Contracting Constraints, Credit Markets and Economic Development

Abhijeet Banerjee

April 19, 2012

Overview

- Literature
- Facts about the Credit Market
- Basic Model

Literature

This paper reviews a number of empirical studies of individual credit markets in developing countries and list six salient features:

- **Sizeable gap between lending rates and deposit rates within the same sub-economy:**
  - Ghatak (1976) observes that average rate of interest paid by the cultivators in India during ′51-′52 to ′61-′62 was around 20%. Whereas the bond rate, bank deposit rate were around 3%.
  - Timberg and Aiyar (1984) observed indigenous style bankers. They found that the gap between the average rate charged to borrowers and depositors by Finance Companies was 16.5%. The gap for other like for eg., Shikarpuri community was 16.5%, financiers from the Gujerati community was 12%, etc.

Literature (Contd.)

- Sizeable gap between lending rates and deposit rates within the same sub-economy:
  - Aleem (1990) gives data of professional money lenders in semi-urban setting in Pakistan in ′80-′81. Average interest rate for loans were 78% whereas the bank rate was 10%.
  - Dasgupta (1989) reports results form a number of case studies conducted by the ADB, NIPFP. For rural sectors in Kerala and Tamil Nadu, average rate of interest by professional money-lenders (who provide 45.61% of credit) was about 52%. While the maximum deposit rate of all the 8 studies being 24%. For the urban sectors, for the informal lenders, i.e., Finance Corporations, maximum deposit rates were 12% minimum lending rate being 48%.

Literature (Contd.)

- **Extreme Variability in the interest rate charged by lenders for superficially similar loan transactions within the same economy:**
    - Timberg and Aiyar (1984) found that the rates for Shikarpuri financiers varied between 21% and 37% on loans to members of local Shikarpuri associations and between 21% and 120% to non-members.
    - Dasgupta (1989) reports that Financial Corporations offer advances for a year or less at rates between 48% per and the astronomical figure of 5% **per day**. The rates of more than a year varied between 24% and 48%. The report also tells that along rural lenders, the average rate for professional money lenders was 51.8% whereas the rates for agricultural money lenders was 29.45%.

Literature (Contd.)

- **Extreme Variability in the interest rate charged by lenders for superficially similar loan transactions within the same economy:**
    - 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 150% are both within two standard deviations of the mean.
    - Ghate (1992) reports on a number of case studies from all over Asia: with thailand having 2-3% interest rates per month in the central plain but 5-7% in the north and north-east.

Literature (Contd.)

- **LOW LEVEL OF DEFAULT:**
  - Timberg and Aiyar (1984) report, average default losses for the informal lenders was between 0.5% and 1.5%.
  - Dasgupta (1989) found default cost as 14% for Shroffs, 7% for auto-financiers in Namakkal and handloom financiers.
- **PRODUCTION AND TRADE FINANCE ARE THE MAIN REASONS GIVEN FOR BORROWING, EVEN IN CASES WHERE THE RATE OF INTEREST IS RELATIVELY HIGH:**
  - Timberg and Aiyar (1984) report for Shikarpuri bankers, atleast 75% of the money goes to finance trade and industry.
  - Dasgupta (1989)metion that hire-purchase financiers, handloom financiers, Shroffs and Financial Corporations (essentially the ones with high interest rates) focus almost exclusively on financial trade and industry.

Literature (Contd.)

- Production and trade finance are the main reasons given for borrowing, even in cases where the rate of interest is relatively high:
  - Ghate (1992) concludes that bulk of informal credit goes to financial trade and production.
  - Murshid (1992) argues that in Bangladesh most loans in his sample were production loans despite the fact that the interest rate is 40% for a 3-5, month loan period.
- Richer people borrow more and pay lower rates of interest:
  - Ghatak (1976) finds a strong positive relationship.
  - Timberg and Aiyar (1984) show that Rastogi and Shikarpuri lenders set credit limit proportional to borrower's wealth.

Literature (Contd.)

