 6 Punjab villages they carried out. The mean interest rate for loans up to Rs 10,000 is 35.81% for landowning households in their sample, but 80.57% for landless laborers.

Fafchamps' (2000) study of informal trade credit in Kenya and Zimbabwe reports an average

monthly interest rate of 2.5% (corresponding to annualized rate of 34%) but also notes that this is the rate for the dominant trading group (Indians in Kenya, whites in Zimbabwe) is 2.5% month while the blacks pay 5% per month in both places.

Irfan et al. (1999), mentioned above, report that interest rates charged by professional money-lenders vary between 48% and 120%.

### 3. Low levels of default:

Timberg and Aiyar (1984) report that average default losses for the informal lenders they studied ranges between 0.5% and 1.5% of working funds.

The “Summary Report on Informal Credit Markets in India” (Dasgupta, 1989) attempts to decompose the observed interest rates into their

various components, and finds that the default costs explain 14 per cent (not 14 percentage points!) of the total interest costs for the Shroffs, around 7% for auto-financiers in Namakkal and handloom financiers in Bangalore and Karur, 4% for Finance Companies, 3% for hire-purchase companies and essentially nothing for the Nidhis.

The same study reports that in four case studies of money-lenders in rural India they found default rates explained about 23% of the observed interest rate.

The study by Aleem gives default rates for each individual lender. The median default rate is between 1.5 and 2% and the maximum is 10%.

4. Production and trade finance are the main reasons given for borrowing, even in cases where the rate of interest is relatively high:

Ghatak (1976) concludes on the basis of his study that “the existing belief about the unproductive use of loans by Indian cultivators ... has not been substantiated.”

Timberg and Aiyar (1984) report that for Shikarpuri bankers (who charge 31.5% on average, and as much as 120% on occasion), at least 75% of the money goes to finance trade and, to lesser extent, industry.

The “Summary Report on Informal Credit Markets in India” (Dasgupta, 1989), reports that several of the categories of lenders that have been already mentioned, such as hire-purchase financiers (interest rates between 28%-41%), handloom financiers (44%-68%), Shroffs (18%-21%) and Finance Corporations (24%-48% for longer term loans and more than 48% on loans of less than a year) focus almost exclusively on financing trade and industry, and even for Chit Funds and Nidhis, which do finance consumption, trade and industry dominate.

Swaminathan (1991) reports that in the two villages she surveys, the share of production loans in the portfolio of lenders is 48.5% and 62.8%. The higher share of production loans is in Gokalipuram, which has the higher interest rates (above 36% for all except the richest group of borrowers).

Ghate (1992) also concludes that the bulk of informal credit goes to finance trade and production.

Murshid (1992) studies Dhaner Upore (cash for kind) loans (you get some amount in rice now and repay some amount in rice later) and argues that most loans in his sample are production loans despite the fact that the interest rate is 40% for a 3-5 month loan period.

Gill and Singh (1997) report that the bulk (63.03%) of borrowing from the informal sector goes to finance production. This proportion is lower

for the landless laborers but it is a non-negligible fraction (36%).

5. Rich people borrow more and pay lower rates of interest; more generally it appears that those who borrow more pay lower interest rates:

Ghatak (1976) correlates asset category with borrowing/debt in the *All India Rural Credit Survey* data and finds a strong positive relationship.

Timberg and Aiyar (1984) report that some of the Shikarpuri and Rastogi lenders set a credit limit that is proportional to the borrower's net worth: Several lenders said that they would lend no more than 25% of the borrower's net worth, though another said he would lend up to 33%.

The “Summary Report on Informal Credit Markets in India” (Dasgupta, 1989) tells us that in their rural sample, landless laborers paid much higher rates (ranging from 28-125%) than cultivators (who paid between 21 and 40%). Moreover, Table 15.9 in that report clearly shows that the average interest rate declines with loan size (from a maximum of 44% to a minimum of 24%). The relation between asset category and interest rate paid is less clear in their data but it remains that the second poorest group (those with assets in the range Rs 5,000-10,000) pays the highest average rate (120%) and the richest (those with more than Rs 100,000) pay the lowest rate (24%).

