Lecture 8: Theory of Corporate Finance VI
Information Asymmetry

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Roadmap

Motivation

- How do a firm's financing options change when there is an information asymmetry between inside and outside creditors?
- Firm wants to adopt a new project. The managers know whether it will succeed or not. The market place does not.
- Can they finance the project using external financing?

Roadmap

Setup

- So far in lectures, we've studied variable investment projects.
- I.e. a project comes up that offers a return that's a function of how much you invest in it initially.
- Here we'll consider a simpler project: a fixed investment project.
- Firm pays a fixed cost and gets a fixed return with some probability in the future.

Setup

- A project costs an borrower $x > 0$ and offers a return of r in the case of success and zero in the case of failure.
- Assume that the borrower has no collateral.
- The borrower can be one of two types: good or bad.
- Good type has probability of success $p \in [0, 1]$ while bad type has probability $q \in [0, 1]$ where $p > q$.

Setup

- We'll assume that the good type yields a positive NPV in expectation from taking the project: $pr - x > 0$.
- There are two sub-cases that we'll look at separately:
  (i) The bad type has positive NPV: $qr - x > 0$,
  (ii) The bad type has negative NPV: $qr - x < 0$.

Setup

- The borrower has private information about their type.
- The market only has some expectation of their type.
- Assume that the market places probability $\alpha \in [0, 1]$ on the borrower being the good type and $1 - \alpha$ on them being the bad type.
- The market therefore has expected probability of the firm's success as

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

Roadmap

Contracts

- We'll consider compensation to the borrower of the form: payout $r_e \geq 0$ in the case of success and zero in the case of failure.
- Given that the creditors can't observe the borrower's type, all borrowers get the same payout.
- Known as a pooling contract.

Contracts

- The profit received by the creditors on this contract is given by

$$[\alpha p + (1-\alpha)q][r - r_e] - x = m(r - r_e) - x$$

  why?

- The expected probability of success denoted by shorthand of m.
- Payoff in case of success is the residual after paying-out the borrower.

Outcomes

- There are two potential outcomes now.

(1) No financing takes place.

(2) Financing takes place.

- The prevalence of the two cases depends on how profitable the project is in expectation relative to its upfront cost.

Outcomes

- As usual, if the project is financed, the creditors will receive zero profits ex ante in equilibrium via the breakeven condition

$$m[r - r_e] - x = 0$$
$$\Rightarrow r_e = \frac{mr - x}{m}.$$

  But notice that r_e here need not be positive always.

- The borrower has limited liability though: you can't give him a negative payout.

No financing

- This prevails when $mr < x$.
- If the project were to go ahead, it would mean a negative expected payout for the borrower.
- When does this take place?

$$\begin{aligned} mr &< x \\ \Rightarrow [\alpha p + (1-\alpha)q]r &< x \\ \Rightarrow \alpha pr + (1-\alpha)qr &< x \\ \Rightarrow \alpha[p-q]r &< x - qr \\ \Rightarrow \alpha &< \frac{x-qr}{[p-q]r} \end{aligned}$$

where recall that α was the fraction of good types in the population.

No financing

- The project cannot be financed when the fraction of good types is sufficiently low.
- There is under-investment: the good types are hurt given the suspicion that they may be bad types.

Financing

- Here we need that $mr \geq x$.
- Means that either $\alpha \geq \frac{x-qr}{[p-q]r}$ or the project has positive NPV for both good and bad types.
- Expected profits for the creditor is zero, so

$$r_e = \frac{mr - x}{m} = r - \frac{x}{m}$$

- What does this mean for the ex-post profits of the creditor?
- Positive profits made on good borrower, losses made on bad type. Exercise: show.

The role of adverse selection

- What does adverse selection do relative to a situation of perfectly symmetric information?
- If the outside creditors knew who was good and who was bad, they could give specific compensation.
- Under perfect information, the good type gets

$$p[r - \hat{r}_e^g] = x$$
$$\Rightarrow \hat{r}_e^g = r - \frac{x}{p}$$

where $\hat{r}_e^g$ denotes the perfect information compensation for the good type.

The role of adverse selection

- With perfect information, the bad type only gets financed when their adoption of the project has a positive NPV: i.e. $qr - x \geq 0$.
- If $qr - x < 0$, then they get no financing.
- If $qr - x \geq 0$ then they're compensated with

$$q(r - \hat{r}_e^b) = x$$
$$\Rightarrow \hat{r}_e^b = r - \frac{x}{q}.$$

The role of adverse selection

- Does adverse selection help or hurt the good type?
    - If α too low, they get hurt since the project is not funded under asymmetry.
    - If α high enough, they get compensation $r_e = r - \frac{x}{m} < r - \frac{x}{p} = \hat{r}_e^g$ in the case of success. Hurt!
- Does adverse selection help or hurt the bad type? Say that their NPV is negative $qr < x$.
    - If α too low, they're indifferent as they wouldn't be funded with perfect information anyway.
    - If α high enough, they're better-off since they get funded and receive positive compensation. Wouldn't be funded at all in perfect information case.
- The lenders ex-ante are indifferent either way. What about ex-post? Exercise.

The role of adverse selection

- The presence of bad types hurts the good types!
- The good type cross-subsidises the bad type.
- The good type is better-off than they would be if α were too low, but still worse-off than under perfect information.

Roadmap

Signalling

- What if the good type were able to signal their type somehow?
- Imagine that there were some certification authority that could verify an borrower's type at a certification cost.
- Under certain conditions for that cost, the we may be able to get a separating equilibrium where good types are funded and bad types are not.

Signalling

- Assume that, at a cost c, the borrower can get a reputable organisation to verify their type.
- Note that, since they have no cash upfront, the certification cost is paid-for upfront by the creditors.
- I.e. the creditors provide $x + c$ rather than just x.
- Bad types won't pay c since they don't want to reveal that they are the bad type.

Signalling

- The compensation for the good type will be

$$p[r - \tilde{r}_e^g] = x + c$$
$$\Rightarrow \tilde{r}_e^g = r - \frac{x + c}{p}.$$

where $\tilde{r}_e^g$ is the borrower's compensation with signalling and information asymmetry.

- How does this compare with the pooling equilibrium case?
- The good type has incentive to incur the certification cost when

$$\tilde{r}_e^g \geq r_e$$
$$\Rightarrow r - \frac{x + c}{p} \geq r - \frac{x}{m}$$
$$\Rightarrow \frac{c}{x + c} \leq (1 - \alpha)\frac{p - q}{p}$$

...where does this come from? See your exercise set.

Signalling

- Good type incurs certification cost when $\frac{c}{x+c} \leq (1-\alpha)\frac{p-q}{p}$.
- When the cost of certification is "sufficiently small" in the overall upfront cost $(x+c)$, the good type should separate themselves from the bad type.
- What are the objects on the left and right sides of the inequality?
- Again, see the exercise set.

Roadmap

Summary

- Adverse selection arises when there is hidden information known to insiders of the firm but unknown to outside creditors.
- This information asymmetry serves to hurt the good types in the population.
- Situations can arise where good types can totally miss investment opportunities.
- Credible signalling can facilitate a separating equilibrium that can potentially make the good types better-off.