- **Richer people borrow more and pay lower rates of interest:**
  - Dasgupta (1989) shows in rural areas, landless laborers paid rates like 28-125% whereas cultivators paid between 21-40%.
  - Swaminthan (1991) finds a strong negative correlation between value of borrower's land assets and interest rates.
- **Bigger Loans are associated with lower interest rates:**
  - Dasgupta (1989) clearly shows average interest rate declines with loan size.
  - Gill and Singh (1997) shows correlation between loan size and interest rate is negative even after the control for the wealth of the borrower.

Facts about the Credit Market

- Gap between depositor and borrowing rate is quite striking at more than 10%.
- High default rate of borrowers can be shown as a reason for the above case, but we have seen that default rate is actually quite low.
- Standard neo-classical predictions of marginal unit of capital earning the same return for every firm in equilibrium goes against the observation of such varied interest rates.

Facts about the Credit Market(Contd.)

- Variance in the interest rates charged of the same type of loan, may be because of variety in belief of truthfulness of the agents. But, as we have seen, the target customers are those who have a reason to be quite truthful.
  For example, a handloom producer would only borrow at 48% if he could not afford that rate by taking money away from his business. So, in other words, he must be earning marginal returns greater than 48%.
- The author finds evidence of variance in marginal product of capital across borrowers in the same economy in Banerjee and Munshi (2001).

The author next points out certain existing ideas explaining the market and tries to find out the significance of the explanation and the motivation for further research regarding the behavior of the credit market.

Facts about the Credit Market(Contd.)

- The standard theory of interest rates decomposes the causes into default rates, opportunity cost, transaction costs and monopoly rents.
- This is useful but the above classification stops short of an explanation as they are not independent causal factors.
- Moving to the point of steps taken by lenders, monitoring is an obvious example, which affects the interest rate.

Facts about the Credit Market(Contd.)

- Lenders also protect themselves by limiting their lending to borrowers they know, which has the following four consequences:
    - It pushes capital to well-connected borrowers and away from others, even if they have same productivity.
    - It makes lending local, as the lenders need to know and trust the borrowers.
    - It forces the lender to limit his lending, with the consequence that both his capital and his skills as a lender may remain unused for a significant part of the time.
    - It gives the lender some $ex-post$ monopoly power, as a borrower would find it hard to leave a lender who knows him well.
- The four components of causes of interest rate are jointly determined in the process of making lending decisions.

Facts about the Credit Market(Contd.)

- The lender's strategy (which affects their decision) also varies depending on nature of the clientele and other environmental characteristics.
- The fact that all these decisions are interrelated clearly makes it dangerous to use any single one of these components to explain the reasons behind the nature of the credit market.
- Both loan size and interest rates are jointly determined and therefore cannot give a causal interpretation of the relation of interest rate and loan size. Rather wealth may be a variable determining both of these outcomes.

Facts about the Credit Market(Contd.)

So we see, in the presence of such interdependent variables, we need a proper theory of credit market which does not try to extract each effect individually. Such a theory would explain:

- Variations in interest rates.
- Gap between interest rates and deposit rates.
- Make predictions about the relation between loan size and interest rates and borrower and lender characteristics.

A Simple Model of Moral Hazard in Credit Market

- Let the amount of capital invested be K.
- Let the production function be given by $F(.)$.
- The Gross Return of investment K is given as

$$\begin{cases} F(K)R(p) & \text{with probability } p \,, \\ 0 & \text{otherwise} \end{cases}$$

- Wealth of investor is given as W and if he wants to invest more, he will have to borrow.
- There is a capital market and the (gross) capital cost is given by ρ

A Simple Model of Moral Hazard in Credit Market (Contd.)

In order to make the problem interesting the author has used the following Assumptions:

1. p is a choice variable for the investor but is unobserved by the lender $p \in [p_0, p_1] \subseteq [0, 1]$
2. $E(p) \equiv pR(p)$ has the property that $E'(p_0) > 0$, and $E''(p) \leq 0$
3. The possible contract is loan contract.

The Basic Moral Hazard Problem

Let us find the optimal level of p for the society by maximizing the social optimization problem.

$$\underset{p}{\text{Max}} \quad \overbrace{F(K)E(p)}^{\text{borrower's gain}} + \underbrace{pr(K-W)}_{\text{lender's gain}} - \overbrace{pr(K-W)}^{\text{borrower's cost}} - \underbrace{\rho(K-W)}_{\text{lender's cost}}$$

Which boils down to,

$$\underset{p}{\text{Max}}\, F(K)E(p) - \rho(K-W)$$

which can also so be interpreted as the total society's gain less society's cost of the investment.

