Lecture 11: Asymmetric Information in the Credit Market

Nenad Kos

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Credit Rationing

- We talk about credit rationing when a borrower cannot get a loan, although he is willing to pay a higher interest rate.
- Why are lenders not willing to grant him the credit even at very high interest rates? What makes market for loans different from, say, market for apples?
- We will see that both adverse selection as well as moral hazard can explain credit rationing.

Asymmetric Information

- We will consider two different models:
  - adverse selection;
  - moral hazard.
- The general idea will be that asymmetric information can prevent agents who should be getting loans from obtaining them.

Lemons problem in the credit market

- A borrower (entrepreneur) has no funds ($A = 0$) to finance a project that costs I.
- The projects yields R if it succeeds and 0 if it fails.
- The borrower and the lender are risk neutral, and the borrower is protected by limited liability, that is, you cannot get more money out of the borrower than the project generates.
- The borrower is one of the two types:
  - a good borrower: probability of success p;
  - a bad borrower: probability of success q.
- We assume $p > q$ and $pR > I$ (at least the good type is creditworthy).

Lemons problem in the credit market

- There are two (sub)cases:
  - pR > I > qR, only the good type is creditworthy;
  - pR > qR > I, both types are creditworthy.

- The borrower knows his type, while the credit market believes that he is the good type with probability α.

- Under asymmetric information the credit market does not know whether the project is more or less likely to succeed. We denote by

$$m = \alpha p + (1 - \alpha) q$$

  the expected success rate.

Lemons problem in the credit market, Symmetric Information

- Suppose the investors know how likely the project is to succeed.
- The contract here specifies how much each type has to repay in the case the project succeeds, or alternatively, how much each type of entrepreneur gets to keep.
- We denote the amount the borrower of type $i \in \{b, g\}$ keeps as R_b^i. The investor gets $R - R_b^i$.
- In the case of failure, there is no money to be divided, so both the investor and the entrepreneur get zero; due to limited liability!!
- Limited liability is very important for originating ideas.

Lemons problem in the credit market, Symmetric Information

- Investors are competitive, they get zero expected payoff.
- The good borrower obtains the credit. The amount of revenue he gets to keep is given by the investors zero profit condition:
$$p(R - R_b^G) = I.$$
- If $qR < I$, the bad borrower does not get the credit. Even if the investor took all the revenue, it would not be enough to cover the investment in expectation.
- If $qR > I$, then even the bad borrower gets the funding and can keep R_B^b if the project succeeds, where
$$q(R - R_b^B) = I.$$
- Notice that $R_b^G > R_b^B$.

Lemons problem in the credit market, Asymmetric Information

- What happens if you try to offer the first best options and let the agents choose?
  - Bad type would pretend to be the good type and get qR_b^G instead of qR_b^B or 0.
- We will consider the contracts that give the borrower R_b in the case of success and 0 in the case of failure.
- If you offered several such contracts, both types would choose the one with the highest R_b. So only one is offered.
- The investor's profit from offering a contract with R_b is

$$[\alpha p + (1-\alpha)q](R - R_b) - I = m(R - R_b) - I$$

Lemons problem in the credit market, Asymmetric Information

Lending:

- Lending occurs when $mR \geq I$. Either both types are credithworthy, or they are credit worthy at least "on average".
- The borrower's share is set up in such a way that the lender breaks even on average:

$$m(R - R_b) = I.$$

- The investors make money on the good type, $pR_b > I$, and loose money on the bad type, $q(R - R_b) < I$; cross subsidization.

Lemons problem in the credit market, Asymmetric Information

- Notice that $R_b < R_b^G$. The good borrower is hurt by presence of bad ones, but not as much as when the market breaks down. To put it differently, capital is costlier now.
- One can think of this in terms of interest rates, where the interst rate is given by

$$R - R_b = I(1 + r).$$

- Then $r > r_G$, where r_G is the interest rate the good type would face under symmetric information.
- When the bad borrower is not creditoworthy we talk of overinvestment. Both types invest, although optimally only the good type should.

