Econ 234C – Corporate Finance
Lecture 5: Internal Investment (III) - Introduction to MH

Ulrike Malmendier
UC Berkeley

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1 Recap: Asymmetric Information and Financing Frictions

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

- Investors' prior on success probability: $m \equiv \alpha p + (1 - \alpha)q$.

- *Key assumption*: project quality = private information of entrepreneur.

- Result:

  - No lending (market breakdown) if $\alpha < \alpha^*$ where α^* is defined by $(\alpha^* p + (1 - \alpha^*)q)R = I$.

  - Cross-subsidization if $\alpha \geq \alpha^*$.

- May also explain the 'Pecking Order of Financing'

  - Internal financing $\succ$ risk-free debt $\succ$ risky debt $\succ$ equity.

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

2 Approach II: Moral Hazard and Financing Frictions

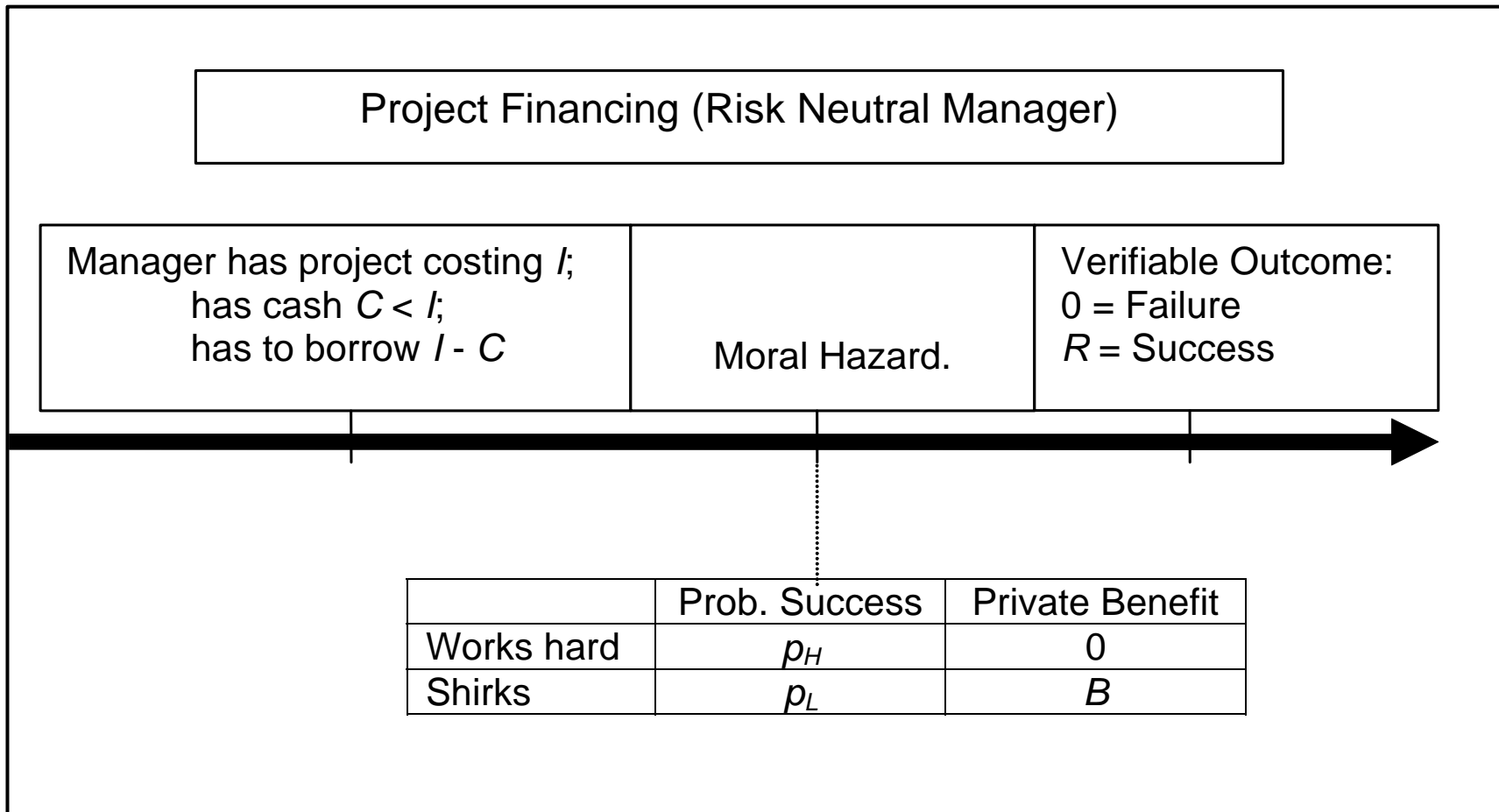Managers' interests may differ from owners' interests because of

