Course topic: **the firm**

- The firm has relationships with
    - Investors
    - Creditors
    - Suppliers
    - Employees (managers)
    - [customers, government, …]

- Applying *economics* to understand these relationships
    - The economics of information
    - Contract theory
    - Three essential informational problems
        - Hidden action
        - Hidden information
        - Non-verifiable information

- At the centre stage: the firm/investor relationship
    - How are firms managed?
    - How are firms financed?
    - How do informational problems affect these questions?

Textbook: Jean Tirole, *The Theory of Corporate Finance*

- A unified treatment of the topic
- Building on a simple model
  - Hidden action (moral hazard)
- Required reading: chapters 1 through 11, including supplementary sections (unless noted otherwise).

Overview

- Basics: one-stage financing – fixed and variable investment models. Applications.
- Multistage financing: liquidity management
- Financing under asymmetric information.
- Exit and voice in corporate governance.
- Control rights.

(in the book, but not in the course:
macroeconomic implications of corporate governance;
political economy of corporate governance)

Corporate governance

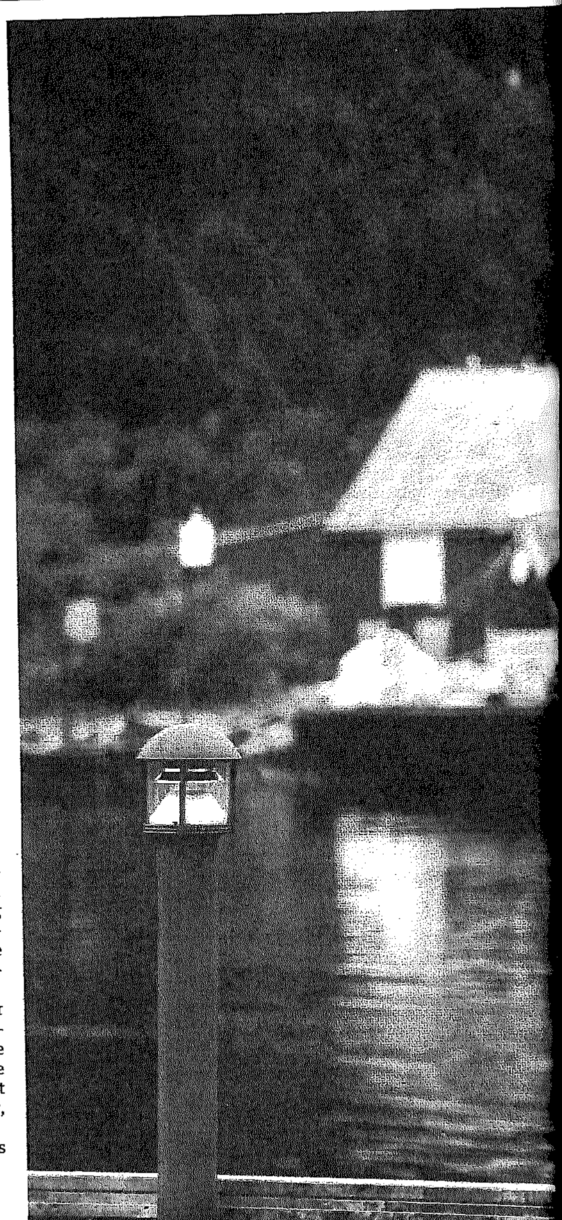
- How *suppliers of finance* to a firm make sure they get returns on their investments.
    - Investors
    - Creditors
- How *corporate insiders* can credibly commit to returning funds to outside investors, thus attracting external finance
    - Insiders: management; current owners
- A narrow definition
    - Stakeholders vs shareholders
        - Employees, customers, suppliers, communities
    - *Case*: Supply ship owners in Herøy.
        - *Dagens Næringsliv* 18 Aug 2016

The separation of ownership and control

- Berle and Means, *The Modern Corporation and Private Property* (1932).
    - Shareholder dispersion – managerial discretion
- Corporate insiders may not act in the interest of the providers of funds.
- How to deal with this problem?
    - Incentives
    - Monitoring

Hvis rederiene forsvinner blir det trist og mørkt her ute

Offshorereder Stig Remøy frykter Sunnmøres maritime klynge kan bli ødelagt av oppkjøp. Han mener Kjell Inge Røkke-eide Akers overtagelse av Rem Offshore var et varsko.



OLJESERVICE

Rune Ytreberg og Jacob Schultz
Fosnavåg/Oslo

De ruvende offshorebåtene ligger i opplag langs kaiene i Ålesund, hagene ved Fiskarstrand og verftene i Ulsteinvik. I hjertet av den maritime klyngen på Sunnmøre ligger nye og dyre båter uten oppdrag. For hver båt er 40 sjøfolk uten jobb.

– Sjøfolkene er veldig urolige, de frykter konsekvensene av restrukturering av flåten, og hva som blir igjen av den norske sjømann, sier ordfører Arnulf Goksøyr (H) i offshorekommunen Herøy.

Kommunen med 8000 innbyggere har 550 sjøfolk, og regionsenteret Fosnavåg er hjem for de fire offshorerederiene Rem Offshore, Havila Shipping, Olympic Shipping og franskeide Bourbon Offshore.

Krisen har rammet hardt, og næringen sliter med dårligere dagrater selv om mange båter er lagt i opplag.

– Vi har tre store rederier som kjemper for livet, sier Goksøyr.

Han sier at arbeidsledigheten i kommunen har steget til 5,4 prosent.

«Tvangsekteskap»

Det Kjell Inge Røkke-kontrollerte Aker-konsernet har inntatt førersetet i å konsolidere offshorebransjen, og bruker det Skudeneshavn-baserte rederiet Solstad Offshore som sitt verktøy, etter å ha gått inn som aksjonær og støttespiller. Aker blokkerte en foreslått refinansiering av Rem Offshore

2016 DN grafikk/GeoAtla

Olympic Shipping

- Offshorerederi i Fosnavåg med 23 skip, der tre er lagt i opplag.
- Gjeld på 4,9 milliarder kroner, samt et obligasjonslån på 800 millioner kroner som forfaller i september 2017.
- Stig Remøy er daglig leder, styreleder og hovedeier i selskapet.

etter å ha kjøpt seg inn i et av selskapets obligasjonslån, og Rem fusjonerte deretter med Solstad Offshore i det Rem-hovedeier Åge Remøy (66) beskrev som «et tvangsekteskap» etter et «bakholdsangrep».

– Dette er en viktig start på konsolideringen i offshorebransjen. Men mulighetene og behovet for videre konsolidering i sektoren er fortsatt stort. Aker ønsker å være en leder i denne prosessen, sa Aker-sjef Øyvind Eriksen da.

Åge Remøy stilte krav om at supplybåtene skal styres fra Fosnavåg slik at en beholder arbeidsplassene der.

Nedenfor rådhuset i Fosnavåg ligger kontoret til Olympic Shipping, som har tre skip i opplag. Både ordføreren og reder Stig Remøy i Olympic frykter at oppkjøp av lokale rederier kan true lokalt eierskap og hele den maritime klyngen på Sunnmøre.

– Hvis rederiene forsvinner blir det trist og mørkt her ute. Konsolidering vil påvirke mange arbeidsplasser. For det maritime clusteret på Sunnmøre er det helt avgjørende at rederiene blir her, sier Remøy.

Stig Remøy (57) er Åge Remøys (66) lillebror.

Internasjonal interesse

Også de London-baserte investorene og milliardærene Kristian Siem og John Fredriksen har signalisert interesse for å bidra til konsolidering og restrukturering av bransjen.

Remøy tror det er «veldig sannsynlig» at det blir færre rederier fremover.

– Alle rederiene har for mye gjeld med dagens utfordrende marked. Det er ikke mulig å betale avdrag som normalt. En nedbetalingsplan for bankgjeld på under ti år kunne håndteres ved å låne opp igjen på enkeltskip dersom verdiene tillot dette. Denne muligheten er borte nå og har skapt press på kapitalsituasjonen, sier Stig Remøy.

– Deler av selskapets verdi ligger i det lokale samarbeidet mellom rederier, verft og sjøfolk. Innovasjonskraften og denne kunnskapen kan forsvinne dersom oppkjøp er basert på å plukke billige skip fra bankene. Det er helt avgjørende for rederiene å kunne jobbe sammen med verft, leverandører og sjøfolk for å levere gode båter, sier Remøy, som mener det er behov for mer enn et rederi for å ta vare på konkurransen og innovasjonen i næringen.

Nei til Røkke

Også Olympic Shipping er tynget av gjeld og arbeider med refinansiering, men Remøy vil ikke la Røkke kjøpe selskapet.

– Røkkes fremgangsmåte med overtagelsen av Rem Offshore var et varsko. Akers modell passer ikke oss. Nå er Rem Offshore vekk, gone, for Sunnmøre. Det er en større tragedie for Sunnmøre at Sunnmøre mistet kontrollen over Rem Offshore, enn at vi tapte 100 millioner kroner på vår investering i Rem Offshore, sier Remøy.

Han mener Fredriksen kan være en god investor.

– Du skal ikke se bort ifra at John Fredriksen ser på Sunnmøre, sier Remøy, som håper det er mulig å bevare lokalt eierskap til offshorerederiene på Sunnmøre.

– Om det lages en bærekraftig modell håper jeg det er penger på Sunnmøre til det.

– Hvem har de pengene?

– Det vil vise seg, sier Remøy, som ikke vil navngi noen investorer.

Remøy presiserer at han ikke er mot investeringer og kapital utenfra, men tror det smarteste for investorer er å samarbeide med de lokale rederiene.

– De investorene som spiller på lag med den maritime klyngen på Sunnmøre vil få den beste avkastningen, sier Remøy.

Han går ned til kaia ved kontoret, slår ut med armen og peker på Fosnavågs nye svarte konserthus, The moral-hazard problem

- *Moral hazard* is an awkward term but the one commonly used
  - No implication of immoral behavior
  - Behavioral risk; hidden action
- Owner/manager conflict
  - Manager does not always act in the interest of owners
- Insufficient effort
  - Insufficient internal control of subordinates
- Allocation of effort across tasks
  - Workforce reallocation, supplier switching
- Overinvestment
  - Pet projects, empire building, acquisitions
- Entrenchment
  - Managers making themselves indispensable
  - Manipulating performance measures
  - Being excessively conservative in good times, excessively risk-taking in bad times
  - Resisting takeovers
  - Lobbying against shareholder activism
- Self-dealing
  - Perks: private jets, big offices, etc.
  - Picking successor
  - Illegal activities: theft, insider trading, etc.

When corporate governance does not work

- Lack of transparency
  - Shareholders do not observe compensation details, such as perks and stock options
- Level of compensation
  - Tripling of average CEO compensation in the US 1980-1994, a further doubling until 2001.
  - Average CEO/worker income ratio in the US went from 42 in 1982 to 531 in 2000.
  - CEO/worker compensation ratio among top US firms was at 296 in 2013, according to the Economic Policy Institute.
  - Proponents argue this is a byproduct of more performance-based pay.
  - Norway: average CEO/worker compensation ratio at 10 in 2005
    - Smaller companies than the US ones
    - Report by Randøy and Skalpe (2007)
- Fuzzy links between performance and compensation
  - Bebchuk and Fried, *Pay without Performance* (2004).
  - Compensation in an oil company based on stock price, when management has little control over the oil price.
  - Golden parachutes when leaving.
- Accounting manipulations
  - The Enron scandal.
  - Manipulating stock price, and therefore compensation.
  - Hiding bad outcomes and therefore protecting against takeovers.

Managerial incentives

- Monetary incentives
  - Compensation
    - Salary: fixed
    - Bonus: based on accounting data
    - Stock-based incentives: based on stock-market data
  - Bonuses vs. stock-holdings
    - Bonuses provide incentives for short-term behavior
    - Shares provide incentives for long-term behavior
    - The two are complements, not substitutes
  - The compensation base
    - Relative performance
  - Shares vs. stock options
    - Stock options provide stronger incentives
    - … but do not perform well after a downturn (excessive risk, lack of credibility).
  - Too low managerial incentives in practice?
    - In the US in the 1980s, the average CEO kept 3‰ of shareholder wealth; later estimate: 2.5%.
    - But incentives are costly to owners, because of manager risk aversion.
  - folk.uio.no/toreni/NilssenOpsjoner.pdf

- Implicit incentives
  - Keeping the job
    - Firing or takeover following poor performance
    - Bankruptcy
  - Career concerns
  - Explicit vs implicit incentives
    - Substitutes: Strong implicit incentives lower the need for explicit incentives
    - … but this is difficult to trace empirically.

Managerial incentives, cont.

- Monitoring
    - Boards of directors
    - Auditors
    - Large shareholders
    - Large creditors
    - Stock brokers
    - Rating agencies
- Active monitoring
    - Interfering with management in order to increase the value of one's claims in the firm.
        - Linked to control rights
    - Forward looking
    - Examples
        - large shareholders sitting on the board
        - resolutions at general assembly
        - takeover raids
        - creditor negotiations during financial distress
- Speculative monitoring
    - Not linked to control rights
    - Partly backward looking, aiming at *measuring* value, rather than at enhancing it.
    - Example: stock-market analysts, rating agencies
    - Provides incentives by making firm's stock value more informative about past performance.
- Product-market competition
    - Relative performance is easier
    - Exogenous shocks are filtered out
- The board of directors
    - Independence; attention; incentives; conflicts
    - Many differences across countries.

Investor activism

- Active monitoring requires control
- Formal control vs real control
  - Majority owner has formal control
  - Minority owners may have real control, convincing other owners of the need to oppose management
- Ownership structure important for the scope of investor activism
  - Institutional investors: pension funds, life insurers, mutual funds
  - Cross-shareholdings
    - Firms owning shares in each other
  - Ownership concentration: huge variations across countries
    - For example: US vs Italy
  - Ownership stability: again international variation
- Limits to active monitoring
  - Monitoring the monitor: incentive problems inside institutional investors
  - Externalities from monitoring
    - One shareholder's monitoring benefits all shareholders – underprovision of monitoring?
  - Costs of monitoring
    - Illiquidity
    - Focus by management on short-term news
    - Incentives for manipulating accounts

<u>The market for corporate control</u>

- Takeovers
  - Keep managers on their toes
  - Make managers act myopically
- Takeover bids: tender offer
- Takeover defenses
  - Corporate charter defenses
    - Making it technically difficult to acquire control
    - Staggered board
    - Supermajority rules
    - Differential voting rights
  - Diluting the raider’s equity
    - Scorched-earth policies: selling out those parts of the firm that the raider wants
  - Poison pills
    - Current shareholders having special rights to purchase additional shares at a low price in case of a takeover attempt
  - White knight
    - An alternative acquirer who is friendly to the current management
  - Greenmail
    - Repurchases of stock from the raider, at a premium
    - Management colluding with the raider, at the expense of other owners.
- Leveraged buyout (LBO)
  - Going private, borrowing to finance the share purchase
  - Management buyout (MBO): an LBO by management

The role of debt in corporate governance

- Debt provides management discipline
  - Management must make sure there is cash flow available in the future for paying back debt
  - Management has less cash available for perks
  - If the firm does not pay back debt, creditors can force the firm into bankrupty
- Debtholders are more conservative then equityholders
  - Debtholders suffer from bad projects, but get no extra benefit from good projects.
- But there are limits to debt
  - Debt means the firm is less liquid, which is costly.
    - Internally generated funds are the cheapest source of capital available for firms.
  - Bankruptcy is costly.