A measure of Adverse Selection

- The by now familiar condition

$$mR \geq I,$$

  can be rewritten as

$$\left[1 - (1 - \alpha)\frac{p - q}{p}\right] pR \geq I$$

- We can define and index of adverse selection:

$$\chi = (1 - \alpha)\frac{p - q}{p}.$$

- Good borrower's pledgeable income, pR, is reduced by the presence of bad borrowers.

Market Timing

- Firms tend to issue stocks when the share prices are high. One explanation: adverse selection is less relevant during the booms.
- Suppose that the probability of success is the sum of their type and a public component τ. The probabilities of success are therefre $p + \tau$ and $q + \tau$.
- The condition for financing

$$[\alpha(p + \tau) + (1 - \alpha)(q + \tau)]R > I.$$

- The better the market conditions, the more likely it is that the firm will be able to obtain financing.
- You can compute that the index of adverse selection decreases when the market conditions improve.

Moral Hazard in Credit Markets

- The entrepreneur has a project that requires a fixed investment I, but she only has assets worth $A < I$.
- To implement the project she must borrow $I - A$.
- Project:
  - If succeeds, yields income $R > 0$.
  - If fails, no income.
- The success of the project depends on the borrower's behavior:
  - If the borrower works hard the project succeeds with probability p_H.
  - If he does not work hard, it succeeds with probability $p_L < p_H$.
- In addition, if the borrower does not work hard she accrues private benefits $B > 0$; this can be interpreted as disutility of effort saved when shirking.

Moral Hazard in Credit Markets

- Both the borrower as well as the lender are risk neutral.
- The borrower is protected by limited liability, her income cannot take negative values.
- Lenders behave competitively in the sense that the loan makes a zero profit (for the lender).
- Contracts:
  - states whether the project is financed;
  - specifies how the profit is shared. Notice that limited liability implies both parties receive zero in the case of failure.
  - in the case of success the lender gets R_l and the borrower R_b; $R_b + R_l = R$.

Moral Hazard in Credit Markets

- In the case of success, the lender's net payoff is

$$R_l - (I - A);$$

  in the case of failure it is $-(I - A)$.
- The borrower's net payoff in the case of success is

$$R_b - A,$$

  and in the case of failure, $-A$, to which (in both cases) we need to add B if the borrower does not work hard.

Moral Hazard in Credit Markets

- We will focus on the case when the project is viable only if the borrower works hard:

$$p_H R - I > 0,$$

but

$$p_L R - I + B < 0,$$

when she does not.

- The last constraint states that the total expected surplus in the case the borrower works is negative

$$p_L R - I + B = [p_L R_l - (I - A)] + [p_L R_b + B - A] < 0.$$

Moral Hazard in Credit Markets

- The lender's zero profit constraint is:

$$p_H R_l = I - A,$$

  provided that the borrower works hard.
- The interest rate can be computed from

$$R_l = (1 + \iota)(I - A),$$

  or, after rearranging

$$1 + \iota = 1/p_H.$$

Moral Hazard in Credit Markets

- The lender must carefully design the contract to get the borrower to work hard.
- The borrower's incentive compatibility constraint

$$p_H R_b \geq p_L R_b + B,$$

or after rearranging

$$R_b \geq \frac{B}{p_H - p_L}.$$

- This is intuitive: the borrower will only be willing to work hard if the reward from doing so is large enough, that is, if R_b is large enough.

Moral Hazard in Credit Markets

- Therefore, the most the lender can get while making sure that the borrower is still working hard is

$$R - \frac{B}{p_H - p_L}.$$

  This is called pledgeable income.

- The expected pledgeable income is

$$p_H(R - \frac{B}{p_H - p_L}).$$

  This is the highest expected revenue for the lender if he wants the borrower to work hard on the project.

Moral Hazard in Credit Markets

- The lender will only lend if there is at least a chance to break even, that is, if the expected pledgable income is at least as high as the amount he lends

$$p_H(R - \frac{B}{p_H - p_L}) \geq I - A.$$

- The above constraint can be rewritten as

$$A \geq \bar{A} = p_H \frac{B}{p_H - p_L} - (p_H R - I).$$

  The borrower must have enough assets to be given a loan.
- "One lands only to the rich."

