Econ 234C – Corporate Finance
Lecture 3: Internal Investment (II)

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Outline

1. Organization
    - Next class (2/13) meeting in Haas
    - Class enrollment: P/F option
    - Information Sheet
    - Financial Economics seminar
2. Homework 1
3. Corporate Investment (II): Myers-Majluf

1 Next class (2/13)

- Change in location just for next time:
  - Business School computer classroom **s300t** (across the hall from the Library in the Haas Computer Center.
  - Gary's directions: "go to the 3rd floor of the Haas Building and ask pretty much anyone for directions."

- Several of the databases require local IP addresses; hard to demo them outside Haas.

- **No new readings** (both because class will be mostly about data and because we will stretch asymmetric information into the next class and then go to Moral Hazard [Jensen 1976 and 1986 papers].)

2 P/F option

- If you want to make finance your field *or* are post-orals but would like to have the option of going on the "finance job market" in addition to the "econ job market," choose one of the enrollment options laid out in the first class.

- If you just want to audit this class, it would be helpful if you could enroll 'pass/fail'. Only requirement: hand in a paper at the end of the class, which relates to CF very broadly defined.

3 Homework 1 (10 points)

Exercises 6.1, 6.2, 6.6 in Tirole.

Due: Next Wednesday, 2/13, in class.

4 Corporate Investment (II)

- Empirical evidence on investment-cash flow sensitivity (since FHP 1988): investment increases with the availability of internal cash.
  - Related evidence: investment decreases with leverage.

- Fundamental empirical difficulty in identifying this sensitivity: cash balances, leverage are endogenous.

- Empirical answer: exploit shocks to C such as oil prices, pension fund requirements, windfall gains from lawsuits.

Theoretical underpinnings

Theoretical underpinnings for investment-cash flow sensitivity and the bigger issue, sub-optimal investment

(1) Asymmetric information $\Longrightarrow$ underinvestment

(2) Moral hazard $\Longrightarrow$ overinvestment

Today: (1) Asymmetric information (Myers, 1977 and 1984; Myers-Majluf, 1984)

Lemons Problem

- Akerlof (1970): gains from trade can remain unexploited when sellers are better informed about their quality than buyers
  - sellers (of investment idea) = firms
  - buyers (of investment idea) = investors
- Implication for investment financing:
  - Firms choose investments whose payoffs are such that the payoffs investors receive are equal to or worse than investors expect.
  - Investors understand firms' incentives to exploit asymmetric information $\Longrightarrow$ ask for (even) higher interest rate / payoffs.
  - Firms raise less external funds or raise external funds less often; rely more on internal cash flow.

– Firms prefer to use funds that do not suffer from informational asymmetries (cash, safe debt), then hybrid securities (convertibles), only then equity.

Lemons Model - Assumptions

- Manager / entrepreneur has investment project costing I, no cash on hand $C = 0$, no (illiquid) assets $A = 0$.

- Project is of good quality or of bad quality:
  - Returns: $\begin{cases} \text{good} \implies \text{return } R \text{ w/prob. } p, \text{ else return 0;} \\ \text{bad} \implies \text{return } R \text{ w/pr. } q < p, \text{ else return 0.} \end{cases}$
  - Two cases: $\begin{cases} \text{only good project creditworthy:} & pR > I > qR \\ \text{both projects creditworthy} & pR > qR > I \end{cases}$

- Entrereneur, investors risk neutral.

- Entrepreneur protected by LL.
- Interest rate normalized to 0.
- Competitive capital markets.
- *Key assumption*: project quality = private information of entrepreneur.
- Investors' prior on success probability:

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

Feasible financial contracts?

1. Benchmark: symmetric information

- Financing (Lending) Conditions?

- Compare payoffs for good and bad projects.

2. Asymmetric information

- Why is the above contract design not robust to asymmetric information?

- Contract design of only good project is creditworthy

  - Implications?

- Contract design of both projects are creditworthy

  - Implications?

3. Pecking Order of Financing

- Empirical stylized fact: Managers prefer internal financing $\succ$ risk-free debt $\succ$ risky debt $\succ$ equity.

- Model interpretation: Managers prefer 'low-information intensity' financing to 'high-information intensity' financing.

- Model: as above, but $A > 0$, which can be used to pay investors (via share ownership or via selling them in case of bankruptcy).

- **Financing condition?**

- Entrepreneur's surplus and, hence, maximization?

- Resulting Contract Design?

- Robustness to the ‘type’ of informational asymmetry

Investment Model - Assumptions

A1. Managers maximize the value of old shareholders' stake in the firm.
Note: MM split assumption A.1 up into 'maximize shareholder value to old investors' and 'old investors do not rebalance their portfolio in response to financing and investment choices.'