International comparison

- Two broad legal traditions
  - Common law
    - Independent judges
    - Limited codification
    - US, UK
  - Civil law
    - Politically appointed judges
    - Codification
    - France, Germany, Scandinavia

- Differences across legal systems
  - Shareholders have more protection in common law countries.
  - Correspondingly, common-law countries have a higher ratio of external capital to GDP.
  - Common-law countries have a more dispersed ownership of firms.

Shareholders vs stakeholders

- Corporate social responsibility.
- The shareholder-value position: taking care of stakeholders through regulations and contracts.

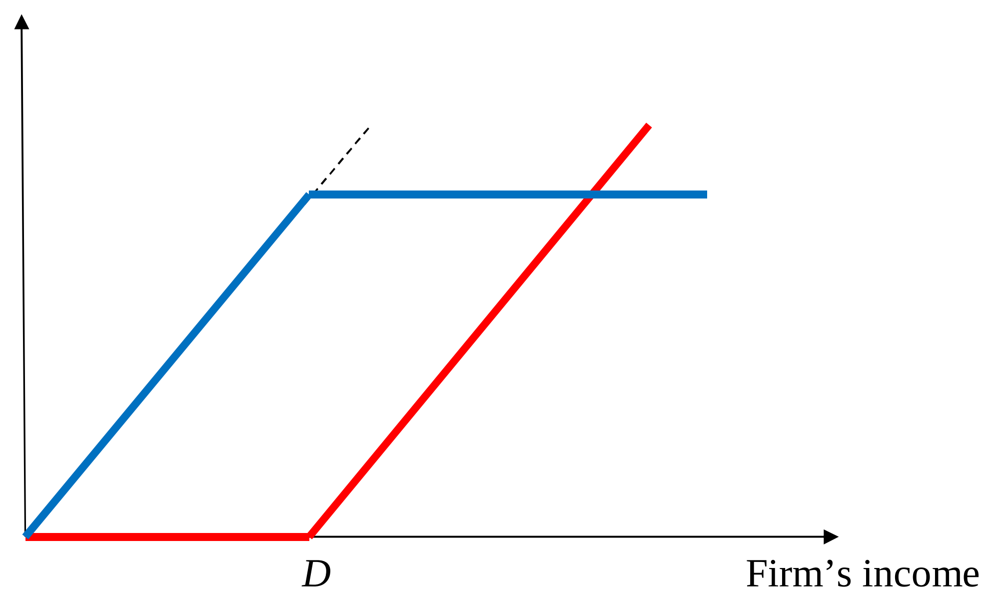
Note: Supplementary section to Tirole's ch. 1 is *not* required reading.

Corporate financing

Two main financial instruments

- debt
- equity

Essentially, debt has a concave return, and equity has a convex return.



Blue – Debt holders' return

Red – Equity holders' return

Question: Who would be more interested in taking risk – the debt holder or the equity holder?

Modifying the picture

- The firm is ongoing, producing not only a single return.
- Who holds the claim matters
    - Equity: insiders (managers, etc.) vs outsiders
    - Debt: banks vs bond holders
- Claims also bring various *control rights* (rights to make decisions)
    - Example: debt holders may seize control if payment is not done according to contract.
- Returns may be hard for outsiders to verify, particularly in small firms.
- Ordinary debt vs secured debt
    - Collateral
- Richness of claims
    - Senior debt vs junior (or subordinated) debt
        - Return for junior debt neither concave nor convex
    - Preferred stock
        - Fixed payment, like debt, but the firm is not obliged to pay.
    - Convertible debt
        - An option for holder to convert from debt to equity.
    - *Mezzanine finance*: in between debt and equity
        - Junior debt, preferred stock, convertible debt.

Financial structure

- The firm's debt-equity mix
- Under some circumstances, it does not matter
  - Modigliani and Miller (1958).
  - Simple illustration: Assume risk neutrality, and consider the case from slide 1.

    D – debt repayment

    V_E – value of equity

    V_D – value of debt

    R – firm income

    Total firm value = $V_E + V_D$

    $$= \boldsymbol{E}[\max(0, R - D)] + \boldsymbol{E}[\min(R, D)]$$

    $$= \begin{cases} E[0] + E[R], & \text{if } R < D; \\ E[R - D] + E[D], & \text{if } R \geq D. \end{cases}$$

    $$= E[R].$$

  - The firm's total value is independent of D.
- Also, *dividend policy* has no effect on firm value.
- The Modigliani-Miller theorem does not hold when corporate insiders do not have proper incentives to maximize total firm value.

  Other causes for the theorem to break down

    - Tax considerations
    - Bankruptcy law

Debt instruments

- Collateral
    - Securing the debt

- Public vs private placement: the liquidity of debt
    - Public bonds
    - Securitization

- Maturity
    - Short term vs long term
    - Trade credit: borrowing from suppliers
    - Long-term: debt covenants

Debt covenants

- Covenants preventing value reduction: the *"conflict view"*
    - Preventing actions that do not increase risk
        - Restrictions on payments to shareholders
        - Limits on further indebtedness
    - Preventing actions that increase risk: *asset substitution*
        - Prohibitions against new lines of business
        - Earmarking
- Covenants defining control rights: the *"control view"*
    - Shift of control if performance is bad
        - Leverage constraint: total debt not exceeding a certain fraction of total assets
        - Minimum amount of liquidity (working capital)
    - Completing the control view
        - Informational covenants
            - reports to lenders, rights of inspection, etc.
        - Covenants limiting accounting manipulations

Bankruptcy process

- Priority rules
    - 1. administrative costs; 2. unpaid taxes; 3. wages; 4. secured debt; 5. junior debt; …; equity holders
- Reorganization

Two dichotomies in the credit market

- One among lenders, the other among borrowers
- Lenders
    - Sophisticated lenders
        - Concentrated, well-informed
        - Relationship investors
        - Banks, institutional investors, etc.
    - Dispersed lenders
        - Public bondholders, trade creditors
        - Numerous, with a free-rider problem
    - Claims issued to the two groups differ greatly
        - Screening: *ex-ante* monitoring
        - Covenants: sophisticated creditors have more and tighter covenants
        - Seniority, security, maturity
        - Financial distress
            - Renegotiation easier with sophisticated investors
        - Certification
            - Having a sophisticated creditor conveys good news to outsiders

Two dichotomies in the credit market, cont.

- Borrowers
  - High-quality vs low-quality borrowers
  - High-quality borrowers have more long-term debt
  - High-quality borrowers can borrow from dispersed investors, low-quality ones must stick to sophisticated investors.
  - High-quality borrowers have less restrictive debt covenants.

The life cycle of equity financing

- Start-up financing
  - Privately held by sophisticated investors
    - Venture capitalists, large customers, etc.
  - Screening, conditions
  - Venture capital: Similar to sophisticated debt holders, with the addition of equity-like control rights (firing manager, controlling financing, etc.)
- Initial public offerings (IPOs)
  - Going public: Most firms don't get this far
  - The costs of going public
    - Information disclosure
    - Underpricing of IPOs: winners' curse?
      - Shares traded at a premium shortly after IPO
    - Private information
    - Giving away control rights: hard for family firms
  - The benefits of going public
    - Diversifying sources of finance
    - Facilitating exit
    - Provides a better measure of firm value
    - Helps disciplining managers: takeover threats
      - But reduced monitoring: dispersed owners
- Seasoned public offerings (SPOs)

Sources of corporate finance

- Figure 2.4, p. 96, in the book.
- Most important: internal financing, that is, retained earnings
- External financing: mostly banks, well ahead of new equity
    - *Net* equity issuance may even be negative
- Bond market: only in the US.
- Tradeoff retained earnings vs payout to investors.
    - Tradeoff funds now vs funds later
        - Retaining earnings now makes it difficult to attract external funds today but provides funds for later.
        - Growth opportunities call for retention
        - Financial constraints call for payout
        - Earnings size calls for payout
    - Dividends vs. payout to debtholders
        - Related to *financial structure*: debt vs equity
        - Table 2.5, p. 99, in the book.
        - Risky firms have a low debt/equity ratio.

Credit rationing

- Loan markets are special
    - Personalized
    - Clearing through *both quantities and prices*
- This is because of private information among borrowers
    - Adverse selection: There are both good and bad firms out there, and banks cannot tell who is who.
    - Moral hazard: Banks cannot observe actions taken by firms.
- Increasing the interest rate makes the borrower care less about the project that is being financed.
    - Lower borrower's income in the absence of bankruptcy
    - No effect on her income in case of bankruptcy
- Moral hazard: a reduced stake reduces incentives
- Adverse selection: an increased interest rate attracts low-quality borrowers
- In equilibrium, borrowers may be *rationed*.
- In order to get outside financing, you may need own funds.

A simple model: Fixed investment

Project costs I.
Entrepreneur has equity $A < I$; borrows $I - A$; is protected by LL.

Moral hazard

Verifiable outcome

	Pr (success)	Private benefit
Behaves	p_H	0
Misbehaves	p_L	B

R p

0   $1 - p$

- A risk neutral entrepreneur has a project requiring a fixed investment I.
  - If success: project return is R. If failure, return is 0.
- The entrepreneur has own funds $A < I$.
  - A = *net worth*, or cash on hand.
- She needs to borrow $I - A$ to carry out the project.
- Project is risky, and success depends on entrepreneur's effort.
  - Misbehaving lowers the success probability of this project ($p_L < p_H$), but creates private benefits B to the entrepreneur.
  - $\Delta p = p_H - p_L$.
- Assume project is viable *if and only if* entrepreneur behaves
  - *Net present value* (NPV) if she behaves: $p_H R - I > 0$.
  - NPV if not: $p_L R - I + B < 0$.
  - In combination: $\dfrac{p_H R}{I} > 1 > \dfrac{p_L R}{I - B}$
  - No loan will be granted that induces misbehavior.
- <u>Loan contract</u>: If success, borrower gets R_b, lender $R_l = R - R_b$.
- *Limited liability*: If failure, both receive 0.

- <u>Lenders</u> are risk neutral and behave competitively.
- Competition among lenders implies $p_H R_l = I - A \Rightarrow R_l = \dfrac{I-A}{p_H}$.
- The interest rate is given by: $R_l = (1 + \iota)(I - A) \Rightarrow 1 + \iota = \dfrac{1}{p_H}$.
    - For $p_H < 1$, there is a default premium: $\iota > 0$.
- Are lenders interested at these terms? – Credit analysis.
    - Need to preserve borrower a sufficient stake in order to induce incentives
    - The *incentive compatibility constraint*

$$p_H R_b \geq p_L R_b + B \Rightarrow R_b \geq \frac{B}{\Delta p}$$

        - What the borrower gets from behaving must be more than what she gets from misbehaving
        - There is a lower limit on the borrower's return
            - Increasing in the private benefits B.
            - Decreasing in the effect of behaving Δp.
    - The maximum income that can be *pledged to lenders* without inducing misbehavior is

$$R - \frac{B}{\Delta p}$$

    - *Expected pledgeable income* is therefore

$$P = p_H\left(R - \frac{B}{\Delta p}\right)$$

- Lenders' *individual rationality constraint*

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

  - Expected pledgeable income must exceed lenders' initial expenses
  - Other names
    - breakeven constraint
    - participation constraint
  - A *necessary (and sufficient) condition* for financing of the entrepreneur's project
- Minimum level of own funds in order to get outside financing

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

- Assumption:

$$\overline{A}>0\Leftrightarrow\left(0<\right)p_H R-I<p_H\frac{B}{\Delta p} \qquad (*)$$

  - Otherwise, even a borrower without any wealth of her own would get credit
  - NPV of project is less than the minimum that must be left to the borrower in order to ensure incentives.
- A project may have NPV > 0, and still not get funded
  - This happens in cases where $A<\overline{A}$.
  - "One only lends to the rich".

- The *agency rent*: what must be left to the borrower to ensure incentives

$$p_H \frac{B}{\Delta p}$$

- The condition $A \geq \bar{A}$ says that agency rent net of borrower's own input must be less than the project's NPV

$$p_H \frac{B}{\Delta p} - A \leq p_H R - I$$

- The borrower's net utility

$$U_b = 0, \quad \text{if } A < \bar{A};$$

$$= p_H R_b - A = p_H(R - R_l) - A = p_H R - I, \quad \text{if } A \geq \bar{A}.$$

  - The borrower gets the entire net present value, if only she can get the project funded.

- Determinants of credit rationing
  - Little cash on hand (low A)
  - High agency costs (high $p_H \frac{B}{\Delta p}$).

- Moral hazard determined by two factors
  - The extent of private benefits from misbehavior: B
  - The extent to which the verifiable final outcome reveals misbehavior
    - Informativeness measured by the *likelihood ratio*

$$\frac{\Delta p}{p_H} = \frac{p_H - p_L}{p_H}$$

- Is this debt or equity?
    - Debt: Entrepreneur owes R_l and must pay this or go bankrupt
    - Equity: Entrepreneur and investor own R_b/R and R_l/R each in the firm.
- A few dynamic considerations
    - A second investment (sec. 3.2.4)
        - Dilution of initial lenders' claim
        - Overinvestment
        - Argument for a negative *debt covenant* prohibiting further debt
    - Reputational capital (sec. 3.2.5)
        - The borrower would gain by a lowering of private benefits *B*.

$$b < B \Rightarrow \overline{A}(b) < \overline{A}(B)$$

        - A more reliable borrower is more likely to get loan
        - Two benefits of successful projects today
            - Increased retained earnings: *A* higher
            - Improved reputation: (lenders' perception of) *B* lower

Relative performance evaluation

- Making agents accountable for events they have no control over weakens incentives in general
- One should always try to make use of the most precise measurement of the agent's performance – the *sufficient statistic* (Holmström, 1979).
- Benchmarking
- Reinterpreting the model in terms of benchmarking
  - Three states of nature
    - Favorable state (probability p_L): Project will succeed whatever the entrepreneur does.
    - Unfavorable state (probability $1 - p_H$): Project will fail whatever the entrepreneur does.
    - Intermediate state (probability $\Delta p = p_H - p_L$): Success not guaranteed but will result if entrepreneur behaves.
  - No-one knows the true state. But lenders can – say, by looking at other firms in the same industry – learn whether or not the state is favorable.
  - Contract: Entrepreneur receives nothing in the favorable state; otherwise, she receives R_b if success.
  - Incentive compatibility constraint is the same: $R_b \geq \frac{B}{\Delta p}$
  - But *pledgeable income* is increased, since entrepreneur is not paid for being lucky: $p_H R - \Delta p \frac{B}{\Delta p} = p_H R - B$.

Debt overhang

- Project is profitable, but entrepreneur is unable to raise funds because of previously incurred debt
- Two interpretations
  - Previous investors have collateral claims that reduce net worth A to below the threshold level $\bar{A}$.
  - Previous debt needs to be renegotiated in order to enable new investments.

Previous debt reduces net worth

- Suppose the entrepreneur has A in cash but owes D to the initial investors.
- Initial investors insisted on a covenant specifying that further loans require their consent
- The assets A are pledged as collateral to initial investors in case of default.
- Let $A > \bar{A} > A - D \geq 0$.
- The new project would have been undertaken in absence of previous debt but is not undertaken, because the investors (old and new together) cannot recoup their expenses ($I - A$) plus the previous debt (D), since $A - D < \bar{A}$, but they can get D by seizing the collateral, since $A \geq D$.