Swaminathan (1991) finds a strong negative relation between the value of the borrower’s land assets and the interest rate he faces: The poorest (those with no land assets) pay 44.9%

in one village and 45.4% in the other, while the rich (those with land valued at more than Rs 50,000) pay 16.9% and 24.2% in the corresponding villages.

Ghate (1992) notes that the interest rate on very small loans in Bangladesh tends to be very high (Taka 10 per week on a loan of Taka 500, or 86% per annum).

Gill and Singh (1997) show that the correlation between loan size and the interest rate is negative after controlling for the wealth of the borrower, and that the correlation between the wealth of the borrower and loan size is negative after controlling for loan size. They also find a positive relation between the borrower's wealth and the loan he gets.

### 3 A Simple Model of Moral Hazard in the Credit Market

- There is an investment opportunity whose gross returns are  $F(K)R(p)$  with probability  $p$  and 0 otherwise, where  $K$  is the amount invested and  $F(\cdot)$  is a production function. If an investor wants to invest more than his wealth,  $W$ , he will need to borrow. There is a capital market and the (gross) cost of capital in that market is  $\rho$ .
- Special assumptions:
  1.  $p$  is a choice for the investor but is unobserved by the lender.  $p$  takes a value between  $p_0$  and  $p_1$ .
  2.  $E(p) \equiv pR(p)$  has the property that  $E'(p_0) > 0$ , and  $E''(p) \leq 0$ .
  3. The only possible contract is a loan contract.
  4. Risk neutrality

### 3.0.1 The Basic Moral Hazard Problem

- The borrower will choose  $p$  such that  $E'(p)F(K) - r(K - W) = 0$ .
- What characterizes  $p^*$ , the social optimum?
- From above

$$E'(p) \frac{F(K)}{K} = r \left(1 - \frac{W}{K}\right).$$

- It follows that

$$p = p(R, F(K)/K),$$

where  $R = r(1 - \frac{W}{K})$  is the interest cost per unit of investment.

- $\frac{\partial p}{\partial R} = ?$  and  $\frac{\partial p}{\partial F(K)/K} = ?$

### 3.0.2 The Interest Rate

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$$r = \rho/p, R = \rho(1 - W/K)/p = \frac{\Gamma}{p}$$

- Solving  $p = p(R, F(K)/K)$  along with  $R = \Gamma/p$ , gives us  $p = \tilde{p}(\Gamma, F(K)/K)$  and  $R = \tilde{R}(\Gamma, F(K)/K)$ .
- Multiple solutions: we choose the interest rate with the lowest interest rate.

Property 2. Interest Rates: Borrowers who are more leveraged tend to pay higher rates, while more productive borrowers pay lower rates. Raising the cost of capital raises the interest rate more than proportionately.

### 3.0.3 The Level of Investment

- The borrower's choice of  $K$  maximizes

$$F(K)E(\tilde{p}(\cdot)) - \rho(K - W)$$

- FOC

$$\begin{aligned} & F'(K)E(\tilde{p}(\cdot)) + \\ & F(K)E'(\tilde{p}(\cdot))\frac{\partial\tilde{p}(\cdot)}{\partial F(K)/K}\frac{\partial F(K)/K}{\partial K} \\ & + F(K)E'(\tilde{p}(\cdot))\frac{\partial\tilde{p}(\cdot)}{\partial\Gamma}\frac{\rho W}{K^2} \\ & = \rho. \end{aligned}$$

- Compared to  $F'(K)E(p^*) = \rho$ , 3 distortions:

$$E(p) < E(p^*)$$

$$\frac{\partial p}{\partial\Gamma} < 0$$

$$\frac{\partial F(K)/K}{\partial K} \leq 0.$$

Property 3. The Level of Investment: Capital market imperfections lead to under-investment in the typical case, though it is not inconceivable that they could generate over-investment. The more wealthy will tend to invest more in absolute terms. When the production technology is linear, the amount invested will be proportional to the investor's wealth. When there is a single indivisible investment, the rich are more likely to invest than the poor. Lowering the cost of capital increases investment.

### 3.0.4 Introducing Monitoring

- This model cannot explain the wedge between the lending and borrowing rates given the low observed default rates.
- The missing piece of the story is monitoring. We assume that the lender can choose  $p$  by paying a cost that is a function of the extent of misalignment of incentives between the borrower and the lender.

