Agency Problem of Outside Finance and Capital Structure

Overview of the lecture:

- Agency Problem of outside finance and "credit rationing" (Jensen and Meckling (1976), Tirole, ch. 3.2)
- Debt finance as the way to mitigate credit rationing (Jensen and Meckling (1976), Tirole, ch. 3.4.3, 3.5)
- Cost of debt: Risk-Shifting (Asset Substitution) Problem (Jensen and Meckling (1976))

NATURE OF THE AGENCY PROBLEM

- Investors provide funds to insider (entrepreneur or manager) as well as (some) de facto decision rights.
- How do the investors ensure that insiders
  - make value-increasing decisions?
  - pay a return on investment?

Agency Problem: insider cannot fully commit to both things; hence, investors may be reluctant to provide finance.

For example, insider can:

- - Engage in "empire building" (overinvestment)
  - Do self-dealing transactions with related parties (e.g. sell assets at below market prices to affiliated companies)
  - Resist a value-increasing takeover
  - Derive "perks": company jets, fancy offices, etc...
  - Simply underprovide effort

MODEL OF THE AGENCY PROBLEM (CREDIT RATIONING)

Three dates $(t = 0, 1, 2)$, no discounting, everybody is risk-neutral

An entrepreneur has a project and he is key to the project (nobody else can do it)

- At $t = 0$: Financing
  - Need $I > 0$
  - Entrepreneur's resources available for investment $A < I$
    Hence, he needs to raise $F \geq I - A$.
  - Invests I in the project and keeps $F + A - I$.
  - Competitive capital markets (meaning entrepreneur has all bargaining power, i.e investors' participation constraint is always binding)
- At $t = 1$: Moral hazard stage
  - The entrepreneur has a choice:
    * Behave (work, take no private benefit). Private benefit $Z = 0$
    * Misbehave (shirk, take private benefit). Private benefit $Z = B$
- At $t = 2$: Cash flow
  - $X \in \left\{X^F, X^S\right\}$ with $\Delta X = X^S - X^F > 0$
  - $\Pr\left[X = X^S\right] := p = \begin{cases} p_H \text{ if ent-r behaved} \\ p_L = p_H - \Delta p \text{ if ent-r misbehaved} \end{cases}$

Assumption (*): Behaving is efficient, i.e.

$p_H X^S + (1 - p_H) X^F > p_L X^S + (1 - p_L) X^F + B$ or $\Delta p \Delta X > B$

Denote: project value $V \equiv NPV + Z =$

$= pX^S + (1 - p)X^F + Z - I$

Assumption: The project's NPV is positive if entrepreneur behaves, i.e.,

$$V_{Z=0} \equiv X^F + p_H \Delta X - I > 0$$

i.e. doing project (given entrepreneur behaves) is efficient

Contract

In exchange for financing F the entrepreneur promices repayment $R(X)$: R^F if $X = X^F$ and R^S if $X = X^S$. If entrepreneur's actions (or private benefit) are contractible, parties can also set specify explicitely whether entrepreneur behaves or not.

Payoffs

- Investors always get net payoff of 0 (competitive market), i.e. $pR^S + (1-p)R^F - F = 0$
- Entrepreneur gets: $p(X^S - R^S) + (1-p)(X^F - R^F) + Z + A + F - I = V + A$

I.e., since the markets are competitive the entrepreneur gets the whole value of the project

$\Rightarrow$ Whenever $V > 0$, the funds will be raised (Entrepreneur compares $V + A$ with A)

First Best. Contractible actions

- The entrepreneur needs to raise at least $I - A$
- He can sell a claim on X with promised repayments at $t = 2$

$$R^F \text{ if } X = X^F \quad \text{and} \quad R^S \text{ if } X = X^S$$

For instance, debt with face value K:

$$R^F = \min\{X^F, K\} \quad \text{and} \quad R^S = \min\{X^S, K\}$$

or a fraction β of equity

$$R^F = \beta X^F \quad \text{and} \quad R^S = \beta X^S$$

Assumption (for now): $X^F = 0$

- Hence all contracts are linear in cash flows: $R^F = 0$ and $R^S \geq 0$
- Thus, there is no difference between debt, equity, etc. which allows us to ignore financing choice issues for now.