- Disutility / cost of effort (laziness)

- Private benefits (perks such as expensive offices)

- Utility from having a larg firm = "empire building"

- Entrenchment (managers want to keep their job and choose investments that make them indispensable)

- Risk-aversion (manager chooses projects with lower NPV but lower downside if that helps to prevent them from being fired)

- Simple investment setting: Manager (entrepreneur, borrower) has investment costing I, cash on hand $C < I$.

- Manager can work hard or shirk.

  - Return consequences: $\begin{cases} \text{work hard} \implies \begin{array}{l} \text{return } R \text{ w/prob. } p_H, \\ \text{else return 0}; \end{array} \\ \text{shirk} \implies \begin{array}{l} \text{return } R \text{ w/pr. } p_L < p_H, \\ \text{else return 0.} \end{array} \end{cases}$

  - Private-benefit consequences: $\begin{cases} \text{work hard} \implies \text{priv. benefit 0}; \\ \text{shirk} \implies \text{priv. ben. } B > 0. \end{cases}$

  - *Note:* You can interpret 'work hard' either as 'having a disutility of effort, which is saved when shirking' or as 'choosing the less glamorous project.'

- **Timeline**:

Project Financing (Risk Neutral Manager)

Manager has project costing I; has cash $C < I$; has to borrow $I - C$	Moral Hazard.	Verifiable Outcome: 0 = Failure R = Success

	Prob. Success	Private Benefit
Works hard	p_H	0
Shirks	p_L	B

- Manager and (potential) investors are risk-neutral. Limited liability.

- Rate of return normalized to $r = 0$.

- Competitive external capital markets (zero profit given $r = 0$).

- Contracting assumptions:
  - Success or failure of the investment verifiable.
  - Effort not observable, not verifiable.

- Contracting problem (simple and 'extreme' version considered here):
  - Project has positive NPV if manager behaves: $p_H R - I > 0$.
  - Project has negative NPV if manager misbehaves, even if we include the manager's private benefit: $p_L R - I + B < 0$.
  - Hence, investor and manager must find a way to offset shirking incentive; otherwise no contract, no financing, no project, no returns.

- Contract suggestion:

    - Pay R_m to the manager if success, 0 if failure.

        * Only contracting option if we consider 'profit-sharing,' given limited-liability.

        * More generally: investor could pay manager also in case of failure. Even then $\{R_m, 0\}$ optimal. *Intuition:* positive transfers can only weaken incentives without providing insurance benefits. (Risk neutrality!)

    - Set R_m such that net payoff weakly higher if working: $R_m(p_H - p_L) \geq B$.

    - Minimum **agency rent** $R_m = \frac{B}{p_H - p_L}$.

- Knowing this, i.e., how much they need to pay the manager, do investors *want* to lend?

  - $p_H(R - \frac{B}{p_H - p_L})$, is the (expected) *pledgable income*.
  - The lending condition says: pledgable income has to be greater than investor outlay.

- We can solve the lending condition for the 'minimum required cash' the manager needs to

  – Call **threshold level** of cash (liquid assets) $\overline{C}$:

  $$\overline{C} = I - p_H\left(R - \frac{B}{p_H - p_L}\right)$$

– What about a manager with cash $C < \overline{C}$?

Answer: Project has positive NPV; yet, it will not be funded.

Intuition: With insufficient liquid assets, the manager/entrepreneur must borrow a large amount;

$\implies$ must pledge a large fraction of the return in case of success;

$\implies$ keeps only a small fraction of the return;

$\implies$ is demotivated and will shirk.

$\implies$ Investors and manager cannot find a loan agreement that both induces effort and allows investors to recoup their investment.