Lack of renegotiation with previous lenders

- Suppose the borrower has no cash: $A = 0$
- But $\bar{A} < 0$: the project would be able to attract funds even without any net worth for the borrower.
- The borrower has already a long-term debt D, which is due later.
- The problem cannot be overcome by the (expected) profitability of the new project: The slack in pledgeable income, $-\bar{A}$, is smaller than what has to be paid back to previous investors, $p_H D$, if the project is funded:

$$p_H D > -\bar{A} \Leftrightarrow \bar{A} + p_H D > 0$$

- Initial investors may want to put in more funds, since they get nothing in case of bankruptcy now ($A = 0$).
- But what if initial investors have no funds available? Are new investors willing? The problem is that old debt is senior, and that the borrower needs to keep a minimum stake in the project to ensure incentives; so expected pledgeable income is

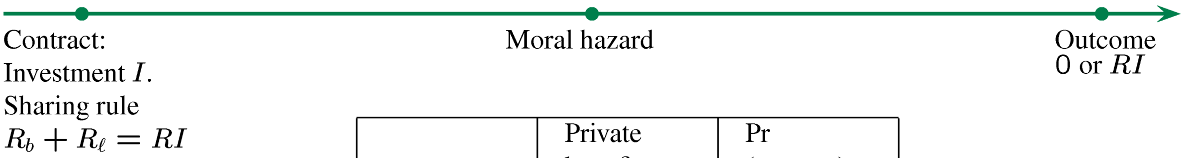
$$p_H\left(R - \frac{B}{\Delta p} - D\right)$$

- New investors are willing to fund if and only if:

$$p_H\left(R - \frac{B}{\Delta p} - D\right) \geq I \Leftrightarrow \bar{A} + p_H D \leq 0$$

- This contradicts the assumption above.
- It is impossible to raise funds from new investors unless some debt forgiveness is renegotiated with old investors.

Borrowing capacity: a variable-investment model



	Private benefit	Pr (success)
Behaves	0	p_H
Misbehaves	BI	p_L

- Constant returns to scale in investment: Investing $I \geq 0$ yields a return RI if success, 0 if failure, with $R > 0$.
- Borrower's private benefit from misbehaving: BI, with $B > 0$.
- Borrower can choose to behave or not.
- Borrower's cash: A; must borrow $I - A$ to invest I.
- Loan contract: $\{R_b, R_l\}$, where $R_b + R_l = RI$.
- Assume project is profitable if and only if borrower behaves

$$p_H R > 1 > p_L R + B$$

- … but that NPV per unit of investment is less than agency costs per unit

$$p_H R - 1 < \frac{p_H B}{\Delta p}$$

  - Equivalent to the $\overline{A} > 0$ assumption in the fixed-investment model
  - Needed here to ensure equilibrium investment being finite, because of the constant-returns-to-scale technology.

- Lenders behave competitively
- Lenders' credit analysis
  - Incentive compatibility: $R_b \geq \dfrac{BI}{\Delta p}$
  - Breakeven: $p_H(RI - R_b) \geq I - A$
  - Borrower's net utility: $U_b = (p_H R - 1)I$
    - The borrower would like as much funding as possible.
- The equity multiplier
  - Determined by incentive compatibility and breakeven constraints. Combining them, we get

    $I \leq kA$, where

    $$k = \frac{1}{1 - p_H\left(R - \dfrac{B}{\Delta p}\right)} > 1.$$

  - The borrower can lever her wealth, with the *equity multiplier k*.
  - The *equity multiplier* is smaller, the higher is the private benefit B, and the lower is the likelihood ratio $\Delta p/p_H$ – our two measures of agency cost.

- The entrepreneur's *borrowing capacity*.
    - Outside financing capacity; debt capacity
    - It is possible for the borrower to invest k times her cash A, that is, to borrow $d = k - 1$ times her cash, where

$$d = \frac{p_H\left(R - \frac{B}{\Delta p}\right)}{1 - p_H\left(R - \frac{B}{\Delta p}\right)}.$$

    - The maximum loan, dA, is the *borrowing capacity*.
    - The borrowing capacity
        - increases with per-unit return R
        - decreases with the extent of the agency problem
- The *shadow value of equity*
    - Borrower's gross utility: $U_b^g = A + U_b$
    - Combine $U_b = (p_H R - 1)I$ and $I = kA$ to get:

$$U_b^g = vA, \text{ where } v = \frac{p_H \frac{B}{\Delta p}}{1 - p_H\left(R - \frac{B}{\Delta p}\right)} > 1$$

    - The shadow value of equity v
        - increases in the per-unit return R
        - decreases in the extent of the agency problem

- Useful notation
  - *Expected payoff per unit of investment*: $\rho_1 = p_H R$
  - *Expected pledgeable income per unit of investment*:
    $$\rho_0 = p_H\left(R - \frac{B}{\Delta p}\right)$$
  - Earlier assumptions imply: $\rho_1 > 1 > \rho_0$.
  - The equity multiplier: $k = \dfrac{1}{1-\rho_0}$
  - The borrowing capacity per unit of net worth: $d = \dfrac{\rho_0}{1-\rho_0}$
  - The shadow value of equity: $\nu = \dfrac{\rho_1 - \rho_0}{1-\rho_0}$
  - Borrower's net utility: $U_b = (\nu - 1)A = (\rho_1 - 1)I$.
- Note: Firms with a low agency cost has a greater *sensitivity of investment to cash flow*.

$$\frac{\partial^2 I}{\partial A \partial \rho_0} = \frac{\partial k}{\partial \rho_0} = \frac{1}{(1-\rho_o)^2} > 0.$$

The maximal incentives principle

- Resolving the debt vs equity question.
- *Salvage value* of assets
    - Investing $I \geq 0$ yields a return $R^S I$ if success, $R^F I$ if failure, with $R^S > R^F > 0$.
    - Define $RI = (R^S - R^F)I$ as the profit increase following success.
    - When secondary asset markets perform better, we should expect R^F to be higher.
- Generalizing $\rho_1 > 1 > \rho_0$:

$$p_H R + R^F > 1 > p_H \left(R - \frac{B}{\Delta p} \right) + R^F$$

- Contract: $\{ R_b^S, R_b^F, I \}$ – how much to invest, and how much of the returns generated that the borrower should have following success and failure.
- The optimal contract maximizes the entrepreneur's net utility,

$$p_H R_b^S + (1 - p_H) R_b^F - A,$$

subject to two constraints:

- the entrepreneur's incentive compatibility constraint:

$$R_b^S - R_b^F \geq \frac{BI}{\Delta p}$$

- the investors' breakeven constraint:

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

- In equilibrium, both constraints will be binding.

- As before, the entrepreneur receives all the NPV:

  $$U_b = (p_H R + R^F - 1)I$$

- In equilibrium, the entrepreneur receives nothing following failure: $R_b^F = 0$.

  - Suppose instead $R_b^F > 0$. Then one can reduce it, and increase R_b^S, at a rate $\frac{\Delta R_b^F}{\Delta R_b^S} = -\frac{p_H}{1-p_H}$, keeping the breakeven constraint binding and the entrepreneur's utility unchanged; but this would make the incentive compatibility constraint slack – a contradiction.

- An all-equity firm is not optimal

  - With no debt, the entrepreneur would, after a failure, receive her share of $R^F I$ corresponding to her share of the firm's stocks.

- Outside investors must hold debt $D \geq R^F I$.

- Borrowing capacity: $I = kA$, and so $D = I - A = dA = (k - 1)A$, where now

  $$k = \frac{1}{1-\left[p_H\left(R-\frac{B}{\Delta p}\right)+R^F\right]}.$$

- Firms borrow more

  - the lower agency costs are;

  - the more liquid assets are.

- *Incentives are maximized when outside investors hold a combination of debt and equity.*

Extensions of the analysis

- Supplementary sections to chapter 3
- A *continuum of effort levels*, disutility of effort $g(e)$
- A *continuum of outcomes*, probability of outcome R with effort level e is $p(R|e)$.
- Linking effort and outcome: higher effort tends to increase income – *the monotone likelihood ratio property* (MLRP)

$$\frac{\partial}{\partial R}\left[\frac{\frac{\partial p(R \mid e)}{\partial e}}{p(R \mid e)}\right] > 0$$

- Essentially same result: A *standard debt contract* – making entrepreneur a residual claimant for the marginal income above the debt repayment level
- Risk aversion – brings in another problem: the *insurance/incentives tradeoff*.
    - Providing incentives means making the risk averse entrepreneur take part in the lottery.
    - A solution exists if effort can be verified after contracts are signed, but before outcome is realized, so that contracts can be *renegotiated*. This makes it possible to separate the insurance and incentives problems.

- *Semi-verifiable* outcome
  - Outcome from investment not verifiable, unless outside investors incur an *audit cost*.
  - The incentive problem is related to hiding income, rather than to enjoying private benefits or reducing effort.
  - Outcome is reported by entrepreneur: $\hat{R}$.
  - The problem for outsiders is to induce truthful reporting.
  - Contract now includes a probability $y(\hat{R})$ of no audit for each report $\hat{R}$.
  - Again, a standard debt contract.
- *Non-verifiable* outcome
  - Not even an audit can verify outcome.
  - Repayment is the result of threats of termination or nonfinancing of future projects.

Further determinants of borrowing capacity: Boosting pledgeable income

- Diversification: more than one project
- Collateral: pledging real assets
- Liquidity: a first look
- Human capital

Diversification

- It may be beneficial for a firm, in terms of getting hold of external funds, to have several projects.
- Equivalently, it may be beneficial for multiple project owners to merge into one firm.
- Previous analysis: constant returns to scale in investment technology
- Expansion in investment project equivalent to an increase in the number of projects whose outcomes are perfectly correlated.
- Consider the opposite extreme: Several projects are available, and they are statistically independent.
- *Cross pledging*: Incomes on one successful project can be offered as "collateral" for other projects.
- Model: Two identical projects. Otherwise: as in the fixed-investment model
- Entrepreneur's initial wealth per project: A; *i.e.*, total wealth: $2A$.

- A benchmark: project financing. For each of the two projects:
  - Borrower receives R_b if success, 0 otherwise.
  - Incentive constraint: $R_b \geq \frac{B}{\Delta p}$
  - Breakeven constraint: $p_H\left(R-\frac{B}{\Delta p}\right) \geq I-A$, or: $A \geq \bar{A}$.
  - Project financing not viable if $A < \bar{A}$.
- *Cross pledging*
  - The two projects financed in combination
  - Contract: Borrower receives R_0, R_1, or R_2 when 0, 1, or 2 projects are successful.
  - Expected return to borrower:

$$p_H^2 R_2 + 2p_H(1-p_H)R_1 + (1-p_H)^2 R_0$$

  - Two incentive constraints:
    - Working on two projects preferred to working on only one

$$p_H^2 R_2 + 2p_H(1-p_H)R_1 + (1-p_H)^2 R_0 \geq$$
$$p_H p_L R_2 + [p_H(1-p_L) + p_L(1-p_H)]R_1 + (1-p_H)(1-p_L)R_0 + B$$

    - Working on two projects preferred to working on none

$$p_H^2 R_2 + 2p_H(1-p_H)R_1 + (1-p_H)^2 R_0 \geq$$
$$p_L^2 R_2 + 2p_L(1-p_L)R_1 + (1-p_L)^2 R_0 + 2B$$

  - Clearly, $R_0 = 0$ in equilibrium, as before.

- *Full cross pledging*: We also have $R_1 = 0$ in equilibrium.
  - In order to increase the borrowing capacity, the borrower offers all returns that are available in those cases where only one project succeeds.
  - We can simplify the incentive constraints.
  - Working on both projects better than on none:

$$p_H^2 R_2 \geq p_L^2 R_2 + 2B \iff$$
$$(p_H^2 - p_L^2) R_2 \geq 2B \iff$$
$$(p_H + p_L) R_2 \geq 2\frac{B}{\Delta p} \iff$$
$$\frac{p_H + p_L}{2} R_2 \geq \frac{B}{\Delta p}$$

  - Working on both projects better than on a single one:

$$p_H^2 R_2 \geq p_H p_L R_2 + B \iff$$
$$p_H R_2 \geq \frac{B}{\Delta p}$$

  - This one is always satisfied when the previous one is.
  - It follows that, in equilibrium, $R_2 \geq \dfrac{2B}{(p_H + p_L)\Delta p}$

- Minimum expected payoff to borrower:

$$p_H^2 R_2 \geq \frac{2 p_H^2 B}{(p_H + p_L)\Delta p} = 2(1 - d_2)\frac{p_H B}{\Delta p},$$

where $d_2 = \dfrac{p_L}{p_H + p_L} \in \left(0, \dfrac{1}{2}\right)$ is an agency-based measure of the *economies of diversification* into two independent projects.

- The breakeven constraint:
  - Expected pledgeable income ≥ investors' expenses

$$2p_H R - 2(1-d_2)\,\frac{p_H B}{\Delta p} \geq 2I - 2A \Leftrightarrow$$

$$p_H R - (1-d_2)\,\frac{p_H B}{\Delta p} \geq I - A \Leftrightarrow$$

$$A \geq \overline{\overline{A}}, \text{ where } \overline{\overline{A}} = I - p_H\left[R - (1-d_2)\frac{B}{\Delta p}\right] < \overline{A}$$

  - Recall: $\overline{A} = p_H \dfrac{B}{\Delta p} - (p_H R - I) = I - p_H\left[R - \dfrac{B}{\Delta p}\right]$

- *Diversification and cross pledging* facilitates financing: $\overline{\overline{A}} < \overline{A}$

- *Statistical independence* of projects similarly facilitates financing.

- *Variable investment*: Diversification increases the borrowing capacity, rather than giving better access to financing.

- Extension to n independent projects: Let borrower have net worth nA. Breakeven constraint for investors now becomes:

$$p_H R - (1-d_n)\,\frac{p_H B}{\Delta p} \geq I - A,$$

where $d_n = \dfrac{p_L\left(p_H^{n-1} - p_L^{n-1}\right)}{p_H^n - p_L^n}$ increases with n.

- Limits to diversification
  - Endogenous correlation: The borrower has an incentive to choose correlated projects, if she can. This decreases the value of cross pledging. → *Asset substitution*.
  - Limited expertise.
  - Limited attention.

- Sequential projects
  - Supplementary section 4.7
  - Variable investment in two projects.
  - Benchmark: simultaneous projects
    - Investment I_i in project $i \in \{1, 2\}$.
    - Return RI_i if success in project i, 0 otherwise
    - Probability of success p_H (p_L) if the borrower behaves (misbehaves)
    - Private benefit from misbehaving in project i: BI_i.
    - Total investment: $I = I_1 + I_2$.
  - Optimal with reward only when both projects succeed: R_b.
  - Binding incentive constraint: misbehavior on both projects

$$p_H^2 R_b \geq p_L^2 R_b + BI$$

    - We disregard misbehavior on one project for now
  - Total net present value: $(p_H R - 1)I$
  - Investors' breakeven constraint:

$$p_H RI - p_H^2 \frac{BI}{p_H^2 - p_L^2} = I - A$$

  - In equilibrium,

$$I = \frac{A}{1-\hat{\rho}_0}, \text{ where}$$

$$\hat{\rho}_0 = p_H\left(R - \frac{p_H}{p_H + p_L}\frac{B}{\Delta p}\right) = p_H\left[R - (1-d_2)\frac{B}{\Delta p}\right], \text{ and}$$

$$U_b = (p_H R - 1)I = \frac{\rho_1 - 1}{1-\hat{\rho}_0}A$$

- Checking the other incentive constraint: misbehavior on project *i*:

$$p_H^2 R_b \geq p_H p_L R_b + BI_i$$

- Combining with the other incentive constraint:

$$\frac{I_i}{I} \leq \frac{p_H}{p_H + p_L}$$

  - This constraint does not bind if total investment is split relatively equally among the two projects

- Sequential projects: Short-term loan agreements

  - Financing one project at the time.

