Lecture 7: 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

1 Introduction

2 Model Environment

3 Pooling Equilibrium

4 Separating Equilibrium

5 Conclusion

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?

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

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.

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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.