Offering R^S, entrepreneur raises exactly $p_H R^S$ (competitive market)

He needs to raise at least $I - A$. Hence, R^S must satisfy:

$$\frac{I - A}{p_H} \leq R^S \leq X^S$$

$X^S p_H > I - A$ due to the assumption that $V_{Z=0} > 0$. Hence, irrespective of A, the entrepreneur can always finance the project by setting R^S satisfying the above condition

Noncontractible actions

The above result holds under the assumption that there is no moral hazard problem.

Assumption: actions are not contractible now. Hence investors cannot force entrepreneur to behave

At $t = 1$, the entrepreneur behaves iff

$$\Delta p(X^S - R^S) \geq B \quad \text{or} \quad R^S \leq R^S_{\max} \equiv X^S - B/\Delta p \qquad \text{(IC)}$$

But financing the project (given entrepreneur behaves) requires

$$R^S \geq R^S_{\min} \equiv (I - A)/p_H \qquad \text{(IR)}$$

Hence, the first best is obtained iff

$$(I - A)/p_H \equiv R^S_{\min} \leq R^S_{\max} \equiv X^S - B/\Delta p$$

or

$$p_H(X^S - B/\Delta p) \geq I - A \qquad (*)$$

Tirole calls $p_H(X^S - B/\Delta p)$ "pledgeable income" – maximum amount that can be pledged to the investors.

Role for internal funds: condition (*) is more likely to be satisfied when A large.

What if $R^S_{\min} > R^S_{\max}$, i.e. (*) does not hold?

The investors' NPV if the entrepreneir misbehaves:

$$NPV_{Z=B} = X^F + p_L \Delta X - I$$

- If $NPV_{Z=B} < 0$, the entrepreneur cannot raise $I - A$, irrespective of R^S (**Credit Rationing**)
- If $NPV_{Z=B} > 0$, he can raise $I - A$ but fails to use these funds optimally (**Deviation from value maximization**)

This is a Commitment (or Time-Consistency) Problem:

- Eventually, since the markets are competitive, the entrepreneur bears all the agency cost (he gets the whole value $V + A$ if the project is financed and A if not) $\Rightarrow$ He would like to commit to behaving. However, once some claims are sold to investors, his incentives are determined solely by the claims that he retains.

- WAYS TO SOLVE (PARTIALLY) THE AGENCY PROBLEM (increase borrowing capacity, raise pledgeable income):
  - Costly commitment (monitoring, bonding)
  - Reputation
  - Collaterization
  - Diversification
  - Capital structure

Costly Commitment:

To commit to behaving, the entrepreneur is willing to pay up to:

$$V_{Z=0} - \max\{V_{Z=B}, 0\}$$

- **Monitoring** by a blockholder, a bank, an auditor, etc...
- **Bonding**: Contractual commitment not to engage in certain actions (even if potentially valuable)

BENEFITS OF DIVERSIFICATION (Diamond (1984), Tirole, ch. 4.2)

- In a perfect market there are no benefits from corporate diversification (investors can diversify themeslves by investing in different projects)
- When Agency Problem exists diversification can be beneficial.
  - Main idea: entrepreneur can cross-pledge the incomes of various projects provided they are not perfectly correlated. This increases pledgeable income and, hence, makes financing (both projects) more feasible.