  - Increased incentives early on: success at the first project provides the borrower with extra funds for the second project.

  - Think ahead and reason back.

  - Project 2: the single-project variable-investment case, with the borrower entering date 2 with assets A_2.

  - Expected payoff per unit of investment: $\rho_1 = p_H R$

  - Expected pledgeable income per unit of investment:

$$\rho_0 = p_H \left(R - \frac{B}{\Delta p} \right)$$

  - Borrower's gross utility from project 2:

$$vA_2 = \frac{\rho_1 - \rho_0}{1 - \rho_0} A_2$$

  - $v > 1$ is the *shadow value of equity*: If you can increase your assets at the start of date 2 with 1 unit, then you increase your utility with v.

- Project 1: Borrower's initial assets A. Return if success: $RI_1 = R_b + R_l$
- Investors' breakeven constraint

$$P_H R_l \geq I_1 + A$$

- Borrower's incentive constraint: $vR_b \geq \frac{BI_1}{\Delta p}$
- Expected pledgeable income per unit of investment

$$\tilde{\rho}_0 = p_H\left(R - \frac{B}{v\Delta p}\right) = \rho_1 - \frac{\rho_1 - \rho_0}{v} = \rho_1 + \rho_0 - 1.$$

- *Debt capacity* at date 1: $I_1 = k_1 A$, where

$$k_1 = \frac{1}{1-\tilde{\rho}_0} = \frac{1}{2-\rho_0-\rho_1} > \frac{1}{1-\rho_0} = k$$

- Assume $\frac{\rho_0 + \rho_1}{2} < 1$; otherwise, debt capacity is infinite.
    - Recall earlier assumption: $\rho_1 > 1 > \rho_0$.
- The borrower invests in project 2 if and only if project 1 is successful. She then invests:

$$I_2 = kA_2 = kR_b = \frac{kB}{v(\Delta p)} I_1 =$$

$$\frac{\frac{1}{1-\rho_0}B}{\frac{\rho_1-\rho_0}{1-\rho_0}\Delta p} I_1 = \frac{B}{p_H \frac{B}{\Delta p}\Delta p} I_1 = \frac{1}{p_H} I_1$$

- Expected investments in the projects are the same:

$$p_H I_2 = I_1$$

- *Stakes increase over time*: $I_2 > I_1$

- Sequential vs simultaneous projects

$$U_b^{seq} = p_H v A_2 - A = (p_H v \frac{B}{v(\Delta p)} k_1 - 1)A$$

$$U_b^{seq} = \frac{2(\rho_1 - 1)}{2 - \rho_0 - \rho_1} A > \frac{\rho_1 - 1}{1 - \hat{\rho}_0} A = U_b^{sim}$$

$$\Leftrightarrow \hat{\rho}_0 < \frac{\rho_0 + \rho_1}{2} \Leftrightarrow d_2 = \frac{p_L}{p_H + p_L} < \frac{1}{2}$$

  - Note error in Tirole, p. 186.

- Sequentiality is better: The borrower has no chance to misbehave on project 2 if project 1 fails, so the moral hazard problem is less serious.

- Long-term loan agreements

  - One agreement for both projects
  - A long-term agreement can never do worse than a sequence of short-term agreements.
  -
  - Risk neutrality and constant returns to scale imply that short-term agreements fair equally well.

Collateral

- Assets = cash + productive assets
- Productive assets = quasi-cash, since they may be *pledged as collateral* to lenders
- *Redeployability* of productive assets
    - Fixed-investment model, with one new feature.
    - Suppose, after investment is made but before effort is put in, it becomes publicly known whether the project is *viable*
    - With probability x, the project is viable and the model proceeds as before
    - With probability $(1 - x)$, the project is not viable, and assets can be sold at a given price $P \leq I$.
    - *Economic distress*, as opposed to financial distress.
    - New assumption on NPV: $xp_H R + (1 - x)P > I$.
    - The entrepreneur chooses to pledge the resale price in full.
    - Breakeven constraint for investors:
    $$xp_H\left(R - \frac{B}{\Delta p}\right) + (1 - x)P \geq I - A$$
    - Threshold level of net worth:
    $$\bar{A} = xp_H\frac{B}{\Delta p} - \left[xp_H R + (1 - x)P - I\right]$$
        - Decreases with asset redeployability
    - *Borrowing patterns across industries*: The more liquid assets, the easier it is for firms borrow.
    - Endogenous redeployability: *fire sale externalities* – further aggravating credit rationing.

Collateral is costly

- A deadweight loss associated with collateralization: assets may have lower value for lenders than for the borrower
  - Transaction costs
  - Borrower's private benefit from ownership: sentimental values, specific skills
  - Prospects of future credit rationing makes the asset of higher value to the borrower than to investors
  - Risk aversion
  - Collateralized assets may receive poor maintenance

Costly collateral and contingent pledging

- Suppose first collateral would not exist without the investment.
- Borrower has no cash initially, needs to borrow I.
- Asset has residual value
  - A to the entrepreneur
  - $A' \leq A$ to the lenders
  - Deadweight loss if asset is seized: $A - A'$
- Contract: $\{R_b, R_l, y_S, y_F\}$
  - y_S – probability that the borrower keeps the asset if success
  - y_F – … if failure
  - *stochastic pledging*: needed in a simple model
- Otherwise, fixed-investment model.

- The equilibrium contract is the one that maximizes borrower's utility, subject to borrower's incentive-compatibility constraint and lenders' breakeven constraint.

  Max $U_b = p_H(R_b + y_S A) + (1 - p_H)y_F A$

  subject to

  $\Delta p[R_b + (y_S - y_F)A] \geq B$, and

  $p_H[R_l + (1 - y_S)A'] + (1 - p_H)(1 - y_F)A' \geq I$

- Borrower wants to pledge as little collateral as possible

- The outcome depends on *the strength of the balance sheet* of the borrower

  - Strength of balance sheet depends on
    - Investment level I (–)
    - Agency costs, measured by $p_H \dfrac{B}{\Delta p}$ (–)
    - Any initial cash, $\tilde{A}$ (+)
  - *Strong balance sheet* – no collateral

    $y_S = y_F = 1$; $R_b > 0$.

  - *Intermediate balance sheet* – collateral if failure:

    $y_S = 1$, $y_F \leq 1$; $R_b \geq 0$.

  - *Weak balance sheet* – borrower gets a share of the asset if success:

    $y_S \leq 1$, $y_F = 0$; $R_b = 0$.

    - *Contingent pledging*: borrower gets a contingent share of the asset rather than of income.

Solution: derivative of the Lagrangian with respect to y_S is positive if that with respect to R_b or that with respect to y_F is. Some of the three regimes may not exist.

- *Weak borrowers pledge more collateral than strong borrowers*
    - Pledging collateral in lack of cash
    - Opposite prediction from adverse-selection theories, where strong firms pledge collateral to show strength.

<u>Pledging existing assets</u>

- Suppose next that the entrepreneur has existing wealth
- *Contingent pledging*
    - If success, the entrepreneur keeps the asset.
    - If failure, the investors receive the collateral.
- Continuous collateral: the entrepreneur chooses an amount $C \in [0, C^{max}]$ to pledge as collateral in case of failure.
    - We need an upper limit on C^{max}; see below.
- Costly collateral: Value βC to investors, where $\beta < 1$.
- Borrower's net utility: Project's NPV without collateral minus expected deadweight loss from pledging collateral.

$$U_b = p_H R - I - (1 - p_H)(1 - \beta)C$$

- To ensure that $U_b \geq 0$ for any feasible C, we assume

$$C^{max} \leq \frac{p_H R - I}{(1 - p_H)(1 - \beta)}$$

- Collateral costly $\Rightarrow C = 0$ if $A \geq \bar{A}$.

- The borrower's incentive compatibility constraint

$$p_H R_b - (1 - p_H)C \geq p_L R_b - (1 - p_L)C + B \Leftrightarrow$$

$$R_b + C \geq \frac{B}{\Delta p}$$

  - The borrower loses both the reward and the collateral when she fails
  - *Limited liability*: In order to ensure that $R_b \geq 0$ for any feasible C, we assume:

$$C^{max} \leq \frac{B}{\Delta p}$$

- The investors' breakeven constraint

$$p_H (R - R_b) + (1 - p_H)\beta C \geq I - A \Leftrightarrow$$

$$p_H \left(R - \frac{B}{\Delta p}\right) + p_H C + (1 - p_H)\beta C \geq I - A$$

- Collateral has two ways of affecting pledgeable income

  - Directly: $+ (1 - p_H)\beta C$

  - Indirectly through a lower reward to borrower: $+ p_H C$

- Borrower pledges the minimum collateral necessary to satisfy the investors' breakeven constraint:

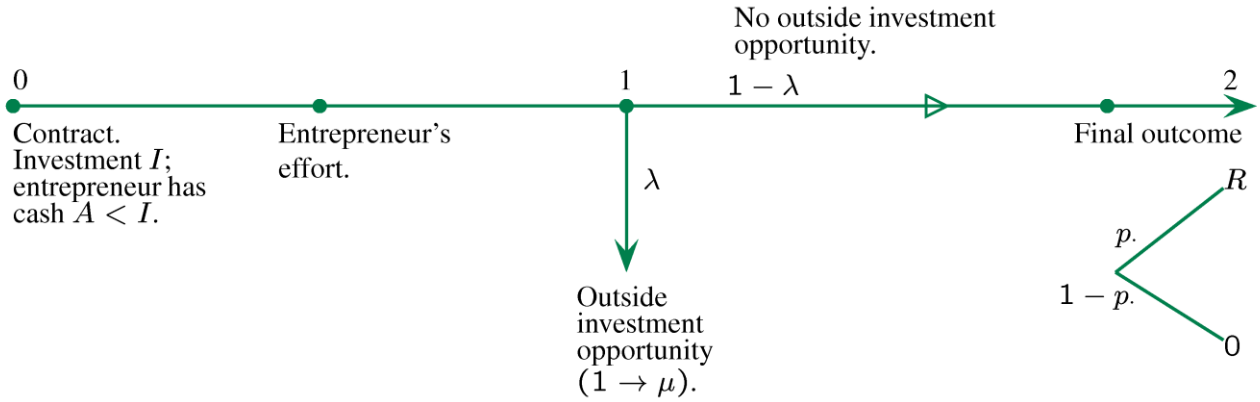
$$C = \frac{I - A - p_H\left(R - B/\Delta p\right)}{p_H + (1 - p_H)\beta}$$

  - … except if this expression gets too big, in which case collateral cannot solve the funding problem.

- Weaker firms pledge more collateral: $\frac{dC}{dA} < 0$.
- Conditional collateral preferable to unconditional.
- More abstract forms of collateral: Putting one's job at stake.

The liquidity-accountability tradeoff

- When should the borrower receive her compensation?
  - Towards the end: good for accountability, because more information about the project is available
  - Along the way, because of her need for liquidity
    - Consumption
    - New projects
- Outside investment opportunities not observable for investors
  - A scope for "strategic exit", escaping sanctions following poor performance
- The other side of the coin: the liquidity of investors
  - The more control you have, the less liquid your assets are
- Model: an extension of the fixed-investment one



- New feature: A new, fleeting investment opportunity at an intermediate date
- Initial investment I, entrepreneur's assets $A < I$.

- Moral hazard: misbehavior means a lower success probability ($p_L < p_H$) but also a private benefit B.
- Project returns at final date: R or 0 (whether or not an intermediate investment opportunity shows up).
- Limited liability, risk neutrality.
- Project would have been financed in the absence of the intermediate liquidity needs:

$$A > \overline{A}$$

- *Liquidity shock*: With probability λ, a new investment opportunity arises.
    - Investing x returns μx, where $\mu > 1$.
- Contract: $\{r_b, R_b\}$. Borrower receives
    - r_b on the intermediate date and nothing on the final date, in the case of a liquidity shock.
    - R_b on the final date if success (0 if failure) and nothing on the intermediate date, in the case of no liquidity shock.
- What if the liquidity shock is not verifiable?
- *Exit vs vesting*: what about *partial vesting*? – Some cash at the intermediate date and some payment at the final date (if success).
- Implementation: where does r_b come from? – Needs to be subtracted from pledgeable income.

- Benchmark case: *Verifiable liquidity shock*
- Borrower's incentive compatibility constraint

$$\lambda\mu r_b + (1-\lambda)p_H R_b \geq \lambda\mu r_b + (1-\lambda)p_L R_b + B \Leftrightarrow$$

$$(1-\lambda)(\Delta p)R_b \geq B \Leftrightarrow$$

$$R_b \geq \frac{1}{1-\lambda}\frac{B}{\Delta p}$$

  - No incentive effect from r_b.
  - Only effect of the liquidity shock is that the borrower's stake must be increased, since final date is reached only with probability $(1-\lambda)$.

- Borrower receives r_b with probability λ. So this is similar to no liquidity shock, but the entrepreneur having available $A - \lambda r_b$.
- Expected pledgeable income:

$$p_H R - \{\lambda r_b + (1-\lambda)p_H \frac{1}{1-\lambda}\frac{B}{\Delta p}\} = p_H\left(R - \frac{B}{\Delta p}\right) - \lambda r_b.$$

- Competition among investors ensures that the borrower gets the NPV from the project. So her total expected net utility is

$$U_b = p_H R - I + \lambda(\mu - 1)r_b.$$

- It is optimal to have r_b as high as possible subject to incentive compatibility:

$$p_H\left(R - \frac{B}{\Delta p}\right) - \lambda r_b = I - A$$

- In equilibrium: $r_b = \frac{1}{\lambda}\left[p_H\left(R - \frac{B}{\Delta p}\right) - (I - A)\right];\ R_b = \frac{1}{1-\lambda}\frac{B}{\Delta p}.$

- *Non-verifiable liquidity shock*
- A *two-dimensional moral-hazard problem*. Incentives needed for borrower
    - to behave in carrying out the project, and
    - to report truthfully about the liquidity shock
- The two forms of moral hazard interact
    - *Strategic exit*: A misbehaving borrower may want to exit even without a liquidity stock before the consequences are disclosed.
- Simplifying assumption: $p_L = 0 \Rightarrow \Delta p = p_H$
    - A misbehaving borrower would indeed want to cash out early, since there is nothing to be had later: $p_L R_b = 0$.
- Borrower's incentive constraint

$$\lambda\mu r_b + (1 - \lambda)p_H R_b \geq [\lambda\mu + (1 - \lambda)]r_b + B \Leftrightarrow$$

$$(1 - \lambda)[p_H R_b - r_b] \geq B \Leftrightarrow$$

$$(1 - \lambda)[(\Delta p)R_b - r_b] \geq B \Leftrightarrow$$

$$R_b \geq \frac{r_b}{\Delta p} + \frac{1}{1-\lambda}\frac{B}{\Delta p}$$

- Compare with the case of verifiable liquidity shock: the possibility of a strategic exit makes the incentive constraint stricter (for a given $r_b > 0$).
- When there is no liquidity shock, the borrower strictly prefers to continue: $p_H R_b > r_b$.
- But would the borrower want to cash out when there *is* a liquidity shock? Is $\mu r_b \geq p_H R_b$? – Suppose first that it is.

- Again, competition among investors ensures that all NPV of the project accrues to the borrower. So, given r_b, her expected net utility is:

$$U_b = p_H R - I + \lambda(\mu - 1)r_b.$$

- But the incentive constraint is stricter, so pledgeable income is smaller. Therefore, r_b is lower when liquidity shock is non-verifiable.

