Corporate Finance Theory

Lecture 3
Financing under asymmetric information

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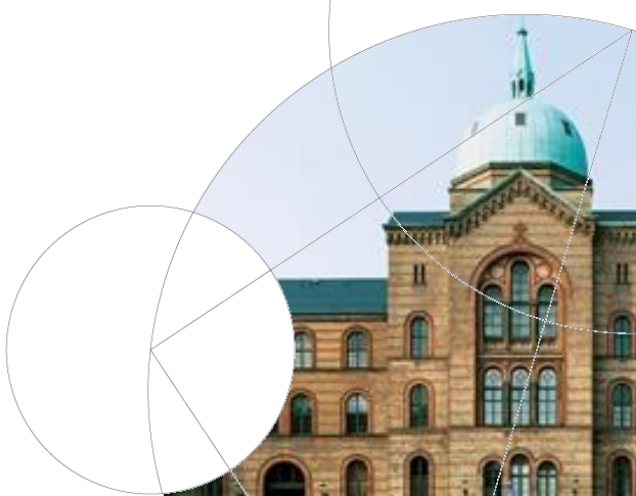


Intended outcomes for the day:

1. To show how asymmetric information about project quality can affect "good" borrowers' ability to raise funds.

2. To explain why information asymmetries can result in negative stock market reactions when firms announce that they will raise funds.

3. To derive how asymmetric information can affect borrower incentives to issue equity vs debt.

Last lecture

We saw that, in a setting with credit rationing due to moral hazard, a firm looking to raise funds may:

- Turn to inside equity and outside debt
- Let investors diversity via cross-pledging between different projects
- Ex post take on excess risk (asset substitution)

FINANCING UNDER ASYMMETRIC INFORMATION

I. INTRODUCTION

2 types of asymmetric information

- investors / insiders — LEMONS
- among investors — WINNER'S CURSE

our focus!!

related auction

IPO pricing!!

- Issue of claims may be motivated by
  - ✓ insurance
  - ✓ project financing,
  - ✓ liquidity need

→ no conflict

Akerlof "Used cars"!

- Asymmetry of information about
  - ✓ value of assets in place,
  - ✓ prospects attached to new investment,
  - ✓ quality of collateral.

} conflict of interest

- Themes:
  - (1) market breakdown → e.g. hurt good borrowers.
  - (2) costly signaling → see textbook

level

riskiness

Asymmetric information may account for a number of observations, e.g.,:

- ✓ negative stock price reaction to equity issuance (and smaller reaction during booms),
- ✓ pecking-order hypothesis (issue low-information-intensity securities first),
- ✓ market timing.

will come a bit later in the lecture.

Asymmetric information predicts dissipative signals (besides lack of financing), e.g.:

- ✓ private placements,
- ✓ limited diversification,
- ✓ insufficient liquidity,
- ✓ dividend distribution,
- ✓ excess collateralization,
- ✓ underpricing.

→ "costly signaling"

Privately-known-prospects model

- Wealth $A = 0$, investment cost I.
- Project succeeds (R) or fails (0).
- Risk neutrality, LL, and zero interest rate in economy.
- No moral hazard.

investor will have a break-even constraint

limited liability

✓ *Two borrower types*

$$pR > I$$

Probability of success p (probability α)

Probability of success q (probability $1 - \alpha$)

prior

$p > q$

Either $pR > I > qR$ (only good type is creditworthy)

or $pR > qR > I$ (both types are creditworthy)

q is low

q is not so low

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

weighted average project quality, under the prior beliefs

Symmetric information benchmark

Baseline

Lenders break even on average:

Lenders: $\begin{bmatrix} p \\ q \end{bmatrix} R_L - I \geq 0$; $R_L + R_B = R$. $R_L = R - R_B$.

$$p(R - R_b^G) = I$$

$$q(R - R_b^B) = I$$ -> if $qR > 1$

$R_b^G > R_b^B$; ie. $R_b^G < R_\ell^B$; lender requires a higher repayment for a bad project.