The Basic Moral Hazard Problem (Contd.)

The First Order Condition gives us:

$$E'(p^*)F(K) = 0 \tag{1}$$

The borrower's maximisation problem is given as:

$$\underset{p}{\text{Max}}\, F(K)E(p) - pr(K-W)$$

And the First Order Condition gives us:

$$E'(p^{**})F(K) = \rho \tag{2}$$

comparing (1) and (2) we can see that:

$$E'(p^{**}) > E'(p^*)$$

And from concavity of $E'(p)$ we can say that,

$$p^{**} < p^*$$

The Basic Moral Hazard Problem (Contd.)

From the First Order Condition of the Borrower's Problem we have:

$$
\begin{aligned}
F(k)E'(p) &= r(K - W) \\
\Rightarrow E'(p)\frac{F(K)}{K} &= r\left(1 - \frac{W}{K}\right) \qquad (3)
\end{aligned}
$$

From (3) we can see the effects of distortions i.e. changes of p on

- Average Product of capital $\left(\frac{F(K)}{K}\right)$
- Leverage ratio $\left(\frac{K}{W}\right)$
- The Interest rate r.

The relationships are given and explained in the following slide.

The Basic Moral Hazard Problem (Contd.)

The equation (3) can be written as ,

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

Property 1 :

1. If leverage ratio $\frac{K}{W}$ increases then there is less efficiency.

$$\frac{K}{W}\uparrow \Rightarrow \frac{1}{\frac{K}{W}}\downarrow \Rightarrow (1 - \frac{1}{\frac{K}{W}})\uparrow \Rightarrow E'(p)\uparrow \Rightarrow p\downarrow$$

2. If there is more productivity $\frac{F(K)}{K}$ then we have more efficiency.

$$\frac{F(K)}{K}\uparrow \Rightarrow E'(p)\downarrow \Rightarrow p\uparrow$$

3. If interest rate rises then we have less efficiency.

$$r\uparrow \Rightarrow E'(p)\uparrow \Rightarrow p\downarrow$$

The Basic Moral Hazard Problem (Contd.)

Interest Rate

If there is perfect competition, then the interest rate of the lender will be given as

$$r = \frac{\rho}{p} \tag{4}$$

or,

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

where Γ is the cost of capital per unit of investment.

The Basic Moral Hazard Problem (Contd.)

Solving $p = r(R, F(K)/K)$ along with $R = \Gamma/p$, gives us:

- $p = \widetilde{p}(\Gamma, F(K)/K)$
- $R = R(\Gamma, F(K)/K)$

If this is the equilibrium, then the comparative statics of the $p(.)$ function are inherited by the $\widetilde{p}(.)$ function, and $\widetilde{r} = \frac{\rho}{\widetilde{p}}$ share the properties of $\widetilde{p}$ function, with the effect only being reversed. So we can see the properties shown in the following slide.

The Basic Moral Hazard Problem (Contd.)

Property 2 :

1. Borrowers who are more leveraged tend to pay higher interest rates.

$$\frac{K}{W} \uparrow \Rightarrow p \downarrow \Rightarrow r \uparrow$$

2. Borrowers who are more productive pay lower interest rates.

$$\frac{F(K)}{K} \uparrow \Rightarrow p \uparrow \Rightarrow r \downarrow$$

3. Increase in cost of capital raises the interest rate more than proportionately.

$$\widetilde{r} = \frac{\rho}{\widetilde{p}} \text{ and } p < 1$$

The Basic Moral Hazard Problem (Contd.)

THE LEVEL OF INVESTMENT

We shall determine the value of K for the borrower with the assumption that p depends on K through the $\widetilde{p}(.)$ function.

$$\underset{K}{\text{Max}}\, F(K)E(p(\Gamma, F(K)/K) - \rho(K - W)$$

The First Order Condition gives us :

$$F'(K)E(p) + F'(K)E(p)\frac{\partial p}{\partial F(K)/K}\frac{\partial F(K)/K}{\partial K} + F(K)E'(p)\frac{\partial p}{\partial \Gamma}\frac{\rho}{W} = \rho \tag{5}$$

From the social optimal maximization problem we will have $F'(K)E(p^*) = \rho$, we can see the following effects of distortion on investment.