### 3.0.5 Modeling Monitoring

The borrower in our model wants to choose  $p = p(R, F(K)/K)$ , which gives him a payoff of

$$F(K)E(p(R, F(K)/K)) - p(K/W, r, F(K)/K)r(K - W).$$

- The lender wants him to choose  $p$  which gives him a payoff of  $F(K)E(p) - pr(K - W)$ .
- The extent of misalignment is therefore

$$D = F(K)[E(p(R, F(K)/K)) - E(p)] - [p(R, F(K)/K) - p]RK. \quad (1)$$

- Monitoring:

$$M = M(K, D/K, m).$$

### 3.0.6 The Cost of Capital with Monitoring

- The lender's participation constraint now takes the form:

$$R = \frac{\Gamma}{p} + \frac{M(K, D/K, m)}{Kp}.$$

- This equation defines  $R(\Gamma, K, p, m)$ , the interest rate for a borrower with a fixed  $W$  who wants to invest an amount  $K$  and promises to choose a project  $p$ .
- Using this, we can define the expected cost of credit per unit of investment:  $C(\Gamma, K, p, m) = pR$ .

### 3.0.7 Properties of $R$

- An increase in  $R$  increases  $D$  which increases  $M$  which increases  $R$ .
- Simple differentiation tells us:

$$\frac{\partial R}{\partial \Gamma} = \frac{1}{p - \frac{p - p(R, F(K)/K)}{K} \frac{\partial M}{\partial (D/K)}} \text{ and}$$

$$\frac{\partial R}{\partial m} = \frac{\partial M / \partial m}{K \left[ p - \frac{p - p(R, F(K)/K)}{K} \frac{\partial M}{\partial (D/K)} \right]}.$$

Property 5. Multiplier: The interest rate and the amount of monitoring can be very sensitive to changes in the cost of capital and/or the cost of monitoring.

This can help explain interest rate variation

### 3.0.8 How much monitoring?

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$$\frac{\partial C}{\partial p} = \frac{1}{K^2} \frac{\partial M}{\partial(D/K)} \times \frac{p(R, F(K)/K)RK - pF(K)E'(p)}{p - \frac{(p-p(R, F(K)/K))}{K} \frac{\partial M}{\partial(D/K)}}.$$

The sign of  $\frac{\partial C}{\partial p}$  depends on the sign of

$$p(R, F(K)/K) \times E'(p(R, F(K)/K)) - pE'(p).$$

- Since  $p > p(R, F(K)/K)$  it follows that  $C_p$  can only be positive if the function  $pE'(p)$  is a decreasing function of  $p$  over a range.
- This makes it clear that it is entirely possible that  $C_p$  be negative for all admissible  $p$ . It may be optimal to raise  $p$  all the way to  $p_1$  and this may be *irrespective of how costly it is to monitor*.

Property 6. Default: Very low levels of default may be optimal even when monitoring is quite costly, though it is never optimal to have less default than in the social optimum.

In fact we do see low levels of default in most private credit contracts, and correspondingly high monitoring costs.

### 3.0.9 The Optimal Credit Contract with Monitoring

- The optimal credit contract will be a combination  $(K, p)$  that maximizes

$$F(K)E(p) - pR(\Gamma, K, p, m)K.$$

- The first order conditions that describe the optimal contract (when it is not a corner solution) are

$$F(K)E'(p) = KC_p \text{ and}$$

$$F'(K)E(p) = C + KC_K.$$

There is, however, relatively little that we can say about the optimal credit contract at this level of generality: An increase in  $K$  affects both the numerator and the denominator of the expression  $\frac{M(K, D/K, m)}{(K-W)p}$ , and without more structure it is not possible to say anything about how more investment affects the expected cost of lending.

## The Model with Constant Returns in Monitoring

- One simple and fruitful way to impose structure is to assume constant returns in monitoring, i.e.,

$$M(K, D/K, m) = KM(D/K, m).$$

- Also assume constant returns in production, i.e.,  
 $F(K) = \sigma K$ .

- In this case,

$$pR = \Gamma + M(\sigma[E(p(R, \sigma) - E(p)] \\ - [p(R, \sigma) - p]R, m).$$

$R$  is therefore a function of  $\sigma$ ,  $m$ ,  $p$  and  $\Gamma = \rho(1 - W/K)$ , and so is, therefore, the expected cost of lending  $C$ .