- Assume there are two projects, each having the same characteristics as above
- The entrepreneur's initial wealth: $2A$.
- Assume $X^F + p_L \Delta X - I < 0$: financing is unfeasible if entrepreneur is expected to misbehave

The case of no diversification

- Assume the returns of the two projects are perfectly correlated (i.e. if one is success the other one is success too and vice versa).
- Manager can behave in both (then $Z = 0$) or misbehave in both (then $Z = 2B$).
- At $t = 1$, the entrepreneur behaves iff

$$\Delta p(2X^S - R^S) \geq 2B \quad \text{or} \quad R^S \leq R^S_{\max} \equiv 2X^S - 2B/\Delta p \tag{IC$_{nd}$}$$

Financing the project (given entrepreneur behaves) requires

$$R^S \geq R^S_{\min} \equiv (2I - 2A)/p_H \tag{IR}$$

Hence, the necessary and sufficient condition for financing both projects:

$$2(I - A)/p_H \equiv R^S_{\min} \leq R^S_{\max} \equiv 2X^S - 2B/\Delta p$$

or

$$p_H(X^S - B/\Delta p) \geq I - A \tag{*}$$

Note: if you want to finance only one project, the conditions is weaker: $p_H(X^S - B/\Delta p) \geq I - 2A$

The case of diversification

- Assume correlation is not perfect. For simplicity: no correlation at all.
- Assume entrepreneur can behave in both, misbehave in both, or misbehave in either
- Four (essentially three) outcomes are possible:
  - Both projects fail: $X = 0$
  - Both pojects succeed: $X = 2X^S$
  - Only one succeeds: $X = X^S$
- How can we relax the financing condition?
- Answer: reward entrepreneur only if both projects succeed; otherwise pay all return to investors. This will help raise pledgeable income
- Specifically, the contract should look as follows:
  - $R = R_0 = 0$ if no project suceeds
  - $R = R_1 = X^S$ if only one succeds (cross-pledging)
  - $R = R_2 < 2X^S$ if both succeed

- Financing both project, given entrepreneur behaves in both, requires:

$$2p_H(1-p_H)X^S + p_H^2 R_2 \geq 2I - 2A$$

$$R_2 \geq R_{2\min} \equiv (2I - 2A - 2p_H(1-p_H)X^S)/p_H^2 \qquad \text{(IR)}$$

- Entrepreneurs prefers to behave in both projects to misbehaving in both projects iff

$$p_H^2(2X^S - R_2) \geq p_L^2(2X^S - R_2) + 2B$$

or

$$\begin{aligned} R_2 &\leq R_{2\max} \equiv 2X^S - 2B/(p_H^2 - p_L^2) = \\ &= 2X^S - 2B/(\Delta p(p_H + p_L)) \qquad (\mathsf{IC}_d) \end{aligned}$$

Hence, the necessary and sufficient condition for financing both projects:

$$p_H\left[X^S - Bp_H/(\Delta p(p_H + p_L))\right] \geq I - A$$

This condition is weaker than (*)

- Hence, diversification increases pledgeable income and makes financing more feasible

Note: We should have checked if behaving in both projects is preferred to behaving only in one. The condition is

$$p_H^2(2X^S - R_2) \geq p_L p_H(2X^S - R_2) + B$$

or

$$R_2 \leq 2X^S - B/(p_H \Delta p)$$

, which is weaker than (IC_d).

JENSEN AND MECKLING (1976). DEBT AS A WAY TO SOLVE THE AGENCY PROBLEM OF OUTSIDE FINANCE

Main Ideas of Jensen and Meckling:

- There are conflicts of interests
  - between insiders and outside investors
  - between equityholders and debtholders
- Insider's decisions **depend** on the capital strucure. Hence, MM I does not hold: operating and financing decisions are **not** independent, i.e., the size of the pie is affected by how the pie is split.
- Proper capital structure minimizes the agency costs

- For now: focus on the conflict of interest between insiders (entrepreneur) and outside investors, i.e. what we have been discussing so far

Model

Same as before except:

- $X^F > 0$, to be able to discuss financing choices (cap. structure)
- $I > X^F$, for simplicity
- $A = 0$, for simplicity