A2. $\tilde{A}, \tilde{R}(\cdot)$ stochastic.

A3. Asymmetric information between managers and investors about the realization of the future value of current assets (A) and the return to investment $(R(I))$.

Notation

As before.
Will introduce debt with face value W and market value D later (Homework 1); but start (again) with equity as the only form of external financing.

Timing

- $\mathbf{t = 0}$:
  CEO + investors learn distribution of R conditional on I, $\tilde{R}(I) \sim F_I$;
  CEO + investors learn distribution of future value of $\tilde{A} \sim G$.

  Simplification: $I \in \{0, I^*\}$ with $\tilde{R}(I^*) =: \tilde{R} \sim F$

  Cash flow C is realized (firm's new net worth $A + C$);

- $\mathbf{t = 1}$:
  CEO learns realization of $\tilde{R}(I^*)$, denoted as R;
  CEO learns realization of $\tilde{A}$, denoted as A;
  CEO chooses I.

- $\mathbf{t = 2}$: A realized; if CEO chose to invest $R(I)$ realized.

Note: Information is symmetric at $t = 0$, asymmetric at $t = 1$,
and symmetric at $t = 2$.

Consider the case $I^* > C$.

With symmetric information and no uncertainty, maximization problem was:

$$\max_{I,s'} \frac{s}{s+s'}(A + R(I))$$

$$\text{s.t. } \frac{s'}{s+s'} \cdot (A + R(I)) = I - C$$

or, with $I \in \{0, I^*\}$,

$$\max_{I \in \{0, I^*\}, s'} \left\{ A + C; \frac{s}{s+s'}(A + R(I^*)) \right\}$$

$$\text{s.t. } \frac{s'}{s+s'} \cdot (A + R(I^*)) = I^* - C \text{ if CEO chooses } I^*$$

What is the new maximization problem when choosing I (at $t = 1$)?

What is the solution for s'?

NOTE (1):

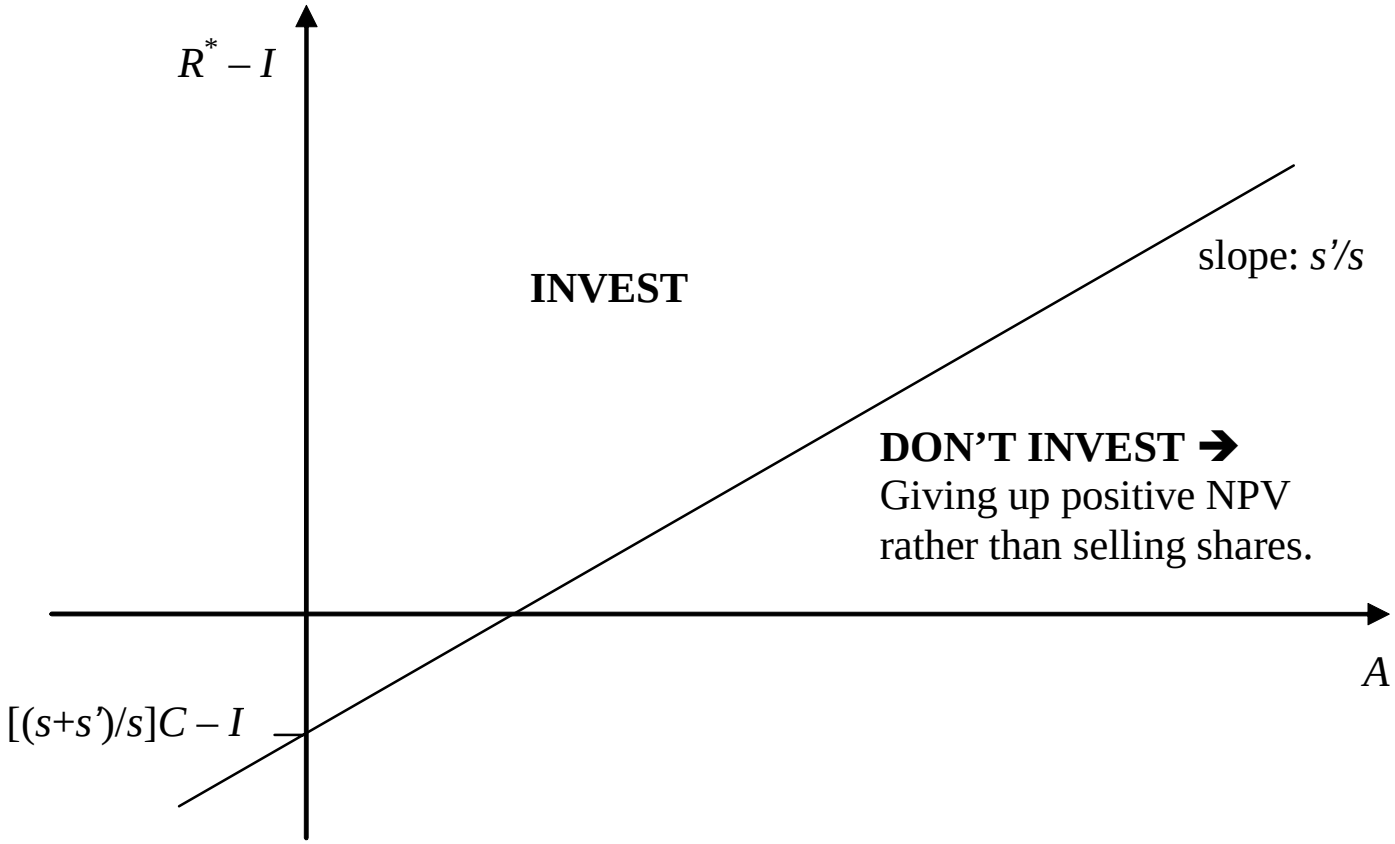
$E[\tilde{A} + \tilde{R}^*|\text{issuance}]$ is the market value of the firm after issuance.