- It follows that keeping  $\rho$  fixed, doubling the borrower's wealth and the amount he invests does not change the  $C$  function and hence all borrowers with the same  $\sigma$  and the same  $m$ , will choose the same leverage ratio and face the same interest rate.
- This model cannot explain why the poor pay lower rates unless  $m$  (or  $\rho$ ) and  $W$  are negatively correlated

## The Model with a Fixed Cost of Monitoring

$$M(K, D/K, m) = KM(D/K, m) + \Phi.$$

- In this case

$$pR = \Gamma + \Phi/K + M(\sigma[E(p(R, \sigma) - E(p)] \quad (2)$$

$$- [p(R, \sigma) - p]R, m). \quad (3)$$

- With these assumptions, the lender's maximization problem may not be convex: To see why, note that  $\Gamma + \Phi/K = \rho(1 - W/K) + \Phi/K$ , which tells us that if  $\Phi > \rho W$ ,  $R$  goes down when  $K$  goes up, encouraging the borrower to borrow even more.
- The solution will be for the poor borrower ( $\rho W \ll \Phi$ ) to borrow nothing while those who borrow will borrow a significant amount. Among those who borrow, the interest rate will go down when  $W$  goes up.

### 3.0.10 Simulation Results

- To assess whether the model generates the right orders of magnitude, the model was simulated under the assumption that  $E(p) = 2p^{0.5}$ , and  $M(D/K, m) = mD/K$ .
- For parameter values  $\rho = 1.05$ ,  $m = 0.8$ ,  $\Phi = 0.5$ ,  $\sigma = 0.66$ , we find that those with wealth levels up to about 1.75 (i.e., about three and a half times the fixed cost of monitoring) do not invest at all.
- When investment begins, the interest rate is above 50% (and the leverage ratio is 2.8) and as the borrower's wealth goes up, the interest rate goes down and converges to about 27%, while the leverage ratio rises and converges to about 4.2.

Property 7. Wealth Effects: When there are constant returns in both production and monitoring, two borrowers who differ only in their wealth levels will be equally leveraged and will pay the same interest rate. When there is a fixed cost of monitoring, richer borrowers will pay a lower rate and will be more leveraged and the very poorest borrower's will prefer not to borrow at all.

## 4 Micro-credit

- If this model is right, reducing monitoring costs can lead to large social gains. Monitoring is costly in itself and generates costly deviations from efficient production.
- Given the multiplier property, small changes in monitoring costs improve efficiency a lot.
- Using a neighbor, friend or relative to monitor may be efficient because he can keep an eye on you without going out his way and because they can punish you for default in more effective ways.
- Once such a system in place so that people are getting credit at below market rates, the rents they are getting can be used to further improve their incentives: “You can have another loan on these great terms next period if you behave this time”.

#### 4.0.11 Towards Micro-credit

- The above arguments can explain the system of using guarantors/co-signers for loans. It also suggests that repeated lending may have advantages.
- Micro-Credit is usually a scheme for combining these ideas: Potential borrowers are usually asked to voluntarily form into groups (the goal is to have groups of friends and neighbors). Then some or all of them are given a loan with the threat that if any one defaults, all of them will be excluded from future loans.
- The additional trick here is that co-borrowers are being used as monitors. Using a co-borrower to monitor may have the advantage that the rents that he gets from getting the loan can be used to give him incentives for monitoring, whereas an outside monitor would have to be paid additional incentive rents (efficiency wages)

#### 4.0.12 Possible concerns

- If outright deliberate default is an option, the borrower may want to borrow as possible and then default (Bulow-Rogoff).
- One default could trigger many, as other group members realize that they would be punished in any case (Besley-Coate)
- Too little risk-taking: Imagine an incentive scheme for monitors that in effect makes them residual claimants: Then their choice of monitoring ( $p$ ) would maximize

$$pr(K - W) - M(D/K)K$$

which yields  $r(1 - W/K) = R = M'(D/K)\partial D/\partial p$ .

The first-best maximizes

$$E(p)F(K) - M(D/K)K$$

which yields  $E'(p)F(K)/K = M'(D/K)\partial D/\partial p$ .

Since the reason there is monitoring is that  $R > E'(p)F(K)/K$ , the chosen  $p$  is too high.