- Expected pledgeable income for a given r_b:

$$p_H R - \left\{ \lambda r_b + (1-\lambda) p_H \left[\frac{r_b}{\Delta p} + \frac{1}{1-\lambda} \frac{B}{\Delta p} \right] \right\} = p_H \left(R - \frac{B}{\Delta p} \right) - r_b$$

- In equilibrium:

$$r_b = p_H \left(R - \frac{B}{\Delta p} \right) - (I - A);\ R_b = \frac{1}{1-\lambda} \frac{B + (1-\lambda) r_b}{\Delta p}$$

- Compared to the case of verifiable liquidity shock:

  r_b is lower, R_b is higher.

  - The possibility of strategic exit hurts the borrower, since she is allowed less liquidity.

- If the above contract does <u>not</u> obey $\mu r_b \geq p_H R_b$:

  - Happens when A is low.

  - Solution: *partial vesting*. Only implementation changes.

    - Total compensation has two components: One, a basis compensation, R_b^0, paid out in case of success.

    - At the intermediate date, the borrower receives cash r_b. She can choose to buy shares for this, which would pay ΔR_b in case of success, where

$$R_b^0 + \Delta R_b = R_b$$

Inalienability of human capital

- Is there a scope for the loan contract to be *renegotiated* as the project proceeds?
- A *renegotiation* must mean that the existing contract is not efficient for the parties involved – that a new contract exists that is weakly better for both borrower and lender, and strictly better for at least one of them.
- *Hold-up*: Suppose the entrepreneur is *indispensable* – the project cannot be completed without her. The entrepreneur may want to renegotiate the initial contract in order to obtain a better deal.
  - The *inalienability of human capital*.
- Model: no moral hazard: $B = 0$; no cash: $A = 0$.
- Otherwise, fixed-investment model.
- The act of "completing the project" cannot be contracted upon until after investment has been made: Renegotiation is needed.
  - Renegotiation replaces effort as the source of the incentive problem.
- Incomplete project returns 0.
- Complete project returns R [prob p_H] or 0 [prob $(1 - p_H)$].
- Disregarding renegotiation, the project can be financed by a debt contract: borrower pays investors D in case of success, such that $p_H D = I$.
  - $R_l = D$, $R_b = R - D$, and $U_b = p_H(R - D) = p_H R - I$.
- Renegotiation: Bargaining over $p_H R - I$.

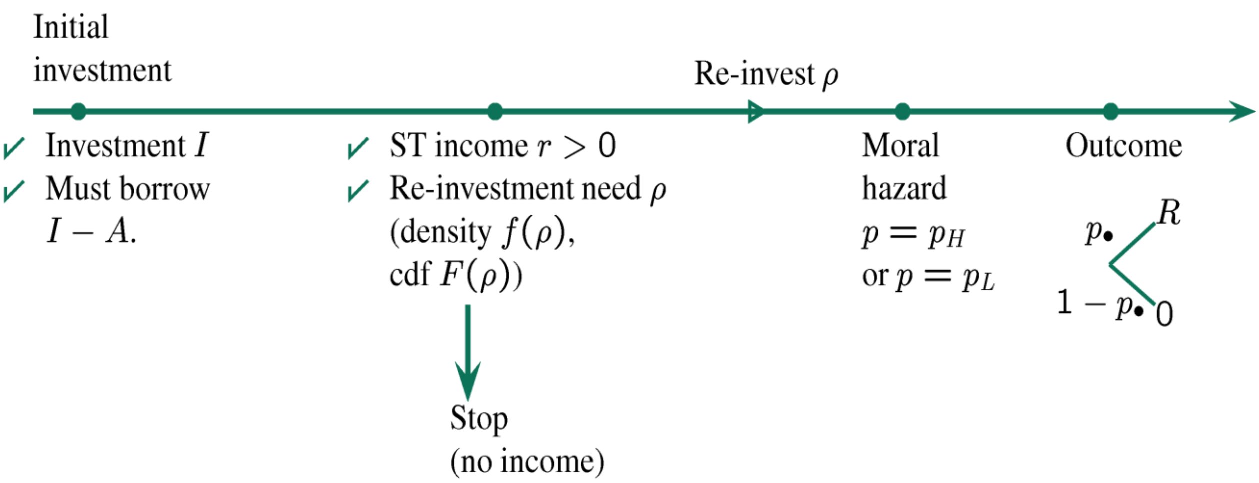
- Who has *bargaining power*?
    - No longer competition among creditors: lender has b.p.
    - Entrepreneur is indispensable: borrower has b.p.
    - Both receive 0 in case of noncompletion of project
- Lender's bargaining power: θ
    - In the renegotiation, lender receives θR in case of success, and borrower receives $(1 - \theta)R$.
    - Lender willing to invest if $\theta p_H R \geq I$.
    - If $\theta > D/R$, then the borrower prefers to simply skip the renegotiation and complete the project.
    - If $\theta < D/R$, then $\theta p_H R < p_H D = I$: the project will not be financed.
    - If the borrower is too indispensable, the project is not carried out.
- Determinants of bargaining power
    - Reputations on both sides
    - Dispersion of lenders
    - Outside options
- If possible, the borrower may want to give the lenders the right to seize the firm's assets – in order to secure some external finance.
- A parallel to collateral – the value of the collateral may depend on how indispensable the entrepreneur is.

Liquidity management

- Multistage financing
- An intermediate date between the financing stage and the realization of the project outcome.
- Following up on the discussion of the liquidity/accountability tradeoff in chapter 4.
- The borrower needs to prepare for a liquidity shock.
- The borrower should hoard reserves.
  - Holding liquid securities
  - Credit line
  - Retensions
- Hoarding of reserves is an insurance mechanism
  - True even if borrower is risk neutral
  - Value of funds higher in bad states than in good states, because of credit rationing.
  - Borrower wants to transfer wealth from good states to bad states. This is what an insurance contract does.

Basic model

- Fixed investment, with a stochastic need for reinvestment at an intermediate date.



- Date 0: Investment I, own assets A, borrowing need $I - A$.
- Date 1 – the intermediate date:
  - Investment yields a short-term return r; deterministic and verifiable.
  - Continuation requires a *reinvestment* of size $\rho \geq 0$, *ex ante* unknown: probability distribution $F(\rho)$, density $f(\rho)$.
  - The value of ρ becomes known at date 1.
  - No reinvestment means liquidation of the firm, liquidation value 0.
- Date 2 – in case of reinvestment at date 1: Investment returns R if success, 0 if failure. Success probability p depends on borrower's effort: $p = p_H$ if she behaves, $p = p_L < p_H$ if not.
- Risk neutrality. Limited liability. Competition among lenders.
- Contract: $\{r_b, R_b, \rho^*\}$
  - r_b and R_b – what borrower receives at dates 1 and 2.
  - ρ^* – the cutoff reinvestment requirement: continue if and only if $\rho \leq \rho^*$.
- Borrower's net utility equals net present value of the project:

$$U_b(\rho^*) = [r + F(\rho^*)p_H R] - \left[I + \int_0^{\rho^*} \rho f(\rho) d\rho\right]$$

  - Second term: expected total investment
- Borrower's incentive constraint:

$$R_b \geq \frac{B}{\Delta p}$$

- Borrower receives 0 at date 1: $r_b = 0$.
  - All of r is paid out to outside investors.
  - Zero r_b increases R_b and alleviates the incentive problem at date 2.
- Expected pledgeable income:

$$\mathcal{P}(\rho^*) = r + F(\rho^*)p_H \left[R - \frac{B}{\Delta p}\right] - \int_0^{\rho^*} \rho f(\rho) d\rho$$

  - Investors must cover all the reinvestment

- NPV is maximized at $\rho^* = p_H R = \rho_1$.
  - $U_b'(\rho^*) = f(\rho^*)p_H R - \rho^* f(\rho^*)$.
  - For $\rho^* < \rho_1$, the expected gain from rescuing the project is larger than the cost.
- Pledgeable income is maximized at $\rho^* = p_H\left[R - \dfrac{B}{\Delta p}\right] = \rho_0$.
  - For $\rho^* > \rho_0$, the cost to the investors from continuing is larger than what they expect to get in return.

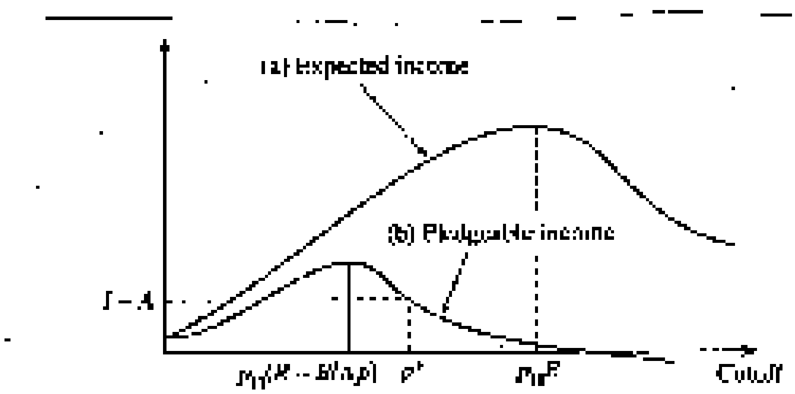


Figure 5.2, p. 204

- Three cases
  - Efficient cutoff: $\mathcal{P}(\rho_1) \geq I - A$.
    - The NPV-maximizing cutoff leaves enough for the investors: $\rho^* = \rho_1$.
  - Too much liquidation: $\mathcal{P}(\rho_1) < I - A \leq \mathcal{P}(\rho_0)$
    - $r_b = 0$, $R_b = B/\Delta p$, and

      $$\rho^* \in [\rho_0, \rho_1) \text{ solves } \mathcal{P}(\rho) = I - A$$
    - Credit rationing at date 1: In order to secure funds at date 0, the borrower accepts a reduced reinvestment cutoff at date 1.
  - No funding: $I - A > \mathcal{P}(\rho_0)$
    - Even maximizing pledgeable income is not enough.

Maturity at a cash rich firm

- *Cash rich firm*: $r > \rho^*$; high short-term returns.
- Implementing the optimal contract
  - Short-term debt: $d = r - \rho^*$.
  - Long-term debt: $D = R - \frac{B}{\Delta p}$ (to be paid if continuation)
- A theory of *maturity structure* of debt
  - Stronger firms have larger A, and subsequently (weakly) higher ρ^* and therefore less short-term debt.
  - The more current debt a firm has, the lower is its A, and the more short-term its future debt will be.
- Short-term debt vs dividend.

Credit lines for cash poor firms

- *Cash poor firm*: $r < \rho^*$. The extreme case: $r = 0$.
- With $r = 0$, there are no short-term returns to cover (in part) the liquidity needs at the intermediate date.
- Can a wait-and-see strategy work?
  - At date 1, the value of ρ is known. But the outside investors are not able to supply more funds than what the firm is worth to them, so the firm will only get funding if

$$\rho \leq p_H\left[R - \frac{B}{\Delta p}\right] = \rho_0.$$

  - This is not optimal, since $\rho^* \in [\rho_0, \rho_1]$.
- It is better to *hoard reserves* at date 0 to face the liquidity shock at date 1.
  - *Liquidity management* is necessary.

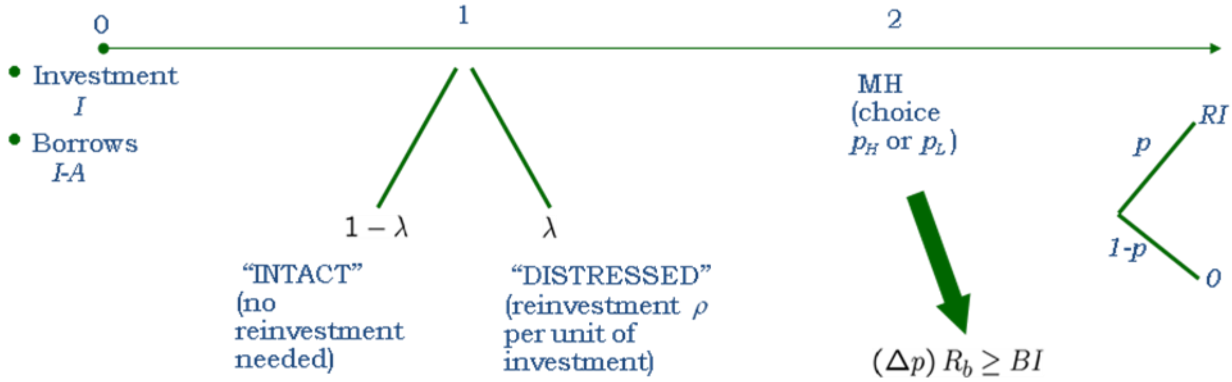
- Two ways to hoard reserves:
  - Borrowing $I + \rho^*$ at date 0, with a covenant that no further claims be issued at date 1, so that initial claimholders are not diluted.
  - Securing a *line of credit* equal to $\rho^* - \rho_0$, with a right to dilute initial claimholders in order to get ρ_0 in new funds at date 1.
    - A line of credit is an agreement providing credit up to a certain amount.
  - The line of credit must be *non-revokable*; otherwise, the lender would not want to abide with the agreement in cases where $\rho \in (\rho_0, \rho^*)$.

<u>Growth opportunities</u>

- An alternative scenario: if you do not reinvest at the intermediate date, you don't have to close down; but if you do reinvest, you increase the prospects of your project.
  - Reinvestment increases probabilities of success from p_H and p_L (depending on borrower efforts) to $p_H + \tau$ and $p_L + \tau$, where $0 < \tau < 1 - p_H$.
- Better growth opportunities (higher τ) call for longer maturities, that is, less short-term debt.

The liquidity-scale tradeoff

- Liquidity management with a variable investment.
- The entrepreneur now faces a choice between a larger investment and more liquidity.
- Variable-investment model.
- First a simple version – two values of the per-unit liquidity shock
    - 0, with probability $1 - \lambda$: the firm is *intact*.
    - ρ, with probability λ: the firm is *in distress*.



- Initial investment *I*. Continuation, which requires a reinvestment ρI if the firm is in distress at date 1, is subject to moral hazard.
- Project yields *RI* at date 2 if success, 0 otherwise.
- Success probability p_H or p_L.
- Private benefit from misbehaving *BI*.
- Assumption: $\rho_0 < c < \rho_1$, where $c \equiv \min\left\{1+\lambda\rho, \frac{1}{1-\lambda}\right\}$.
    - No liquidity shock: $\lambda = 0$, and so $c = 1$.
- Borrower receives R_b if success, 0 otherwise, where $R_b \geq \frac{B}{\Delta p}$.
- If distress: abandon or pursue the project?