R_ℓ gross repayment: $\frac{R_\ell}{I}$ gross interest rate.

Not incentive compatible under asymmetric information.

Net interest rate: $r \equiv \frac{R_\ell}{I} - 1$

→ lender charges a higher interest rate for lower quality projects.!!

A bad borrower can profitably mimic a good borrower and earn

$qR_b^G > qR_b^B$ ↙ R_b^B in case of success.

↑ Bad borrower, receive R_b^G in case of success

Asymmetric information

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

(a) $mR < I$ ⇒ no lending (market breakdown)

(b) $mR > I$ (equivalently $\alpha \geq \alpha^*$). There exists a lending contract:

- ✓ Cross subsidy: $p(R - R_b) > I$ and $q(R - R_b) < I$.
- ✓ Overinvestment if bad borrower is not credit worthy.

suffer losses from the bad projects.

investors make profits off good projects

Scenario where good and bad borrowers raise funds

Bayes Rule

$$\mathbb{P}(\text{good} \mid \text{raise funds}) = \frac{\mathbb{P}(\text{raise funds} \mid \text{good})\,\mathbb{P}(\text{good})}{\mathbb{P}(\text{raise funds} \mid \text{good})\,\mathbb{P}(\text{good}) + \mathbb{P}(\text{raise funds} \mid \text{bad})\,\mathbb{P}(\text{bad})}$$

$$= \frac{1 \cdot \alpha}{1 \cdot \alpha + 1 \cdot (1-\alpha)} = \alpha$$

posterior = prior.

Break-even constraint:

$$\alpha p \cdot R_\ell + (1-\alpha) q R_\ell = I$$

αp: prob. success, good; $(1-\alpha) q$: prob. success, bad

Just: $mR_\ell = I$, where $m \equiv \alpha p + (1-\alpha) q$.

To move forward, find a contract, there must exist some $R_\ell \in [0, R]$ s.t. $mR_\ell = I$; $m < p$.

- Project get financed. $mR \geq I$
- Not get financed. $mR < I$

Measure of adverse selection

$$mR > I \iff [1-\chi]pR > I$$

where

$$\chi \equiv (1-\alpha)\left(\frac{p-q}{p}\right)$$

Asymmetric info:
$mR > I$
$\neq$
$pR > I$

$m < p$, measure of lemons problem

condition for financing to go ahead

Show that this is the case!

$pR[1-\chi] > I$

Asym. info ↓ similar to $\frac{B}{\Delta p}$

$\chi \equiv (1-\alpha)\left(\frac{p-q}{p}\right)$

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

Compare to the condition with moral hazard:

$$p_H\left(R-\frac{B}{\Delta p}\right) \geq I$$

χ is a measure of the adverse selection problem. The higher the value of χ (or equivalently, the lower the value of α), the harder to raise funds.

Extension: market timing

project financed → $mR > I$; $mR < I$

Observation: Firms tend to issue shares when stock prices are high. **Possible mechanism:** Adverse selection may becoming less relevant during "booms"

Assume that the probability of success shifts up by $\tau > 0$

$$\{p + \tau\,,\, q + \tau\}.$$

Condition for financing: $[\alpha(p+\tau) + (1-\alpha)(q+\tau)]R > I$

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

Or equivalently:

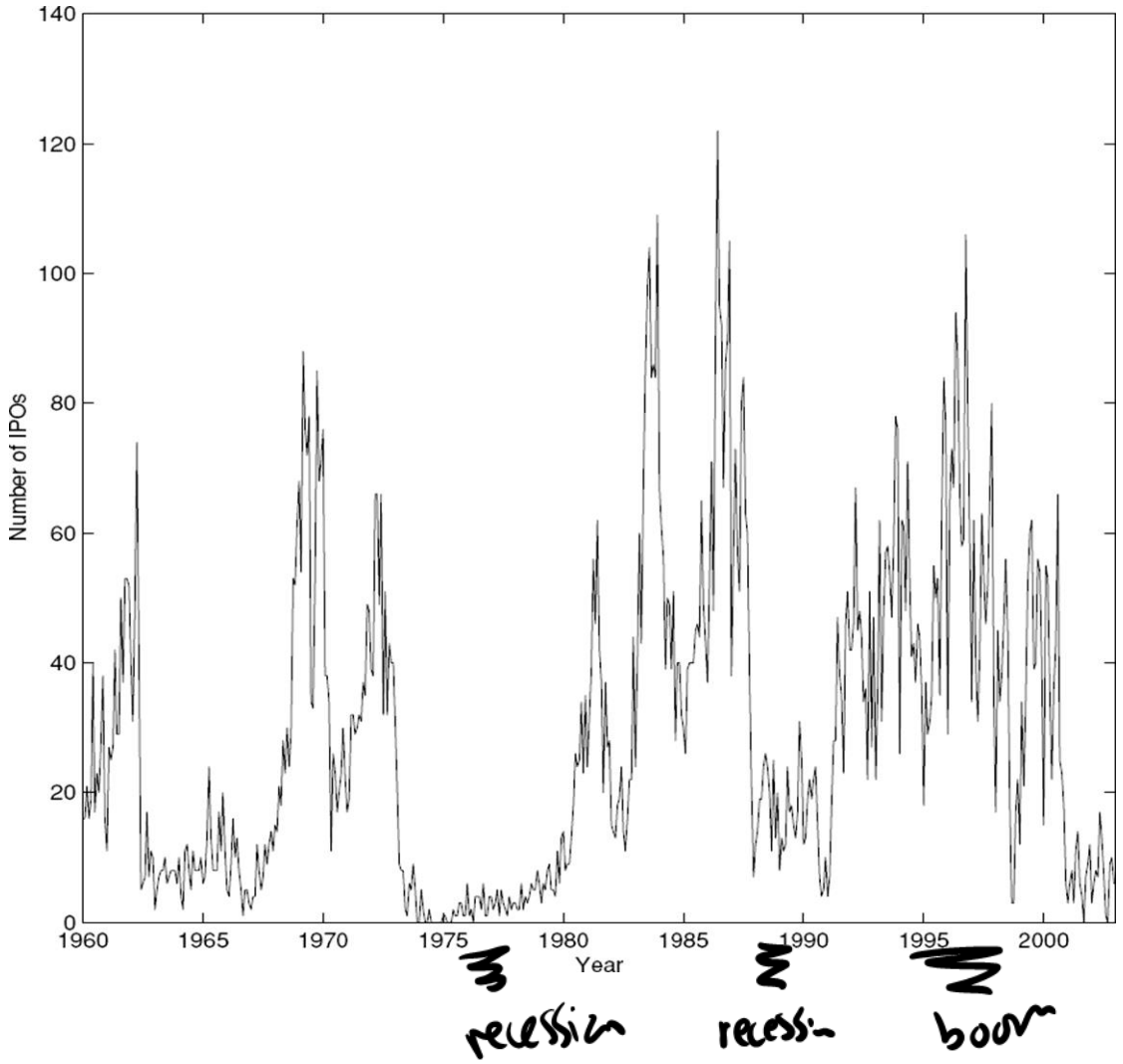
$$[m + \tau]R \geq I.$$

The better the market conditions, the easier to obtain financing.

Possible explanation for IPO waves.

Good times → higher NPV good projects

"washes out" asym. info problems



Pastor & Veronesi (2005)

The Journal of Finance, Volume: 60, Issue: 4, Pages: 1713-1757, First published: 12 August 2005, DOI: (10.1111/j.1540-6261.2005.00778.x)

Extension: negative stock price reaction

- ✓ Entrepreneur already has an existing project, with probability of success p or q.
- ✓ Deepening investment would increase probability of success by τ

cost I

efficient

$$\tau R > I.$$

cash flow in case of success.

Financing?