First Best: Modigliani-Miller

Financing choices are irrelevant in the absence of Moral Hazard (i.e. when entrepreneur's actions are contractible)

Say the entrepreneur chooses to raise exactly I. Then, he offers R^F and R^S such that:

$$I = (1 - p_H)R^L + p_H R^S = R^F + p_H \Delta R$$

Debt with face value $K > X^L$:

$$R^F = X^F, \qquad R^S = K = X^F + \frac{I - X^F}{p_H}$$

$$\Delta R = \frac{I - X^F}{p_H}$$

The investors's then get

$$p_H K + (1 - p_H) X^F - I = 0$$

Equity: Sell a fraction β of existing shares, i.e.,

$$\begin{aligned} R^F &= \beta X^F, \qquad R^S = \beta X^S \\ \text{such that } \beta &= \frac{I}{X^F + p_H \Delta X} \end{aligned}$$

The investors's then get

$$p_H \beta X^S + (1 - p_H) \beta X^F - I = 0$$

Irrespective of financing, the entrepreneur receives the investment's entire $V = NPV + Z$ and the investors receive 0 (competitive capital markets):

Optimality of Debt

Irrelevance of financing choice breaks down, once actions are non-contractible.

At $t = 1$, the entrepreneur behaves iff

$$p_H(X^S - R^S) + (1 - p_H)(X^F - R^F) \geq$$
$$\geq p_L(X^S - R^S) + (1 - p_L)(X^F - R^F) + B \quad \text{or}$$
$$\Delta p\,(\Delta X - \Delta R) \geq B \quad \text{or} \quad \Delta R \leq \Delta R^{\max} \equiv \Delta X - B/\Delta p \tag{IC}$$

Financing the project (given behaving) requires

$$I \leq R^F + p_H \Delta R \tag{IR}$$

Necessary and sufficient condition for the existence of R^F and R^S satisfying these constraints is

$$p_H(\Delta X - B/\Delta p) + R^F \geq I \tag{**}$$

(**) is analogous to (*): LHS is pledgeable income. (**) is more likely to be satisfied when R^F is as large as possible, i.e. $R^F = X^F$. This is precisely the debt contract with face value $K = R^S > X^F$.

Debt financing is thus an optimal response to the moral hazard problem:

All projects that can be financed (e.g., with equity) can also be debt-financed but the reverse is not true.

Intuition:

The debt contract makes the entrepreneur "internalize" the consequences of his actions for the firm value. Hence, it maximizes his incentive to exert effort.

Remarks:

- In a more general model where effort affects the distribution of cash flows $F(X \mid e)$ over a continuum, Innes (1990) shows that debt is optimal under two conditions (see Tirole, ch. 3.6):
  - Monotone (log) Likelihood Ratio Property:
    $$\frac{\partial}{\partial X}\left(\frac{\frac{\partial F(X|e)}{\partial e}}{F(X|e)}\right) > 0.$$
  - Monotonic repayment schedule: $\dfrac{dR(X)}{dX} \geq 0$
- In a continuous investment model (i.e. I is not fixed, Tirole ch. 3.4) optimality of debt continues to hold.
  - Additional prediction appears: firms with lower B or higher A borrow more.

JENSEN AND MECKLING (1976). COST OF DEBT: "RISK-SHIFTING" ("ASSET SUBSTITUTION")

- Let us introduce a conflict between debtholders and equityholders
- Same model except that now moral hazard is about risk choice:
- The entrepreneur chooses between two mutually exclusive projects generating $X \in \{0, \hat{X}, 2\hat{X}\}$.

	$\Pr\left[\mathbf{X} = \mathbf{2\hat{X}}\right]$	$\Pr\left[\mathbf{X} = \mathbf{\hat{X}}\right]$	$\Pr\left[\mathbf{X} = \mathbf{0}\right]$
Project A:	p_1	$1 - p_1 - p_2$	p_2
Project B:	$p_1 + \Delta_1$	$1 - (p_1 + \Delta_1)$ $-(p_2 + \Delta_2)$	$p_2 + \Delta_2$

with $0 < \Delta_1 < \Delta_2$ and $p_1 + \Delta_1 + p_2 + \Delta_2 < 1$.