- Abandon project if distress
  - Investors' breakeven constraint

    $(1 - \lambda)\rho_0 I = I - A$
  - Entrepreneur's net utility = NPV

    $$U_b^0 = [(1 - \lambda)\rho_1 - 1]I = \frac{(1-\lambda)\rho_1 - 1}{1-(1-\lambda)\rho_0} A = \frac{\rho_1 - \frac{1}{1-\lambda}}{\frac{1}{1-\lambda} - \rho_0} A$$
  - Compare with case without liquidity shock: $\lambda = 0$.
- Pursue project if distress
  - Investors' breakeven constraint

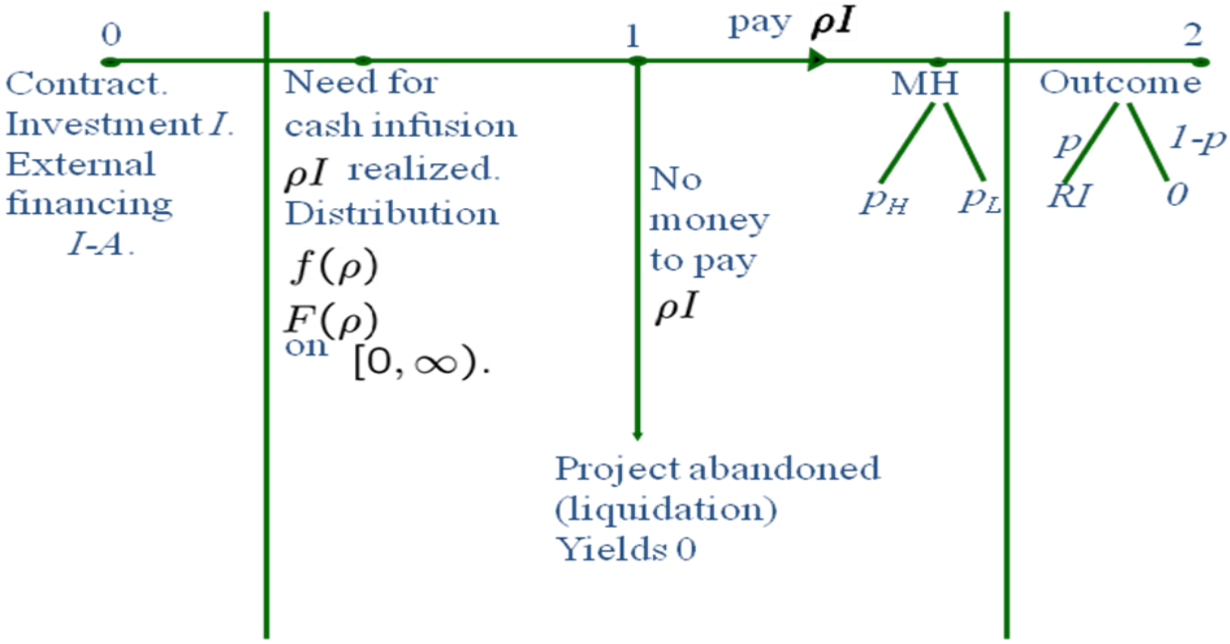
    $\rho_0 I = (1 + \lambda\rho)I - A$
  - Entrepreneur's net utility = NPV

    $$U_b^1 = [\rho_1 - (1 + \lambda\rho)]I = \frac{\rho_1 - (1+\lambda\rho)}{(1+\lambda\rho) - \rho_0} A$$
- Pursuing the project in case of distress at date 1 is better than abandoning it if:

  $$U_b^1 \geq U_b^0 \Leftrightarrow 1 + \lambda\rho \leq \frac{1}{1-\lambda} \Leftrightarrow \rho \leq \frac{1}{1-\lambda}$$
- Withstanding the liquidity shock is optimal if it is
  - low: ρ is low
  - likely: λ is high.
- If $\rho_0 < \rho \leq \frac{1}{1-\lambda}$, then *liquidity management* is required.
  - For example: a credit line.

<u>A continuum of liquidity shocks</u>

- Continuous investment, continuous shock.
- At date 1, continuation requires a reinvestment ρI, where $\rho \geq 0$.
  - Per-unit-of-investment cost overruns.
  - Probability distribution $F(\rho)$, density $f(\rho)$.



- NPV($\tilde{\rho}$) – net present value for a given cutoff $\tilde{\rho}$.

$$\text{NPV}(\tilde{\rho}) = \{F(\tilde{\rho})p_H R - \left[1 + \int_0^{\tilde{\rho}} \rho f(\rho) d\rho\right]\} I$$

- Assumption: There exists some $\tilde{\rho}$ such that NPV($\tilde{\rho}$) > 0.
- Question: What is the optimal cutoff rule ρ^*?
- Incentive constraint if continuation: $R_b \geq \dfrac{BI}{\Delta p}$
- Breakeven constraint with cutoff at ρ^*:

$$F(\rho^*)p_H(RI - R_b) \geq I - A + \int_0^{\rho^*} \rho I f(\rho) d\rho$$

- Borrowing capacity:

$$I \leq k(\rho^*)A = \frac{1}{1+\int_0^{\rho^*} \rho f(\rho)d\rho - \rho_0 F(\rho^*)} A$$

- Recall the equity multiplier without liquidity shock: $k = \dfrac{1}{1-\rho_0}$
- Liquidity shocks reduce the equity multiplier: $k(\rho^*) < \dfrac{1}{1-\rho_0}$.
- Due to competition among creditors, borrower obtains NPV(ρ^*).

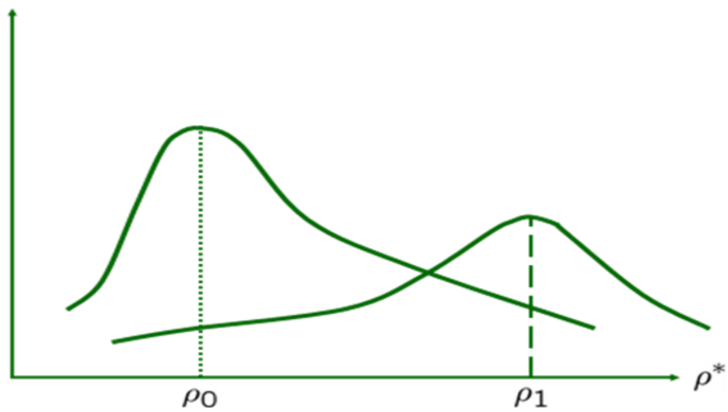
$$U_b = \{F(\rho^*)\rho_1 - [1+\int_0^{\rho^*} \rho f(\rho)d\rho]\}I \Leftrightarrow$$

$$U_b = m(\rho^*)k(\rho^*)A,$$

where

$$m(\rho^*) = F(\rho^*)\rho_1 - 1 - \int_0^{\rho^*} \rho f(\rho)d\rho$$

- The *margin* per unit of investment: $m(\rho^*)$
- The borrower must trade off the margin and the equity multiplier
  - Maximizing $m(\rho^*)$ would maximize profit and yield $\rho^* = \rho_1$. But $k'(\rho_1) < 0$.
  - Maximizing $k(\rho^*)$ would maximize pledgeable income and yield ρ_0. But $m'(\rho_0) > 0$.



- Write the borrower's net utility as

$$U_b = \frac{\rho_1 - c(\rho^*)}{c(\rho^*) - \rho_0} A, \text{ where: } c(\rho^*) = \frac{1+\int_0^{\rho^*} \rho f(\rho)d\rho}{F(\rho^*)}$$

- Note: $F(\rho^*)c(\rho^*) = 1+\int_0^{\rho^*} \rho f(\rho)d\rho$
  - $c(\rho^*)$ is the *expected cost per unit of effective investment*
- Maximizing U_b is tantamount to minimizing $c(\rho^*)$.

- Minimizing $c(\rho^*)$:

$$c'(\rho^*) = \frac{\rho^* f(\rho^*)F(\rho^*) - \left[1 + \int_0^{\rho^*} \rho f(\rho) d\rho\right] f(\rho^*)}{[F(\rho^*)]^2}$$

$$c'(\rho^*) = \frac{f(\rho^*)}{F(\rho^*)}[\rho^* - c(\rho^*)].$$

- The optimal cutoff is implicitly defined by:

$$\rho^* = c(\rho^*)$$

- In equilibrium, the borrower's net utility is

$$U_b = \frac{\rho_1 - \rho^*}{\rho^* - \rho_0} A$$

- The optimum cutoff lies between the expected per-unit-of-investment pledgeable income and income:

$$\rho_0 < \rho^* < \rho_1$$

    - *Trading off size and liquidity*: Increasing the cutoff above ρ^* would be good for profit but would also increase the demand for liquidity.

<u>Risk management</u>

- Suppose there is some residual uncertainty ε in the reinvestment requirement at date 1, such that $E(\varepsilon \mid \rho) = 0$.
- Consequences are adverse if liquidity falls short of a reinvestment
- Calls for buying insurance even if the entrepreneur is risk neutral.
- Tirole, Sec. 5.4

Endogenous liquidity shocks

- The entrepreneur may incur efforts to reduce – or even eliminate – the need for reinvestments. How to provide her with incentives to do this?
- A simple situation:
    - Before date 1, the borrower can incur effort costs c that will eliminate reinvestment needs completely: $\rho = 0$ with probability 1. If not, then ρ is drawn from the distribution $F(\rho)$ as before.
    - If the firm is cash poor – little or no income r at date 1 – the optimal contract has a covenant that no more funds shall be reinvested. But is this credible?
    - If the borrower does *not* incur costs c and the liquidity needs turn out to be $0 \leq \rho \leq \rho_0$, then it is in both lender's and borrower's interest to renegotiate the original contract.
    - This scope for renegotiation reduces the borrower's incentives to incur the effort costs c.
    - *Soft budget constraint*.
- More generally: Suppose the borrower can act at date 0 in a way that would improve the project, and that information arrives at date 1 that indicates whether or not she did so.
    - Moral hazard at both dates 0 and 1 (with respect to outcomes at dates 1 and 2).
    - Examples
        - Short-term income r stochastic *and* dependent on date-0 efforts
        - The project, if abandoned at date 1, has a liquidation value L that is stochastic and dependent on date 0 efforts
        - The project's date-2 return can be improved through efforts at date 0, and information about these improvements may be available before the reinvestment decision is made.
- Here: short-term income affected stochastically by date-0 efforts.

<u>Endogenous intermediate income</u>

- Variable-investment model.
- The usual stochastic return RI at date 2, subject to date-1 moral hazard.
- An investment of I at date 0 returns rI at date 1, where r is verifiable, and $r \in [0, r^+]$.
- Exerting effort affects the probability distribution of r.
- If the entrepreneur works at date 0, then r is distributed according to $G(r)$, with density $g(r)$. If the entrepreneur shirks at date 0, then r is distributed according to $\tilde{G}(r)$, with density $\tilde{g}(r)$.
- The likelihood ratio

$$l(r) = \frac{g(r) - \tilde{g}(r)}{g(r)}$$

- *The monotone likelihood ratio property* (MLRP): $l'(r) \geq 0$.
    - Implying that the distribution of r improves if the entrepreneur works: $G(r) \leq \tilde{G}(r)$, $\forall\, r$.
- Private benefit at date 0 if entrepreneur shirks: $B_0 I$.
- <u>Benchmark</u>: Credibility is not an issue – the "no soft budget constraint" (NSBC) case.
- Contract: $\{\rho^*(r), \Delta(r)\}$, where
    - $\rho^*(r)$ is the state-contingent cutoff
    - $\Delta(r) \geq 0$ is the borrower's state-contingent "extra rent" per unit of investment:
        - If continuation,

$$\Delta(r) = p_H \left(R_b - \frac{BI}{\Delta p} \right),$$

          what the borrower receives over and above the minimum required to preserve date-1 incentives.
        - If liquidation, $\Delta(r)$ is cash compensation.

- Lenders' breakeven constraint (IR_l):

$$\left\{\int_0^{r^+}\left[r+F\left(\rho^*(r)\right)\rho_0-\int_0^{\rho^*(r)}\rho f(\rho)d\rho-\Delta(r)\right]g(r)dr\right\} I\geq I-A$$

- Borrower's date-0 incentive constraint (IC_b):

$$\left\{\int_0^{r^+}\left[F\left(\rho^*(r)\right)\left(\rho_1-\rho_0\right)+\Delta(r)\right]\left[g(r)-\tilde{g}(r)\right]dr\right\} I\geq B_0 I \Leftrightarrow$$

$$\left\{\int_0^{r^+}\left[F\left(\rho^*(r)\right)\left(\rho_1-\rho_0\right)+\Delta(r)\right]l(r)g(r)dr\right\} I\geq B_0 I$$

- The optimal contract maximizes borrower's net utility subject to the two above constraints, with respect to $\{\rho^*(r), \Delta(r), I\}$. We ignore the choice of I for the moment.

$$U_b=\left\{\int_0^{r^+}\left[r+F\left(\rho^*(r)\right)\rho_1-\int_0^{\rho^*(r)}\rho f(\rho)d\rho-1\right]g(r)dr\right\} I$$

- Lagrangian multipliers: μ for IR_l and ν for IC_b.
- Pointwise maximization.
  - For each r, find the optimal pair $\{\rho^*(r), \Delta(r)\}$
- Fix r. First-order conditions with respect to $\rho^*(r)$ and $\Delta(r)$:

$$\{f(\rho^*)\rho_1-\rho^*f(\rho^*)+\mu[f(\rho^*)\rho_0-\rho^*f(\rho^*)]+\nu[f(\rho^*)(\rho_1-\rho_0)]l(r)\}\times g(r)I=0$$

$$\{-\mu+\nu l(r)\}g(r)I=0$$

$\Leftrightarrow$

$$\rho^*(r)=\frac{\rho_1+\mu\rho_0}{1+\mu}+\frac{\nu(\rho_1-\rho_0)}{1+\mu}l(r)$$

$$\mu=\nu l(r)$$

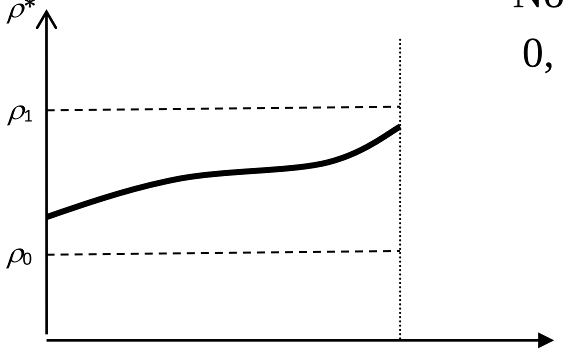
  - But the constraint $\Delta(r)\geq 0$ may be binding. Therefore,
    - either: $\Delta(r)>0 \Rightarrow \mu=\nu l(r) \Rightarrow \rho^*=\rho_1$,
    - or: $\Delta(r)=0 \Rightarrow -\mu+\nu l(r)\leq 0 \Rightarrow \rho^*\leq\rho_1$.

- $E_{G(\cdot)}[l(r)] = \int_0^{r^+} \frac{g(r)-\tilde{g}(r)}{g(r)} g(r)dr = \int_0^{r^+} g(r)dr - \int_0^{r^+} \tilde{g}(r)dr = 0$
- This implies: $E[\rho^*(r)] = \frac{\rho_1 + \mu\rho_0}{1+\mu}$
  - In expectation, the cutoff is a weighted average of ρ_1 and ρ_0, and $\rho_0 < E[\rho^*(r))] < \rho_1$; as in the case without date-0 moral hazard, the firm *trades off size and liquidity*.
- We can write:

$$\rho^*(r) = E[\rho^*(r)] + \lambda l(r),$$

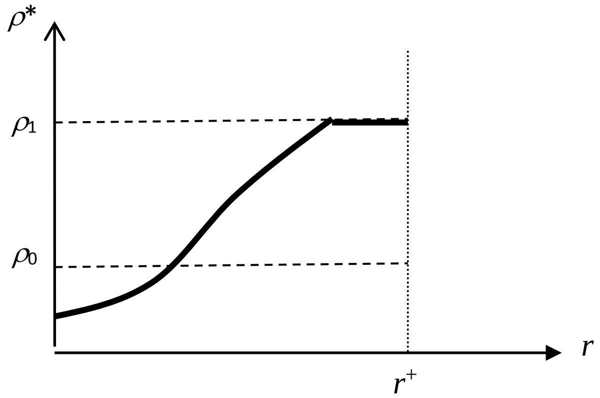
where: $\lambda = \frac{\nu}{1+\mu}(\rho_1 - \rho_0) > 0$.