Scenario 1: both good, bad firms try to raise funds → lender break-even-conditions

expected repayment

$$[\alpha(p+\tau) + (1-\alpha)(q+\tau)]\, R_\ell = I.$$

investor outlay

Good borrower can refuse to be financed. Hence *pooling* only if:

Expected payoff of good borrower

$$(p+\tau)\,(R - R_\ell) \geq pR \iff \tau R \geq \left(\frac{p+\tau}{m+\tau}\right) I$$

greater than 1 by $p > m$.

jofi778-fig-0001-m.jpg

Extension: negative stock price reaction II

If a pooling equilibrium exists:

-Cross subsidization, as before. Good borrowers effectively subsidize bad borrowers.

-If the deepening investment is anticipated, then the value of shares before and after the seasoned equity offering is:

NO STOCK PRICE REACTION TO THE OFFERING

Suppose a pooling equilibrium does not exist:

$$(p+\tau)(R-R_l) < pR$$

Consider a separating equilibrium where:

-Good borrowers **do not** raise funds for a deepening investment

-Bad borrowers **do** raise funds for a deepening investment

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Extension: negative stock price reaction III

Separating equilibrium:

-Good borrowers **do not** raise funds for a deepening investment
-Bad borrowers **do** raise funds for a deepening investment

last slide

Investor beliefs follow from Bayes' rule and borrowers' equilibrium strategies.

Thus, (not) raising funds perfectly reveals the borrower as bad (good)

$$P(\text{good}|\text{raise}) = P(\text{good})P(\text{raise}|\text{good})$$

$$P(\text{good})P(\text{raise}|\text{good}) + P(\text{bad})P(\text{raise}|\text{bad})$$

Investor break-even constraint: $(q+\tau)R_l^B = I$

small large. bad project probability.

$$R_l^B > R_l$$

Good borrower does not want to raise funds by

$$(p+\tau)(R-R_l^B) < (p+\tau)(R-R_l) < pR$$

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Extension: negative stock price reaction IV

Value of shares before the seasoned equity offering:

$$V_0 = \alpha[pR] + (1-\alpha)[(q+\tau)R - I]$$

Value of shares after the seasoned equity offering:

$$V_1 = (q+\tau)R - I$$

It can be shown that $V_0 > V_1$

Conclusion:

Now set $\alpha = 0$ → firm raises funds for this deepening investment

The firm is bad!

Stock price reaction is negative when the firm raises funds. Why? Investors, informally, know that "bad projects" are more attractive to finance; shares are overpriced

Question

Is it possible for a separating equilibrium to exist where good borrowers (with probability of success p) raise funds for the deepening investment but bad borrowers (with probability of success q < p) do not?

A. Yes, but only if q is sufficiently close to p

B. Yes, but only if q is sufficiently close to 0

C. No, because bad borrowers who mimic good borrowers by raising funds can make a positive NPV investment

D. No, because bad borrowers find it less costly than good borrowers to relinquish a claim on their assets, which are overvalued.

Best answer

room 897458

Discuss in pairs, then go to socrative.com and vote for what you think is the best answer

Signaling game: "good types" find the action (giving up a claim on their project) more costly than "bad types".!!