The Basic Moral Hazard Problem (Contd.)

$$F'(K)E(p) + F'(K)E(p)\frac{\partial p}{\partial F(K)/K}\frac{\partial F(K)/K}{\partial K} + F(K)E'(p)\frac{\partial p}{\partial \Gamma}\frac{\rho}{W} = \rho$$

- In the first term effect of distortion on investment is determined through the sign of $\frac{\partial p}{\partial \Gamma}$ which is negative. So it discourages investment.

$$\Gamma \uparrow \Rightarrow r \uparrow \text{(Property 2)}$$
$$r \uparrow \Rightarrow p \downarrow \text{(Property 1)}$$

- The effect of distortion in the second term depends on the sign of $\frac{\partial F(K)/K}{\partial K}$ which again depends on $F(K)$. If it is concave, then the sign is negative. But non-concave function can give it a positive sign.

The Basic Moral Hazard Problem (Contd.)

- Since $E(\widehat{p}) < E(\widetilde{p})$ The effect of distortion on the first term on investment in the first term depends on the nature of $F(K)$ as we have,

$$
\begin{aligned}
F'(\widehat{K})E(\widehat{p}) &= \rho \\
F'(\widehat{K}) = \frac{\rho}{E(\widehat{p})} &> \frac{\rho}{E(\widetilde{p})} = F'(\widetilde{K}) \\
F'(\widehat{K}) &> F(\widetilde{K})
\end{aligned}
$$

Hence, if the function is concave then increase in distortion would discourage investment whereas non-concave function can give a positive result.

The Basic Moral Hazard Problem (Contd.)

So, as we see, concavity on the production function would imply that capital market imperfection leads to less investment.
Now we shall see the effect of wealth on investment.

- In case of the social optimum, investment is not affected by wealth as we have the First Order Condition as:

$$E'(p^*)F(K) = 0$$

- In the borrower's problem, keeping K fixed if we change W, we have:

$$W \uparrow \Rightarrow \frac{K}{W} \downarrow \Rightarrow p \uparrow \text{ from property 1}$$
$$p \uparrow \Rightarrow E'(p) \uparrow, E''(p) \downarrow$$

The Basic Moral Hazard Problem (Contd.)

- So, we can say, W and p would have the same effect. Hence, following the previous argument, if $F(.)$ is concave,increase in W and p would encourage investment.
- In case we have a linear production function i.e., $F(K) = \sigma K$ then the change in K will be precisely proportional to change in W which we see in the following explanation.

$$F(K) = \sigma K \Rightarrow F(K)/K = \sigma$$
$$\Rightarrow p = \widetilde{p}(\Gamma(W/K))$$

The Basic Moral Hazard Problem (Contd.)

So equation (5):

$$F'(K)E(p) + F(K)E'(p)\frac{\partial p}{\partial F(K)/K}\frac{\partial F(K)/K}{\partial K} + F(K)E'(p)\frac{\partial p}{\partial \Gamma}\frac{\rho}{W} = \rho$$

now becomes:

$$\sigma E(p(\Gamma(W/K))) + \sigma K E'(p)\frac{\partial p}{\partial \Gamma}\frac{\rho}{W} = \rho$$
$$\Rightarrow \sigma E(p(\Gamma(W/K))) + \sigma E'(p)\frac{\partial p}{\partial \Gamma}\frac{\rho K}{W} = \rho$$

Solving this we can have:

$$\frac{K}{W} = f(parameters)$$

The Basic Moral Hazard Problem (Contd.)

- The case of non-concavity is a bit more complex. The author gives certain examples to describe it.
  Say there is a single indivisible K. Then investment opportunity is either K or 0.
- From property 1, at same K, higher W would imply higher p hence they can invest more.
- But in a more general set up non-concave F raises the possibility that poor might invest more than the rich which we'll see now.

The Basic Moral Hazard Problem (Contd.)