$E[\tilde{A} + \tilde{R}^*|\text{issuance}] - (I - C)$ is the market value of shares of the old shareholders after issuance.

NOTE (2): $E[\tilde{A} + \tilde{R}^*|\text{issuance}]$ is not unique!
(Thus simple comparative statics / derivatives difficult.)

What is the decision rule for investment?

Let's graph the decision rule for investment.



What happens as C increases? (Intuition + graph)

What happens as A is know?

Introducing debt

Argument in MM:

With equity financing firm issues & invests only if

$$\begin{aligned} A + C &\leq (A + R)\frac{E[A + R|\text{issuance,C}] - (I - C)}{E[A + R|\text{issuance,C}]} \\ &= (A + R) - [A + R]\frac{(I - C)}{E[A + R|\text{issuance,C}]} \\ &= (A + C + R - I^*) - [I - C]\frac{(A + R) - E[A + R|...]}{E[A + R|...]} \\ &= (A + C + R - I^*) - \text{loss or gain to (new) equity holders} \end{aligned}$$

Note: E[loss/gain]=0 in equilibrium –> see formally above.

With debt financing

$$A + C \leq (A + C + R - I^*) - \text{loss or gain to (new) debt holders holders}$$

Use option-pricing argument: $|\Delta_E| > |\Delta_D|$, i.e. gain or loss for equity holders always larger than for debt-holders.

–> If firm pre-announces use of debt or equity: if both negative, the firm invests; if both positive or 0, then debt will be issued in some states of the world where equity will not be issued. Thus less underinvestment under debt. Thus ex-ante value of the firm higher under debt.

–> If firm announces use of debt or equity only at $t = 1$: Issuing equity signals $\Delta_E < 0$ (since $|\Delta_E| > |\Delta_D|$ and firm choose equity if $\Delta_E < \Delta_D$. Thus, issuing equity signals a sure loss. Thus the firm will never issue equity.

Formally

Suggestion: Consider an investment project with cost I and a stochastic return $\widetilde{R}$, given by R_G with probability p and R_B with probability $1-p$, where $R_G > R_B$.

Start with A non-stochastic.

The firm can use cash $c \in [0, C]$, can issue debt with face value w, and offer new shares s'.

The firm can thus obtain sufficient financing for the investment project if

$$I \leq A + C + E[\tilde{R}]. \tag{1}$$

First derive the CEO's choice of financing conditional on implementing the project.

The CEO will implement the project only if the resulting value to old shareholders is higher than $A + C$, the value of the firm without implementing the investment project.

$$\max \quad \frac{s'}{s+s'} E[(A + C + \tilde{R} - c - w)^+] \tag{2}$$

$$\text{s.t.} \quad \frac{s}{s+s'} E[(A + C + \tilde{R} - c - w)^+] = I - c - d \tag{3}$$

$$E[\min\{w, A + C + \tilde{R} - c\}] = d \tag{4}$$

$$0 \leq c \leq C,\ d \geq 0,\ c + d \leq I \tag{5}$$

Note that the right-hand side of (3), $I - c - d$, is the financing gap remaining after the use of cash and debt and equals the market price of the new shares if the investment project is implemented.

$==>$ Next steps: next class.

5 Required readings for next class (and class after)

- Two Jensen papers handed out last time.

- **Also required:**

Familiarize yourself with WRDS (to get something out of Gary Peete's introduction!).