Technology

Sea Aims to Raise $6.3 Billion in 2021's Biggest Equity Deal

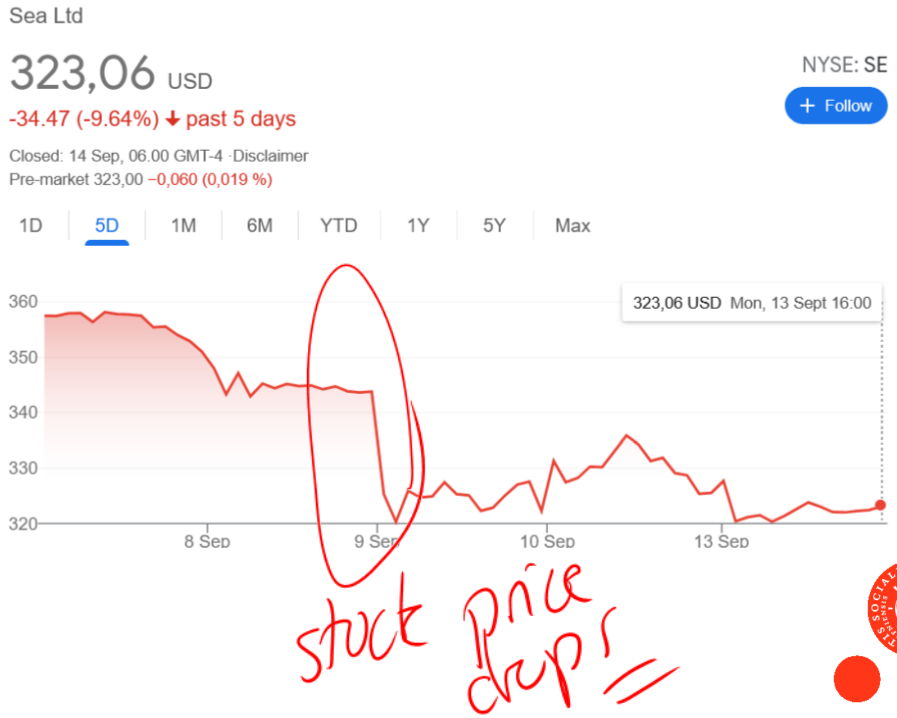
By Yoolim Lee and Drew Singer

September 9, 2021, 12:17 a.m. GMT+2 *Updated on September 9, 2021, 2:58 a.m. GMT+2*

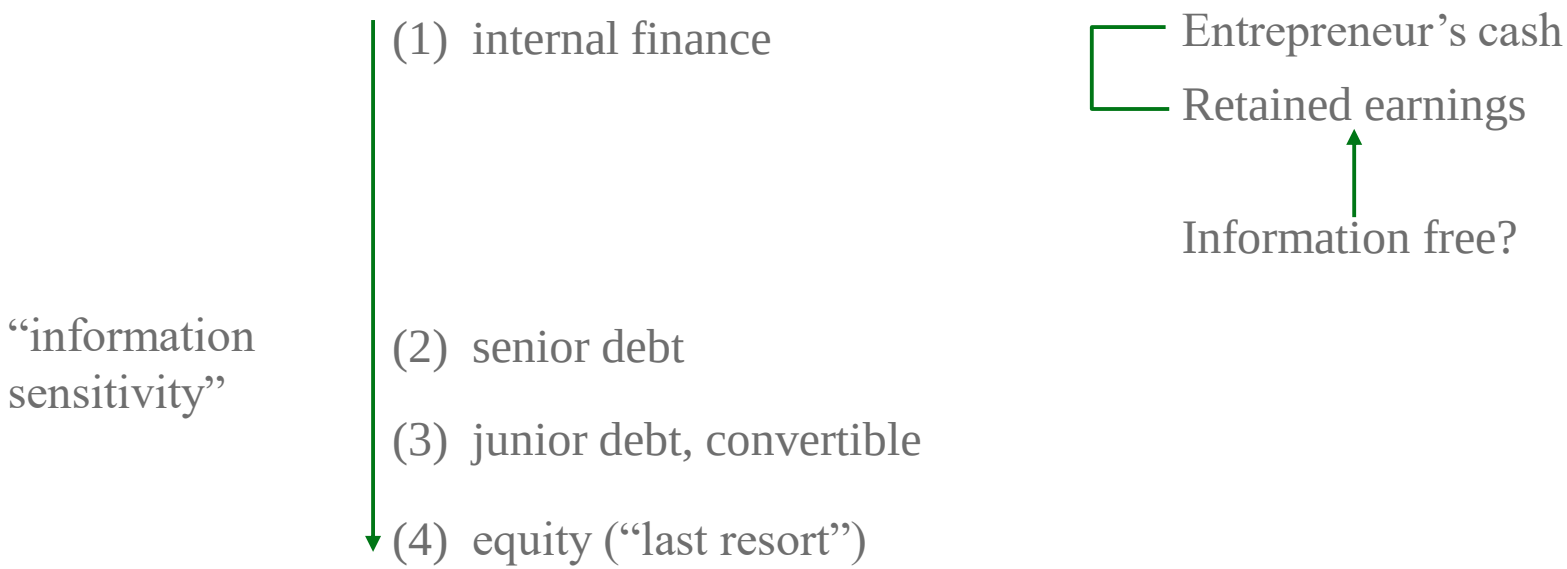
- Gaming and e-commerce giant is selling shares and convertibles
- The deal coincides with a resurgence of global stock sales