- By assumption (MLRP): $l'(r) \geq 0$. Therefore: $\frac{d\rho^*}{dr} \geq 0$.
- The continuation rule is more lenient, the higher is the date-1 income r.
- Two possibilities:
  - $\rho^*(r)$ increases moderately
    - because the date-0 incentive problem is small
      - date-0 private benefits B_0 not very high, so that the borrower's date-0 incentive constraint is not very restrictive, making ν low;
      - date-0 liquidity shocks being mainly outside the borrower's control, so that $l(r)$ stays close to 0.
    - or because the date-1 incentive problem is small
      - date-1 private benefits B small, or $\Delta p/p_H$ large, again making ν low.



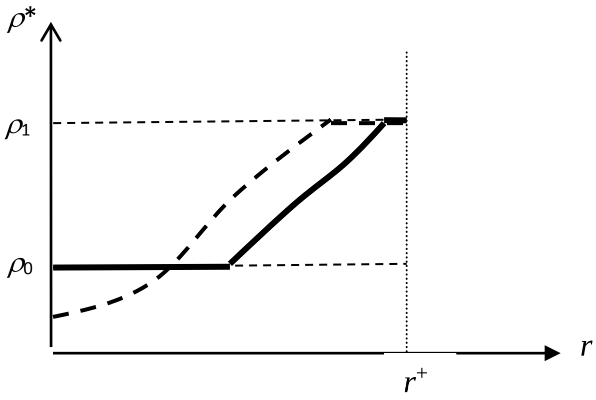
- No extra rent to the borrower: $\Delta(r) = 0, \forall r$.

- $\rho^*(r)$ increases steeply
  - because one or both of the two moral hazard problems are more serious
  - When intermediate income is high, first-best can be reached: $\rho^* = \rho_1$.
  - Extra rent to the borrower at high r: When intermediate income is high, she gets to keep some of it.
  - At a low intermediate income, we may even have $\rho^* < \rho_0$.



- *Soft budget constraint*: $\rho^* < \rho_0$ is not credible.
  - The parties will renegotiate a contract whenever r is realized and $\rho^*(r) < \rho_0$.
  - Formally, same problem as before, with an added constraint: $\rho^* \geq \rho_0$.
  - When incentive problems are small, so that there is only a moderate increase in $\rho^*(r)$ in the NSBC case, there is no change in the optimal contract.
  - When incentive problems are greater, the constraint $\rho^* \geq \rho_0$ binds for small values of r.

- Increasing ρ^* in order to satisfy the credibility constraint at low values of r calls for decreasing it for higher values of r, in order to keep satisfying the lenders' breakeven constraint.



- Credibility problems at low values of r decreases continuation – and reduces efficiency – at larger values.

Free cash flow

- Tirole, Sec. 5.6.
- If the firm has more cash than it needs, there are incentives for *overinvestment*. It has been argued that debt may mitigate this problem.
- Back to the discussion of the liquidity-scale tradeoff.
- But now there is a deterministic short-term income rI, which is fully pledgeable.
- Lenders' breakeven constraint with cutoff at ρ^*:

$$rI + F(\rho^*)p_H(RI - R_b) \geq I - A + \int_0^{\rho^*} \rho I\, f(\rho)\, d\rho$$

- Everything as if the unit investment cost is $(1 - r)$ rather than 1.
- Cutoff implicitly given by:

$$\rho^* = c(\rho^*) = \frac{1 - r + \int_0^{\rho^*} \rho f(\rho)\, d\rho}{F(\rho^*)}$$

  - Cutoff ρ^* is now *decreasing* in the short-term income r.
    - A high r makes it possible to reduce continuation in order to increase the borrowing capacity.
- The *free-cash-flow* assumption: $r > \rho^*$.
  - The entrepreneur would like to commit herself not to reinvest the amount $(r - \rho^*)I$.
  - This calls for *short-term debt*, that is, debt to be paid at the intermediate date.
  - In more general settings, short-term debt may not fully resolve the free-cash-flow problem.

Corporate finance under asymmetric information

- Two big information problems
  - Moral hazard
  - Adverse selection
- Why do firms issue claims on the capital market?
  - financing investments
  - for risk-sharing reasons
  - liquidity: cashing in and moving on
  - *trying to sell overvalued assets to investors*
- Asymmetric information between insiders and investors
  - The lemons problem: adverse selection
    - market breakdown
    - cross subsidization
  - Good borrowers may find it difficult to distinguish themselves from bad ones
  - Stock prices react negatively to equity offerings
    - An equity offering could indicate overvalued assets
    - Share issues are bad signals about profits
    - Conversely, share buybacks are good signals
  - The pecking-order hypothesis
    - internal finance $\succ$ debt $\succ$ hybrid capital $\succ$ equity
  - Distorted contracts may signal good borrowers' qualities.
    - Investing too little too late, etc.

- How to build a theory
  - Who are the insiders? And what are their objectives?
    - Managers? Current owners?
  - Which contracts are offered?
  - Who moves first – the informed or the uninformed?
    - Signalling vs screening.
- Who knows what?
  - Here: stick to insiders having private information
  - Some outside investors better informed than others?
  - Outsiders having information that insiders don't have?
  - Insiders' information affecting also third parties?
    - A firm may want to tell the capital market about high market demand, but does not want potential competitors to know.

A simple model: private information about prospects

- Borrower has no funds: $A = 0$. Investment costs I.
- Risk neutrality. Limited liability. Competitive capital market. No moral hazard: $B = 0$.
- Project returns R if successful, 0 otherwise.
- The borrower is one of two *types*: either *good* with success probability p, or *bad* with success probability q, where $p > q$, and $pR > I$.

- Two cases
  - Only the good type is creditworthy: $pR > I > qR$.
  - Both borrower types are creditworthy: $pR > qR > I$.
- The borrower knows her own type.
- Outside investors believe she is good with probability α and bad with probability $1 - \alpha$.
- Investors' *prior success probability*:

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

- Contract: R_b – what borrower receives if success; 0 if failure.

- Benchmark: Symmetric information
  - Good borrower receives R_b^G, holding investors at breakeven: $p(R - R_b^G) = I$
  - If bad borrower is creditworthy ($qR > I$), then she receives R_b^B such that $q(R - R_b^B) = I$.
  - Good borrowers get higher returns: $R_b^G > R_b^B$

- Asymmetric information
  - Stick to the simple contract: R_b.
  - Investors cannot tell good borrowers from bad ones.
  - Breakeven: $m(R - R_b) \geq I$

- *No lending* if $mR < I$.
  - Happens if bad type is not creditworthy ($qR < I$) and expected overall profitability is low:

$$[\alpha p + (1 - \alpha)q]R < I \iff \alpha < \alpha^* = \frac{(I/R) - q}{p - q}$$

  - *Underinvestment* – good borrowers do not get financing, even though they have profitable projects.
- *Lending* if $mR \geq I$.
  - Happens either if both types are creditworthy, or if the bad type is not, but $\alpha \geq \alpha^*$.
  - Breakeven constraint binding: $R_b = R - \dfrac{I}{m}$
  - *Cross-subsidization* – investors lose money on bad borrowers and make money on good borrowers:

$$p(R - R_b) > I > q(R - R_b)$$

  - *Overinvestment* if bad type is not creditworthy, which happens if

$$\frac{(I/R) - \alpha p}{1 - \alpha} \leq q \leq I/R$$

- *A measure of adverse selection*

  Lending requires

  $mR \geq I \iff$

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

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

  $[1 - \chi]pR \geq \text{I},$

  where: $\chi = (1-\alpha)\dfrac{p-q}{p}$

  - Good borrowers' pledgeable income *pR* is discounted by the presence of bad borrowers.
  - The problem of adverse selection is increasing in
    - the probability of the bad type, $1 - \alpha$, and
    - the likelihood ratio $\dfrac{p-q}{p}$.
  - A counterpart to the agency cost in the moral-hazard case.

- With adverse selection, the good borrower does not receive the project's NPV = $pR - I$, conditioned on receiving financing – as in the moral-hazard case. Rather, she receives

$$pR_b = p(R - \frac{I}{m}) = (pR - I) - \frac{\chi}{1-\chi} I \, .$$

Private information about *assets in place*

- Suppose the firm has an ongoing project and only needs a *deepening investment* but has no cash available.

- As it stands – with the assets in place – the firm has either a good project with success probability p or a bad one with success probability q. The probability of the project being good, as seen from outside investors, is α. If the project is good (bad), then the firm is undervalued (overvalued).

- A deepening investment increases the success probability for both project types with τ, such that $\tau R > I$. But contracts cannot be based on this investment in isolation.

- Would the firm want to *issue new shares* in order to obtain funds for the deepening investment?

  - An entrepreneur with good assets in place is less willing to let new investors in than is one with bad assets in place.

- Pooling vs separating equilibrium

  - In a *pooling equilibrium*, the types behave identically and offer outside investors identical contracts.

  - In a *separating equilibrium*, the types behave differently and offer outside investors different contracts.

- Breakeven constraint in a pooling equilibrium

$$[\alpha(p + \tau) + (1 - \alpha)(q + \tau)]R_l = I \Leftrightarrow R_l = \frac{I}{m+\tau}$$

- Good firm's incentive constraint in a pooling equilibrium:
  - It must be better to carry out the deepening investment with the financing terms in the market than to keep the project as it is now.

$$(p + \tau)(R - R_l) \geq pR \Leftrightarrow pR + \tau R - \frac{p+\tau}{m+\tau} I \geq pR$$

$$\Leftrightarrow \tau R \geq \frac{p+\tau}{m+\tau} I \Leftrightarrow \tau R - I \geq \frac{\chi_\tau}{1-\chi_\tau} I,$$

where: $\chi_\tau = \dfrac{(1-\alpha)[(p+\tau)-(q+\tau)]}{p+\tau} = \dfrac{(1-\alpha)(p-q)}{p+\tau}$

  - *Type-dependent reservation utility*: The better project the firm has, the higher value it gets from simply staying out of the capital market.
  - The deepening investment must not only be profitable, but sufficiently so, since $\frac{\chi_\tau}{1-\chi_\tau} I$ is strictly positive.
  - The good type invests if
    - the deepening investment is very profitable, or
    - there is little adverse selection (χ_τ is low).
- In a pooling equilibrium, both types invest and carry out an equity offering. The total value of the firm after the investment, as seen from the outside, is $(m + \tau)R - I$.
  - No stock-market reaction to the equity offering, since it is uninformative.

- If $\tau R < \frac{p+\tau}{m+\tau} I$, then
  - the good type would not invest in a pooling equilibrium
  - no pooling equilibrium exists
  - the only equilibrium is a *separating* one, where the firm, if it is of good type, does not invest.
  - the outside investors, if observing an equity offering, understand that this must come from a bad type and require a higher stake: $R_b^B = \frac{I}{q+\tau}$
  - there is a negative stock price reaction to an equity offering:
    - before the announcement, the value of the firm to outside investors is

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

    - after the announcement, the value is

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

    - there is a fall in this value if

      $$pR > (q+\tau)R - I$$

    - but we know already that

      $$\begin{aligned} pR &> (p+\tau)(R - \frac{I}{m+\tau}) > (p+\tau)(R - \frac{I}{q+\tau}) \\ &> (q+\tau)(R - \frac{I}{q+\tau}) = (q+\tau)R - I \end{aligned}$$

  - The pooling equilibrium is more likely to exist in good times, when τ is high and/or I low: Stock-price reactions should on average be less negative in booms.

The pecking-order hypothesis: debt is preferable to new equity

- Myers and Majluf (1984)
- Again – in order to discuss debt vs equity in a simple model, it is necessary to introduce a salvage value: return if failure is R_F, if success $R_S = R_F + R$, where $0 < R_F < I$.
- No assets in place: $A = 0$; so private information is about prospects.
- Suppose $mR_S + (1 - m)R_F > I$; there will be lending even if investors cannot tell good type from bad.
- Contract: $\{R_b^S, R_b^F\}$ – what the borrower gets if success, failure.
- Breakeven constraint of outside investors:

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

- Expected profit of a good borrower:

$$pR_b^S + (1 - p)R_b^F$$

- In the optimal contract, the good borrower wants to commit all the salvage value as safe debt to investors, because this decreases the adverse-selection problem.
  - A decrease in R_b^F makes the outside investors able to sustain an increase in R_b^S at a rate $\frac{m}{1-m}$, which will increase the good borrower's profit at a rate $\frac{p}{1-p} > \frac{m}{1-m}$.
  - The equilibrium contract: $\{R_b^S, R_b^F\} = \{R - \frac{I - R_F}{m}, 0\}$.

- Implementation of the contract.
  - First, a debt obligation $D = R_F$.
    - This is safe debt, since the firm will always have at least R^F to pay its debt.
  - Secondly, an equity issue, where outside shareholders get a fraction R_l/R of profits in excess of R_F, such that

$$mR_l = I - D, \text{ or: } R_l = \frac{I - D}{m} = \frac{I - R_F}{m}.$$

- Adverse selection entails cross-subsidization from good to bad borrowers. Issuing debt minimizes this cross-subsidization and therefore minimizes the adverse-selection problem for a good borrower.

- More generally, the good borrower would want to issue *low-information-intensive claims* to mitigate the adverse selection problem.
  - The more sensitive the investors' claims are to the borrower's private information, the higher returns they demand from a good borrower to cover for the losses on a bad one.
  - Some modifications
    - Insurance needs for a risk-averse entrepreneur: who is most needy of service – the good type or the bad type?
    - Information-intensive claims are better for value measurement, improving incentives to create value and making it easier for the entrepreneur to exit in case of a liquidity shock.
    - If there is private information about the project *riskiness*, then the best solution may be some hybrid claim, such as convertible debt.
    - Investors with market power.

Dissipative signals

- Costly ways for the good borrower to separate from bad ones without having to abstain from investment altogether.
- Disclosure of verifiable information.
- *Certification*: buying the services of a certification agency, such as a rating agency, an auditor, etc.
    - Suppose $mR > I$, so that the good borrower gets funding, but is concerned about cross-subsidization.
    - Without certification, borrower gets R_b in case of success, where $m(R - R_b) = I$, so that $R_b = R - \frac{I}{m}$.
    - Certification costs c, needs to be covered out of the investment.
    - Bad borrower would never buy certification.
    - With certification, good borrower gets return R_b^G, where $p(R - R_b^G) = I + c$.
    - Good borrower buys certification if and only if

$$R_b^G > R_b \Leftrightarrow R - \frac{I+c}{p} > R - \frac{I}{m} \Leftrightarrow \frac{c}{I+c} < \chi$$

    - Certification pays off if its costs are small relative to the extent of the adverse-selection problem.
- *Collateral* as a costly signal of private information
    - A good-type borrower may use collateral in order to tell the outside investors about her type.
        - It is more expensive for a bad type to pledge collateral, since the probability of failure, and therefore loss of the collateral, is greater for the bad type than for the good type.