- Intuitively, convex production function gives a direct effect:

$$K \uparrow \Rightarrow F(K)/K \uparrow \Rightarrow p \uparrow$$

- however there exists a indirect effect as:

$$K \uparrow \Rightarrow K/W \uparrow \Rightarrow p \downarrow$$

- Now, the balance will depend much on W via the leverage ratio.
  Lower wealth will give more incentive to distort and hence in non-concave function case, more investment.

The Basic Moral Hazard Problem (Contd.)

- If we look at the effect of Cost of capital on Capital then we have:
  - Lowering cost of capital increase p and encourages investment.
  - But in the social optimum too cost of capital has the same effect.
  - Hence we cannot say much about this effect.
- Hence we can now summarize the above with the help of the following property.

The Basic Moral Hazard Problem (Contd.)

Property 3:

1. Capital market imperfections generally lead to under investment, though it is not inconceivable that they can actually generate higher investment.
2. The more wealthy will tend to invest more in absolute terms.
3. In case of linear production function, the investment amount is proportional to the investor's wealth.
4. When there is a single indivisible investment, the rich are more likely to invest.
5. Lowering cost of capital increases investment.

The Basic Moral Hazard Problem (Contd.)

If we look further into the effects of distortion of cost of capital we can see:

Property 4:

1. For a given supply curve, market imperfection would lower demand of capital and hence the cost.
2. In the long run however, supply of capital will respond to the pattern of wealth creation generated by capital imperfection and hence effect would be ambiguous.

Next the author will introduce Monitoring, and its effects will be covered by Anwesha Banerjee in the following class.
Thank You!

Contracting constraints, Credit Markets and Development: Introducing monitoring in the optimal contract

Abhijit Banerjee

The main idea

- To set up a problem which will model the role of moral hazard in the credit market
- Next, include the possibility of monitoring on the part of the moneylender in the model
- Show how including monitoring explains some existing facts about the credit market

Facts that will be explained by the model

- The high variability in interest rates
- The low rates of default
- Why richer people borrow more than the poor
- Why the poor end up both investing less and paying higher interest rates
- Essentially, the model with monitoring captures how WEALTH effects the amount of credit available, and the differences in interest rate

The moral hazard problem

- The borrower will choose p so as to maximize net expected returns (assuming limited liability)

$$\text{Max } F(K)E(p) - pr(K\text{-}W)$$

- The first order condition is

$$F(K)E'(p) - r(K - W) = 0$$

- Optimal p under moral hazard will be less than social optimum.

- Dividing both sides by K,

$$[F(K)/K]E'(p) = r\,[1- (W/K)] \quad \ldots \quad (1)$$

- Optimal level of p can therefore be written as

$$\boxed{p= p[R,\ F(K)/K]} \quad \ldots \ (2)$$

- Where

$$\boxed{R = r\,[\,1 - (W/K)\,]} \quad \ldots \quad (3)$$

is the interest cost (or gain, when seen from the point of view of lender) per unit investment.

Assuming that r is competitively determined, in equilibrium,

expected interest gain = cost of capital (per unit investment)

$$\text{Max}_K \; pr(K - W) - \rho(K - W)$$

$$r = \rho/p$$

Then

$$\boxed{R = \rho\,(1 - W/K)/p = \Gamma/p} \qquad \text{.... (5)}$$

where

$$\Gamma = \rho\,(1 - W/K)$$

Is the cost of capital per unit investment

Introducing monitoring

- Assumption 1 (A1)

  The project choice p is a function of the amount of monitoring: if lender monitors at a level 'a', borrower chooses p(a)

Assumption 2 (A2)

The amount of monitoring is a function of the extent of misalignment of incentives between borrower and lender

Explaining A2

The borrower wants to choose

$$p^* = p\,(R, F(K)/K) \qquad \ldots (6)$$

- The lender wants him to choose a level of p which is GREATER than p* because of the moral hazard problem