Decision to issue new shares often leads to a negative stock price reaction.

Consistent with our model, if decision to issue shares aims to benefit **existing** shareholders.



Pecking order theory (Myers 1984)



Pecking Order Theory II

Now assume that project failure gives R^F (salvage value) and success gives $R^S = R + R^F$.

Implies distinction between debt and equity claims.

Probability of success is p for a good borrower and q < p for a bad borrower.

Prior probability that the borrower is good given by α.

Prior mean probability of success: $m \equiv \alpha p + (1 - \alpha)q$

Assume: $mR^S + (1 - m)R^F > I$

Pecking Order Theory III

Reward to the borrower from success and failure: $\{R_b^S, R_b^F\}$

Conditional on borrower receiving funding, investors' breakeven condition is:

$$m(R^S - R_b^S) + (1-m)(R^F - R_b^F) \geq I$$

The good borrower maximizes her expected payoff: $pR_b^S + (1-p)R_b^F$

subject to the breakeven condition.

At the optimum, the breakeven condition binds. Rewrite:

$$[p - (1-\alpha)(p-q)](R^s - R_b^S) + [1 - p + (1-\alpha)(p-q)](R^F - R_b^F) = I$$

Pecking Order Theory IV

Use breakeven constraint to rewrite good borrower utility:

$$pR_b^S + (1-p)R_b^F = [pR^S + (1-p)R^F - I] - (1-\alpha)(p-q)[(R^S - R_b^S) - (R^F - R_b^F)]$$

Decreasing in R_b^F ! Increasing in R_b^S !

Thus, the good borrower prefers the contract with R_b^F = 0, where R_b^S is just large enough to make the investors' breakeven constraint bind:

$$m(R^S - R_b^S) + (1-m)R^F = I$$

Pecking Order Theory V

Summing up

The good borrower effectively offers safe debt obligation: $D = R^F$

Along with risky equity that grants a fraction R_l/R of profits in excess of R^F in case of project success, where:

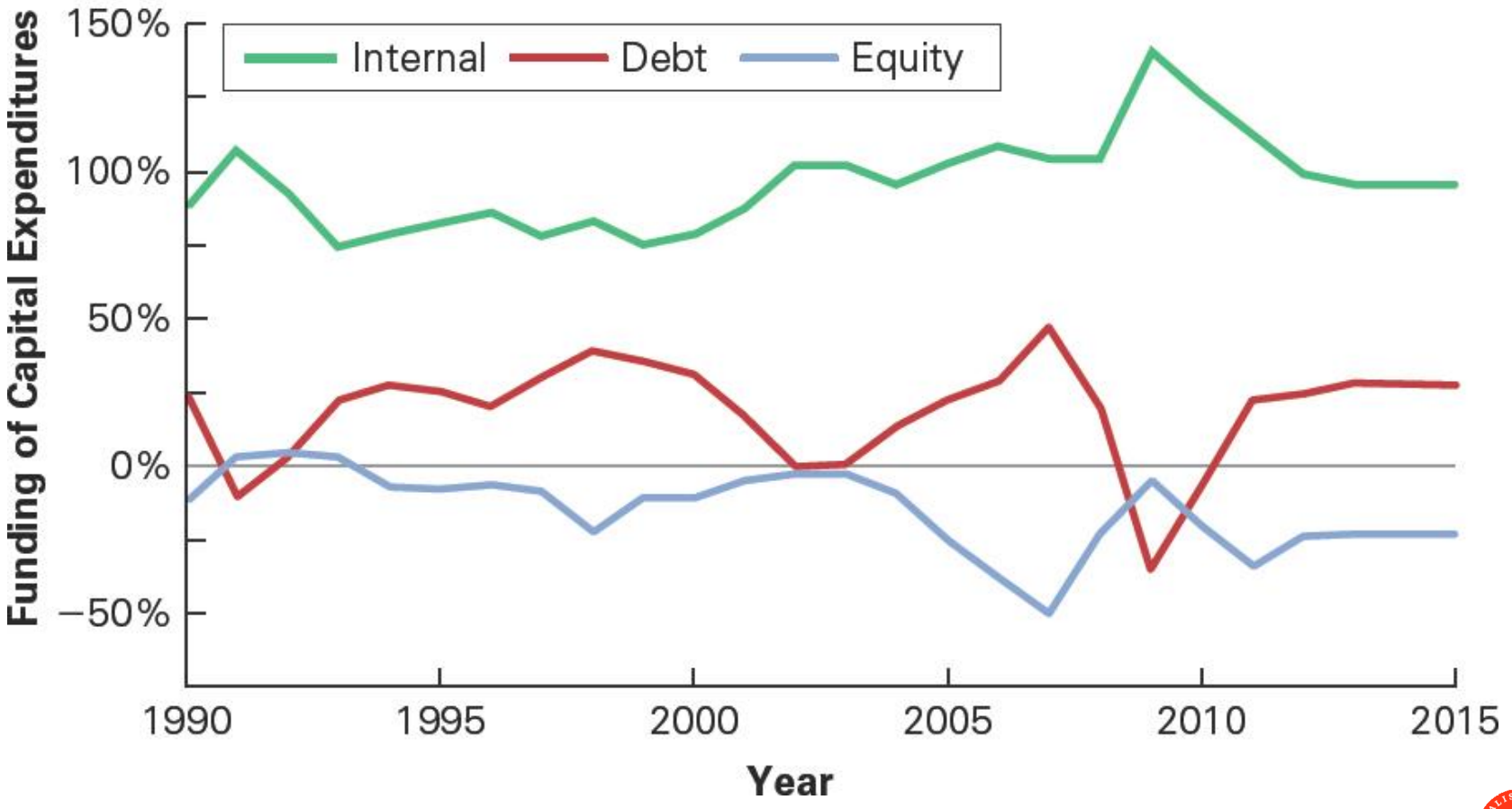
$$mR_l = I - D$$

The borrower must issue more equity when

- The adverse-selection problem is severe (low m)
- The investment cost is high (high I)

Start by issuing the claim least exposed to adverse selection, to minimize cross-subsidization with the bad borrower.

Figure 16.4 Aggregate Sources of Funding for Capital Expenditures, U.S. Corporations



Source: Federal Reserve Flow of Funds. Taken from Berk and DeMarzo, Corporate Finance, 5th Edition (2020).

Intended outcomes revisited

1. To show how asymmetric information about project quality can affect "good" borrowers' ability to raise funds. Adverse selection can lead to market breakdown or cross subsidization, where good borrowers effectively subsidize bad borrowers. Investors profits from good borrowers can cover their losses from bad borrowers.

2. To explain why information asymmetries can result in negative stock market reactions when firms announce that they will raise funds. Raising funds for a positive NPV investment may also reveal negative information about the firm's prospects. Firms with bad projects find it less costly to issue a claim on project returns.

3. To derive how asymmetric information can affect borrower incentives to issue equity vs debt. Good borrowers have an incentive to first issue the claim that is least sensitive to their private information. For example, issue safe debt before risky equity. Relation to Pecking Order Theory.

For next time

We will take a first look at "The Leverage Ratchet Effect" by Admati et al. (2018).

In this course, we will concentrate on Admatiet al. (2018)'s static model.

To prepare for Lecture 4, please watch the two videos in the module for that lecture: one about debt, the other about Admati et al. (2018)'s baseline model.