Moral Hazard in Credit Markets

Moral Hazard in Credit Markets

- When $A < \bar{A}$, the project has a positive net value, but is not funded. The borrower would have to borrow a lot, and therefore, give up a large fraction of the return in the case the project succeeded. This would reduce his incentive to work for success.
- There is credit rationing. The borrower might be willing to to give a large part of his return to the lenders (pay high interest rate). But the lenders do not want it, since then the borrower would have no incentive to work.

Moral Hazard in Credit Markets

- To make things interesting we assume

$$\bar{A} > 0,$$

or equivalently

$$p_H R - I < p_H \frac{B}{p_H - p_L},$$

otherwise the lender gets a loan even if he has no assets.

Moral Hazard in Credit Markets

- Conversely, if $A \geq \bar{A}$, the project gets financed. The investors get R_l defined through the zero profit condition:

$$p_H R_l = I - A,$$

and the borrower

$$R_b = R - R_l.$$

- Notice that this does induce the borrower to work hard.
- The term $\frac{B}{p_H - p_L}$ is the minimal amount that has to be left to the borrower to give him incentive to work. It is often referred to as agency rent.
- The borrower's payoff is 0 if $A < \bar{A}$, and $U_b = p_H R - I$ if $A \geq \bar{A}$.

Moral Hazard in Credit Markets

- Determinants of credit rationing (in the moral hazard problem):
  1. Low amount of assets (low A).
  2. High agency cost; measured by the combination of private benefits B and the likelihood ratio $\frac{p_H - p_L}{p_H}$ (fixing the project NPV: $p_H R$).
- The informativeness of the performance variable is captured by the likelihood ratio $\frac{p_H - p_L}{p_H}$. It measures reduction in probability of success when the borrower misbehaves.
- The higher the likelihood ratio, the more informative is the outcome about the effort choice, and the easier the access to financing.

Full investment of entrepreneurial assets

- So far we assumed the borrower invests all her wealth.
- Is this optimal? If $A > \bar{A}$ would the borrower want to consume some c and invest only $A - c$?
- Suppose $A \leq I$ and the borrower invests $A_b \in [\bar{A}, A]$. The investor's zero profit condition is

$$p_H R_l - (I - A_b) = 0.$$

- The borrower's payoff is

$$A - A_b + p_h R_b = A - A_b + p_H(R - R_l) = A + p_H R - I.$$

- Notice that it does not depend on A_b.

High-powered investment schemes

- We assumed that the borrower gets 0 if the project fails.
- Could one do better by rewarding the agent even if the task fails?
- Suppose the borrower receives R_b^S in the case of success and R_b^F in the case of failure.
- To get the borrower to work hard, we need

$$p_H R_b^S + (1 - p_H) R_b^F \geq p_L R_b^S + (1 - p_L) R_b^F + B,$$

or after rearranging

$$(p_H - p_L)(R_b^S - R_b^F) \geq B.$$

High-powered investment schemes

- The investor's income is

$$p_H(R - R_b^S) + (1 - p_H)(-R_b^F) \leq \underbrace{p_H\left(R - \frac{B}{p_H - p_L}\right)}_{\text{pledgable income}} - R_b^F.$$

- This incentive scheme decreases the lender's expected revenue. At the same time, the borrower's payoff (provided that he still gets funding) does not change, he still gets the entire surplus.
- As a consequence: rewarding the borrower in the case of failure cannot raise her utility, but it can compromise financing.

Crowdfunding

Kickstarter

- "Funding platform for creative projects."
- A project is a finite work with a clear goal.
- Funding is all-or-nothing: nobody is charged for the pledge unless the funding reaches its goal.
- Backers are people who pledge money.
- Why do they do it? Goodness of their heart, friends, rewards.
- Rewards: often the product at a reduced price; sometimes rewards grow in the amount of money collected.

Kickstarter

FinalStraw, the world's first collapsible, reusable straw

Clean, compact, and totally badass. For anyone who wants to rid their lives—and the planet—of single-use plastic.

Pre-Order Now!

Created by

Emma Cohen & Miles Pepper

38,443 backers pledged $1,894,878 to help bring this project to life.

Kickstarter

Addicting New Game - Straight from the Stone Age

A brand new game - straight from the Stone Age! RoXzai is easy to pick up & hard to put down.

Created by

Buck Howdy

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69 backers pledged $5,145 to help bring this project to life.

Kickstarter