$\implies$ There is **credit rationing**.

('One only lends to the rich.')

Implications

1. Two types of determinants of credit rationing:

   - Low amount of cash on hand (low C).

   - High agency cost as measured by the size of the private benefit B relative to the likelihood ratio $\Delta p/p_H$, for a given NPV $p_H R$. (The **agency rent** is $p_H \frac{B}{p_H - p_L} = B/(\Delta p/p_H)$.)

2. Investment-cash flow sensitivity:

   - Holding constant the quality of the investment project and the private benefit, richer firms/managers are more likely to obtain financing and implement the project.

3 Debt Overhang

- *Debt Overhang* = Situation in which a profitable project (which would always be financed in the absence of previous claims) is not been financed due to 'overhanging debt' (previous claims).

  – Important topic in CF/contract theory:
  * Traditional treatment: Debt overhang prevents positive-NPV investments from being implemented.

  * Later treatment (Hart-Moore): Debt overhang prevents managers with misaligned incentives from wasting free cash flow!

  – Important topic in the context of International Finance, Trade, and Development: the debt stock of a country exceeds the country's future capacity to repay it. As a result the (developing) country cannot raise further funds, even for important and financially promising projects.

– Example: IMF research paper "Debt Overhang or Debt Irrelevance? Revisiting the Debt-Growth Link" by Tito Cordella, Luca Antonio Ricci, and Marta Ruiz-Arranz, which asks whether Highly Indebted Poor Countries (HIPCs) suffer from a debt overhang and whether debt relief is therefore going to improve their growth rates.

See http://www.imf.org/external/pubs/ft/wp/2005/wp05223.pdf.

(Their answer: There is a negative marginal relationship between debt and growth at intermediate levels of debt, but not at very low debt levels, below the "debt overhang" threshold, or at very high levels, above the "debt irrelevance" threshold. Countries with good policies and institutions face overhang when debt rises above 15-30 percent of GDP, but the marginal effect of debt on growth becomes irrelevant above 70-80 percent. In countries with bad policies and institutions, overhang and irrelevance thresholds seem to be lower.)

- Can the model of credit-rationing explain this phenomenon?
  - **Intuition**: The claims of previous investors reduces firm value / liquid assets below the threshold level.

Version 1 (simple extension of the credit-rationing model)

- Firm has positive cash, $C > 0$.
  - Actually: having positive cash and/or collateral would also work in the model.

- Firm owes D to prior investors (from previous borrowing).

- Previous borrowing contract:
  - Cash/collateral C is pledged to prior investors in case of default.
  - Covenant: firm cannot raise more funds without their consent. (**What is a covenant?**)

- Under what conditions would the project be financed if no previous debt?

  Answer:

- Under what conditions will the project be financed if previous debt?

  Answer:

Intuition: Investors as a whole (prior + new) cannot recoup the cost of their investment $(I - C)$ plus previous debt D.

Version 2 (Lack of Renegotiation)

- Investment project is *very* profitable: would attract funds even if firm has zero net worth

$$\overline{C} < 0.$$

  (What does a negative $\overline{C}$ mean, intuitively?)

- Firm no cash, $C = 0$.

- Firm owes D to prior investors (from previous borrowing).

  – Prior debt is a 'senior' claim.
    (**What does 'senior debt' mean?**)

– Debt overhang is sufficiently serious such that even the high profitability of the new project / the slack in pledgable income $-\overline{C}$ does not remedy the debt overhang problem:

$$p_H D > -\overline{C}$$

Question 1: Can the firm convince the *prior investors* to finance the project (if they have cash)?

- Insights:

  - If there is 'slack' in the pledgable income, $\overline{C} < 0$, then investment will happen.

  - If initial claimholders have cash to finance the new investment, they will always agree to do so.

Question 2: Can the firm convince *new investors* to finance the project (e.g., because the prior investors do not have any more cash)?