Assume that Project A's NPV is positive, i.e.,

$$(1 + p_1 - p_2)\hat{X} - I > 0$$

First Best

Project B's NPV is

$$(1 + p_1 + \Delta_1 - p_2 - \Delta_2)\hat{X} - I$$

which is less than NPV of Project A, the difference being:

$$(\Delta_2 - \Delta_1)\hat{X} > 0$$

$\Rightarrow I$ should be used for Project A.

Debt Finance

Suppose that I is raised in debt with face value K.

Assume that $(1-p_2)\hat{X} < I$, meaning that it must be that $K > \hat{X}$, i.e. default in case $X = \hat{X}$.

The entrepreneur gets a positive payoff only when $X = 2\hat{X}$. With Project A, he gets

$$p_1(2\hat{X} - K)$$

while with Project B, he gets

$$(p_1 + \Delta_1)(2\hat{X} - K)$$

$\Rightarrow$ once I has been raised, the entrepreneur picks Project B.

- Entrepreneur is better off in state $X = 2\hat{X}$ and equally well off when $X = 0$ or $X = \hat{X}$.
- Because of **limited liability**, entrepreneur does not internalize loss in low states, but maximizes returns in the state, where he is residual claimant.
- Ultimately, cost borne by entrepreneur: investors anticipate asset substitution and hence ask for a higher face value of debt. That is, $\tilde{K}$ is such that

$$(p_1 + \Delta_1)\tilde{K} + (1 - p_1 - \Delta_1 - p_2 - \Delta_2)\hat{X} = I$$

Nonetheless, entrepreneur keeps picking Project B.

If NPV of Project B $<$ 0, investors will not provide finance (market break-down).

Equity Finance

Suppose I has been raised in equity; fraction $\beta = (1 - \alpha)$ sold.

Once I raised and invested, entrepreneur receives a fraction α of the cash flows

$\Rightarrow$ he maximizes expected cash flows

$\Rightarrow$ undertakes Project A, i.e., no incentives to shift to Project B.

Equity finance is clearly the optimal contract because it induces no distortion in investment decisions.

Implications of Risk-Shifting (Asset Substitution) Model

- More debt when there is less risk-shifting potential: e.g.,
  - Regulated public monopolies with less managerial discretion
  - Firms in mature industries with few growth opportunities
  - Evidence on the US seem to support these concluisons
- Risk shifting incentives are higher when the firm is in financial distress since this is when limited liability becomes important (Gambling for Resurrection). (e.g. if $\hat{X} > K$ there would be no risk-shifting)

Mitigating Asset Substitution (except using equity finance):

- **Short-term debt** allows to renegotiate lending rate to adjust for higher risk, lessening the incentives to switch or choose high risk projects.
- **Covenants** to debt contract, e.g. prohibit investments into new, unrelated lines of business.
- **Convertible Debt** gives debtholders the option to become equityholders when returns are high $\Longrightarrow$ the entrepreneur is not the sole residual claimant when $X = 2\hat{X}$. Anticipating the conversion, he opts for Project A.
  - US evidence: highly leveraged, high-growth firms are most likely to issue convertible bonds. These firms exhibit high default risk, and hence high potential for asset substitution.

Jensen and Meckling Perspective on Capital Structure

- Capital structure is such that the sum of all agency costs are minimized.
- Hence, Jensen and Meckling (1976) conclude, optimal capital structure likely to be a mix of debt and equity.
- Agency costs encompass also costs for monitoring and bonding activities. Thus, to the extent that monitoring and bonding are useful, the equilibrium capital structure is chosen to minimize sum of **all** agency costs.

For instance, suppose under-provision of effort could be avoided by monitoring and monitoring is cheap, then firm should be all-equity financed.