- The payoff of the borrower

$$F(K)E(p^*) - p^*r(K - W)$$

- The payoff of the borrower for any arbitrary choice of p (say, some p which the lender wants him to choose)

$$F(K)E(p) - pr(K - W)$$

- Extent of misalignment

$$D = F(K)[E(p^*) - E(p)] - [p^* - p]RK \qquad ...(7)$$

Monitoring is therefore a function of D; a more general form is

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

Where m is a parameter that shifts the monitoring cost function, $dM/dm > 0$

D/K -> extent of misalignment per unit capital K

Cost of capital with monitoring

The lender will now charge a rate of interest which in expected terms covers

- Γ (the cost of capital) as well as
- M (monitoring cost) per unit investment;

$$pR = \Gamma + \frac{M(K, D/K, m)}{K} \qquad \ldots(8)$$

$$C(\Gamma, K, p, m) = pR$$

Properties of the C(.) function: Explaining interest rate variability

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

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

- Since p > p*, increase in cost of lending (higher ρ or m) has an increased MULTIPLIER effect on the interest rate (since p < 1)
- The multiplier shows how small differences in monitoring can create large variations in interest rate

Explaining low default rates

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

- From (1), we have E’(p*)F(K) = RK.
- Substituting in the above expression, the sign of δC/δp depends on the sign of

  p*E’(p*) –pE’(p)

- Since p>p*, C_p can only be positive if pE’(p) is a decreasing function of p

- If C_p is negative for all p, then higher values of p is actually less costly in terms of monitoring
- It may be optimal to raise p to its maximum, p_1 (this is INDEPENDENT of the cost of monitoring)
- Therefore, very low rates of default may be optimal even if monitoring is very costly
- It will never be optimal for p to exceed it's social welfare optimizing level:

$$E'(p) = 0 \Rightarrow C_p > 0$$

Optimal credit contract with monitoring

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

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

- The first order conditions are

$$F(K)E'(p) = KC_p \qquad \text{...(9)}$$

$$F'(K)E(p) = C + KC_k \qquad \text{...(10)}$$

The model with constant returns to monitoring per unit capital

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

Assumption 3 (A3) : Constant returns to scale production

$$F(K) = \sigma K$$

Dividing (7) by K,

$$D/K = F(K)/K\,[E(p^*) - E(p)] - [p^* - p]R$$

$$p^* = p(F(K)/K, R) = p(\sigma, R)$$

From (8),

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

- Optimal R is a function of σ, Γ, m, and p (NOT of K); we have
$$pR = C(.)$$

- Keeping p and Γ fixed, doubling the borrower's wealth and the amount he invests does not change the unit cost of lending

- All borrowers with the same σ and the same m will choose the same leverage ratio and face the same interest rate

- Rich will simply invest more

Model with a Fixed Cost of monitoring

- There is a fixed cost, and a variable cost component of monitoring.

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

Equation (8) becomes

$$pR = \Gamma + \Phi/K + M(\ \sigma[E(p(R,\sigma)) - E(p)] - [p(R, \sigma) - p]R, m) \qquad \text{...(11)}$$

Case 1

$$\Gamma + \Phi/K = \rho(1 - W/K) + \Phi/K$$

If $\Phi > \rho W$: as $K\uparrow$ $R\downarrow$ (holding p constant)

Richer borrowers will borrow more; it maybe optimal for the poor borrower to optimally borrow nothing.

Case 2: $\rho W > \Phi$

- As long as p, σ, ρ and m are held constant, R is completely determined by $(\rho W - \Phi)/K$: from (11)

$$C = C\,(\rho W - \Phi/K)$$

From (10) we get

$$\sigma = C(\rho W - \Phi/K) + [\Phi - \rho W/K]C'(\rho W - \Phi/K)$$

$(\rho W - \Phi)/K$ is uniquely determined by σ

Results

1. Increase in W results in a more than proportional increase in K

$$(\rho W - \Phi)/K = A$$
$$\rho W/K = A + \Phi/K$$

2. Higher values of Φ are associated with lower values of K

3. Changes in W and Φ do not affect R (from (11)) => r ↓ as W ↑

$$R = r(1 - W/K)$$

Results: Summary

- When there are constant returns in both production and monitoring, two borrowers who only differ in their wealth levels will be equally leveraged and will pay the same interest rate
- With fixed costs, richer borrowers borrow more, pay a lower interest rate

Thank you

Special thanks to Saikat for all the moral support :P