- How much income can be pledged to new investors?
  Answer:

- Thus, what is the condition under which new investors are willing to finance the project?
  Answer:

- Insights:
  - Even though there is 'slack' in the pledgable income, $\overline{C} < 0$, then investment will happen not happen pledgable income is less than cost of investment. This is **debt overhang.**

- Solution: If renegotiation with old firm is possible, prior investors might 'forgive some debt.'
  - How much debt will prior investors forgive?
    Answer:

- Idea:
  - Renegotiation benefits all sides.
  - Creditors benefit by getting $p_H \overline{D}$ instead of 0.
  - Firm benefits since gets payment for new project.
  - New investors benefit since they get (competitive) rate of return.

- In practice, whether or not renegotiation is possible depends on many factors.
  - Debt overhang more likely an issue with many creditors (renegotiation more complex, difficult).
  - Debt overhang also worse when asymmetric information included.
  - Political obstacles.

- Recent good example of debt renegotiation and its difficulties:
  - Treasury Department and a groupd banks announced a new plan (Project Lifeline) today (2/12/2008) to allow seriously delinquent homeowners / borrowers — meaning those who are more than 90 days behind on payments — to suspend foreclosure actions for 30 days. (Successor of earlier plan 'Hope Now.')
  $\rightarrow$ Illustrates the difficulties: joint attempt to overcome the difficulty of renegotiating with many creditors.

4 Investment-Cash Flow Sensitivity

- Statistics about Financing Sources 1970-1985 in Mayer (1990)

	US	Canada	UK	Japan	Germ.	France	Italy
Internal Funds	**66.9%**	54.2%	72.0%	33.7%	55.2%	44.1%	38.5%
Bonds + Loans	**32.8%**	18.9%	22.2%	43.8%	21.8%	43.8%	41%
Stock	**0.8%**	11.9%	4.9%	3.5%	10.8%	2.1%	10.8%
Other (adj.)	**−0.5%**	15.0%	0.9%	19.0%	12.2%	10.0%	9.7%

- **Insights**:
  - Internal funds (retained earnings) are a dominant source of financing in all countries.
  - Two directions:
    * When managers have little cash (internal funds), they underinvest.
    * When managers have lots of cash (internal funds), they over-invest.

- Our earlier comments:

  - Overinvestment is easy to link to Moral Hazard (Principal-Agent problems): whenever the manager has lots of cash, he invests in his pet projects and waste shareholders' money.
    We will model this more formally later. ('Free Cash Flow Problem.')

  - Underinvestment seems to have to do with 'credit constraints.' E.g., Managers cannot convince creditors that they have a good project.

- The models of the past classes suggest that also underinvestment and credit constraints might be linked to Moral Hazard.

  - Let's see how ...

- Let's introduce a variable name for pledgeable income: $\rho \equiv p_H(R - \frac{B}{\Delta p})$.

- Suppose our universe of firms have all the same investment project with cost I and returns R or 0 (with probabilities p_H or p_L and $1 - p_H$ or $1 - p_L$), but they are heterogeneous in

  - pledgeable income $p_H(R - \frac{B}{\Delta p})$ and

  - available cash C.

- Further suppose pledgeable income and C are independently distributed. (Note that, given the identical investment projects across firms, this amounts to B and C being independently distributed.)

  - Realistic?

– C distributed $\sim G(C)$, continuous cumulative distribution function with density $g(C)$.

• Which firms receive financing?

Answer:

• What is the aggregate investment?

(Remember that I, R, p_H, p_L are identical for all firms.)

Answer:

- Now consider a small, uniform increase in cash, δC for all firms. How does the aggregate investment change?

  Answer:

– Interpretation: I/CF sensitivity due to agency problems!

- How does the sensitivity of investment to cash-flow vary depending on how high the agency costs are (= how low the minimum required pledgeable income ρ_0 is)?
  Answer:

  - Interpretation:

    * If the density is increasing ($g' > 0$), then investment-cash flow sensitivity is lower for firms with low agency costs (lower minimum required ρ_0).

    * If the density is decreasing ($g' < 0$), then investment-cash flow sensitivity is higher for firms with low agency costs (lower minimum required ρ_0).

    * Hence: difficult to predict how I/CF sensitivity varies with measures of financial constraints.

- Final Remark: There are other reasons for I/CF sensitivity, which are equally plausible:

  - Asymmetric information

  - Differences in beliefs / Overconfidence

5 Readings for next class (and class after)

- Hubris; see syllabus.

- Start with M&A; see syllabus.