- Suppose that
  - without private information, even a bad-type borrower would receive funding: $qR - I > 0$; and
  - a collateral of value C to the firm only returns βC to an outside investor, where $0 \leq \beta < 1$.
- Contract with collateral: $\{R_b, C\}$.
- The good-type borrower maximizes her expected profit subject to two constraints:
  - breakeven among investors, and
  - a *mimicking constraint* stating that it is better for a bad-type borrower not to offer this contract, even if this reveals her type, than to mimic the good type and suffer the risk of losing the collateral.
- Formally, the good-type borrower solves

$$\max_{\{R_b, C\}} pR_b - (1-p)C$$

subject to

$$p(R - R_b) + (1 - p)\beta C \geq I$$

$$qR_b - (1 - q)C \leq qR - I$$

- Both constraints are binding in equilibrium. The solution is found by solving the equation system where both constraints hold with equality:

$$\{R_b^*, C^*\} = \{R - \frac{1-\beta\frac{1-p}{1-q}}{p-\beta q\frac{1-p}{1-q}} I,\ \frac{1}{1+(1-\beta)q\frac{1-p}{p-q}} I\}$$

- Here, $R_b^* > R - (I/p)$, the good borrower's return in case of success without private information. The equilibrium contract with private information makes use of both the bad-type borrower's greater concern for losing collateral and her smaller interest in return if success.

- Determinants of collateral: $C^* = \dfrac{1}{1+(1-\beta)q\dfrac{1-p}{p-q}}I$
    - Cheaper collateral implies that more collateral needs to be pledged: $\partial C^*/\partial\beta > 0$.
        - If the cost of collateral decreases, in the sense that βC (the outsiders' valuation of the collateral) gets closer to C (the borrower's valuation), then the good-type borrower needs to provide more collateral in order to scare off the bad type.
    - The stronger the asymmetry of information is, the more collateral is needed: $\partial C^*/\partial q < 0$.
        - Fixing the quality of the good type, p, outsiders get more concerned about the borrower's type when q is small.
- Testable implication: good firms pledge more collateral than bad firms.
    - The opposite implication of what the moral-hazard theory has.
    - Empirical studies exist supporting moral hazard as an information-based explanation for collateral.
- Other ways of signalling a firm's high quality to investors:
    - More *short-term debt* than called for without private information about the probability of reinvestment needs. This reduces the good (low-probability) firm's chances of continuation, but increases its return in the event of continuation and eventual success.
    - More *dividend* paid out than otherwise called for, in order to signal a firm's strength.

Corporate finance and product markets

- Profit destruction
- Relative performance / benchmarking
- Effects of competition on corporate governance and financial structure

Profit destruction

- A project's profitability may depend on how many other firms succeed with similar projects.
  - There is a *strategic uncertainty*.
  - Investors have to take into account the scope for other firms' success.
- Two firms, each with own funds A.
- One firm's return in case of success is: M if the other firm fails; $D \leq M$ if the other firm succeeds.
- Success probabilities p_H or $p_L = p_H - \Delta p$, depending on whether the entrepreneur works or not.
- The fixed-investment model, with $A < I < p_H M$.
- The two firms' projects are statistically independent.
  - Technological uncertainty?
  - No scope for relative-performance evaluation.

- If both firms get funding, then a firm's expected return is:

$$p_H[(1 - p_H)M + p_H D]$$

  - Investors' breakeven constraint defines $\bar{A}$:

$$p_H[(1 - p_H)(M - \frac{B}{\Delta p}) + p_H(D - \frac{B}{\Delta p})] = I - \bar{A}$$

- If only one firm gets funding, then this firm's expected return is:

$$p_H M$$

  - Investors' breakeven constraint defines $\underline{A} < \bar{A}$:

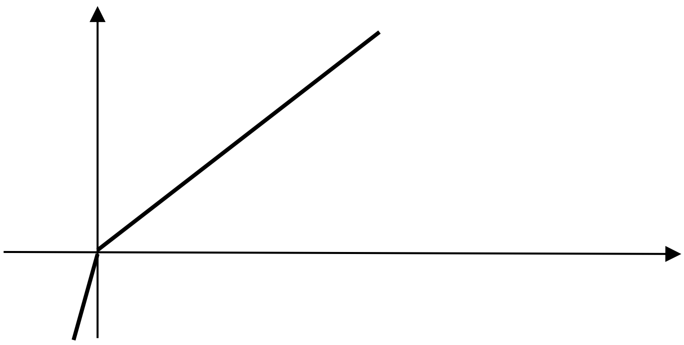
$$p_H(M - \frac{B}{\Delta p})] = I - \underline{A}$$

- If $A < \underline{A}$, then no firm enters. If $A \geq \bar{A}$, then both firms enter.
- If $\underline{A} \leq A < \bar{A}$, then one firm enters. But which?
  - There are two asymmetric equilibria in pure strategies. There also exists a symmetric mixed-strategy equilibrium.

<u>Benchmarking</u>

- Suppose now the two projects are perfectly correlated.
  - A random variable ω is distributed uniformly on [0, 1].
  - A project always succeeds if $\omega < p_L$, always fails if $\omega > p_H$, and succeeds only with good behavior if $p_L < \omega < p_H$.
  - Because of the uniform distribution, the probability of success is p_H with good behavior, p_L otherwise.
  - Perfect correlation means the two firms have the same ω.

- Risk neutrality and limited liability: there is nothing to gain from relative performance.
  - Shirking will be discovered whenever $p_L < \omega < p_H$, but cannot be punished with more than 0, which is the return for the entrepreneur even without benchmarking.
- Alternative assumption: the entrepreneur is not protected by limited liability but is risk averse.
  - No limited liability: contracts with $R_b < 0$ are feasible.
  - Risk aversion: $u'(R) > 0$, $u''(R) < 0$: more important to increase returns in bad times than to increase then in good times.
  - Simple special case: entrepreneur locally risk neutral for any $R > 0$: $u(R) = R$; but $u'(R) > 1$ for $R \leq 0$.
    - Say, $u(R) = (1 + \theta)R$ for $R \leq 0$, where $\theta > 1$.



- Now, we can have relative-performance contracts such as:

$$R_b = \begin{cases} a, & \text{if the firm does at least as well as the other firm;} \\ -b, & \text{if the firm does worse than the other firm.} \end{cases}$$

- Good behavior ensures the return a, misbehavior means a probability Δp that the return is $-b$. As θ increases, this threat gets very effective and ensures, as $\theta \to \infty$, that the moral-hazard problem disappears.

Competition may affect corporate governance and financial structure

- A key topic in the theory of industrial organization: A firm can improve its competitive position by
  - looking tough, when that is called for; and
  - looking soft, when that is called for.
- Looking tough is often good in order to *deter other firms' entry*.
  - If a firm, in case of other firms' entering its industry, produces a high quantity, then prices will be low and profits low, and entry is less attractive.
  - Looking tough can also help in securing a firm a large market share: If a firm produces a high quantity, then other firms are less interested in producing high quantities.
- Looking soft is sometimes good in order to dampen competition among the firms in an industry – particularly under price competition.
  - If a firm sets a high price, other firms will be induced to do the same, and profits will be high.
- There is an issue of credibility here.
  - When actually faced with a new entry, a firm may not be so interested in producing a high quantity after all.
  - In order for *looking tough* to work as an entry deterrent, it is necessary to have a commitment device.
- Corporate governance may work as *committing* the firm to looking tough or looking soft.

- Strategic complements and strategic substitutes
  - Two firms’ decision variables are *strategic complements* if one firm’s increasing its variable induces the other firm to also increase: $\frac{\partial^2 \pi}{\partial x_i \partial x_j} > 0$.
  - Two firms’ decision variables are *strategic substitutes* if one firm’s increasing its variable induces the other firm to decrease: $\frac{\partial^2 \pi}{\partial x_i \partial x_j} < 0$.
- Allocation of control rights (ch. 10)
- Suppose that intermediate actions can be taken before completion of the firm’s project that enhance project returns but which nevertheless reduce the entrepreneur’s utility.
  - Firing workers, selling off a division of the firm, etc.
- Since they entail a loss of entrepreneurial utility, these decisions will not be taken as long as the entrepreneur has control
  - If the firm does not need to take these actions in order to secure funds, they will not be taken.
  - If, on the other hand, they are necessary, then an allocation of control rights from entrepreneur to investors need to be made.
- A firm with allocation of control rights to investors is *looking tough*.
- Competition in the product market may affect firms’ incentives to look tough and therefore to allocate control rights to investors.
  - Entry deterrence: Give control to investors in order to keep other entrepreneurs out of the market.
    - If they enter, they may need to do the same.

Predation and corporate finance

- Predation: inducing rival firms to exit, for example through aggressive competition.
- In order to succeed, predation requires the predating firm to be stronger than the prey.
  - the *long-purse story* of predation (or deep-pocket story)

- A model of predation
  - Two dates: 0 and 1. Duopoly. Firms identical, except their wealths: Firm 1 financially strong, the predator; firm 2 financially weak, the prey.
  - An investment need at both dates. Both firms have available own funds for date 0. Profit at date 0 determines firm 2's available own funds at date 1 – retained earnings.
  - Date 0: Firm 1 may take a predatory action reducing both firms' date-0 profit. In particular, firm 2's profit falls from A to a.
  - Date 1: A firm's profit if success depends on whether or not the other firm succeeds.

$$C = (1 - p_H)M + p_H D$$

  - Assume that whether pledgeable income is enough for firm 2 to secure outside funding depends on firm 1's decision on predation at date 0

$$I - A < p_H\left(C - \frac{B}{\Delta p}\right) < I - a.$$

- Predation by firm 1 at date 0 triggers firm 2's exit. But is predation profitable?
  - Gain from predation: elimination of a rival in the event that both firms would have succeeded

$$p_H^2(M - D)$$

  - Cost of predation: k
  - If both firms suffer the same cost of predation, then

$$k = A - a.$$

- Predation at date 0 occurs if: $k < p_H^2(M - D)$

* But what if the weak firm foresees all this and secures funding already at date 0 for the investment needed at date 1?
  - Strategic security design
  - The weak firm may want to sign a *long-term contract* with investors at date 0 to reduce the risk of predation.
  - But even if such a long-term contract is available, the possibility of predation may lead to further moral-hazard problems: is low revenue caused by predation or by low effort?
  - Tirole, Sec. 7.1.2.1.

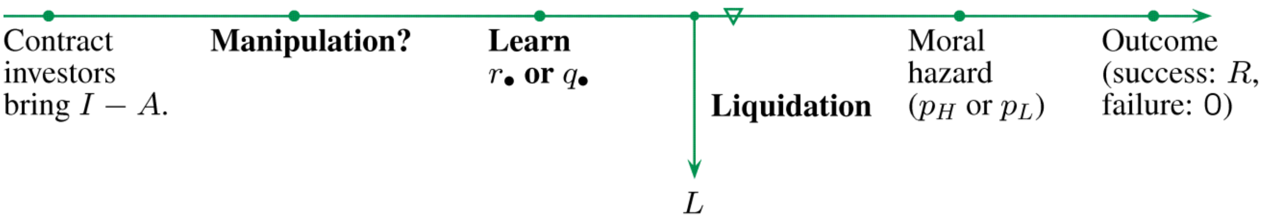
Earnings manipulations

- Solving one incentive problem may create others
    - High-powered incentive schemes (where compensation is highly dependent on the firm's outcome) increase the manager's interest in
        - manipulating the timing of income recognition: moving income forward or backward in time, if this serves her interests
        - taking actions that affect the firm's risk
- *Multitasking:* It is difficult to enhance behavior along one dimension without also affecting behavior in other dimensions.
- Accounting manipulation techniques (cooking the books)
    - Moving loss provisions forward, so that today's accounts look better than they actually are;
    - Choosing between capitalization and expensing of maintenance and investment costs; and so on.
- Manipulating the firm's operations
    - Delaying maintenance
    - Running sales in December, rather than in January
    - Giving customers favorable terms in order to obtain particularly early or late delivery.

A model of managerial myopia

- *Posturing*: Pretending to be something else.
- Management may have incentives to *boost short-term profit* at the cost of long-term loss.
- Fixed-investment model. Probability of success depends on both ability and behavior.
    - High ability: success probability is r_H or r_L, depending on whether the manager puts in effort or not, where $r_H > r_L$.
    - Low ability: success probability is q_H or q_L, where $q_H < r_H$, $q_L < r_L$, and $q_H - q_L = r_H - r_L = \Delta p$.
        - Whatever the ability, shirking has the same effect.
- At the funding stage, *no-one* knows the manager's ability; the prior probability of the manager being able is α.

$$p_H = \alpha r_H + (1 - \alpha)q_H; \;\; p_L = \alpha r_L + (1 - \alpha)q_L; \;\; p_H - p_L = \Delta p.$$



- After contracts are signed, ability becomes publicly observable and verifiable.
- Contract specifies whether, after ability is known, management is allowed to continue or not: $\{z^r, z^q\}$ – where z^i is the probability of continuation if ability turns out to be i.
    - In principle, also other items should be contracted upon. More on this later.

- In case of termination, there is a value L to share between investors and incumbent management.
- Benchmark: no manipulation
    - Assumption: $q_H R > L$. – Even a low-ability manager would prefer keeping her job.
    - Furthermore, guaranteed tenure or guaranteed termination does not generate enough expected pledgeable income,

      $$\max\{ p_H(R - \frac{B}{\Delta p}), L\} < I - A,$$

      while there is enough pledgeable income if there is termination only when ability is low, as long as outside investors get the liquidation value in case of termination:

      $$\alpha r_H(R - \frac{B}{\Delta p}) + (1 - \alpha)L > I - A.$$

    - The entrepreneur's net utility equals the NPV, given the contract's probabilities of continuation z^r and z^q.

      $$U_b = \alpha[z^r r_H R + (1 - z^r)L] + (1 - \alpha)[z^q q_H R + (1 - z^q)L] - I$$

    - NPV would have been maximized at guaranteed tenure, $z^r = z^q = 1$. But this fails in attracting outside investors.
    - In order to keep z^r and z^q, and therefore NPV, as high as possible, the contract will leave as much as possible to investors in case of liquidation, and in case of continuation and success:

      $$L^r = L^q = L, \text{ and } R_b^r = R_b^q = \frac{B}{\Delta p}.$$

- It is more to gain from keeping z^r high than from keeping z^q high. Therefore, the contract will have $z^r = 1$ and $z^q = z^*$, where z^* is the highest one that satisfies investors' breakeven constraint:

  $$\alpha r_H\left(R - \frac{B}{\Delta p}\right) + (1-\alpha)\left[z^* q_H\left(R - \frac{B}{\Delta p}\right) + (1 - z^*)L\right] = I - A$$

  - Error in Tirole: p. 303, column 1, line 6: "smallest" should be "highest".

- *Manipulation*: The entrepreneur can, at a cost, alter the information received by the outside investors.
  - The act of manipulation: the entrepreneur boosts short-term performance by generating information that indicates high ability, r.
  - The cost of manipulation: a (uniform) reduction τ in the probability of success.

- Two forms of manipulation
  - *Uninformed manipulation*: When deciding whether to manipulate information, the entrepreneur still does not know her ability.
  - *Informed manipulation*: Before deciding whether to manipulate information – but after the contract is signed – the entrepreneur gets to know her ability.
    - If she knows her ability already when the contract is signed, then she could use dissipative signals, such as distorted continuation rules in the contract, to reveal her type to outside investors.
    - When do entrepreneurs get to know their abilities? – Say ability is determined by the quality of equipment purchased: scope for informed manipulation?

Uninformed manipulation:

- The *no-manipulation constraint*: the entrepreneur's gain from manipulation must be less than what she gets from abstaining from manipulation

$$z^r(p_H - \tau)R_b \le [\alpha z^r r_H + (1-\alpha)z^q q_H]R_b \Leftrightarrow$$

$$\frac{z^r}{z^q} \le \frac{1}{1-\frac{\tau}{(1-\alpha)q_H}}$$

- The continuation probability at high ability cannot be too much different from that at low ability.
  - The lower the cost of manipulation τ is, the closer the two probabilities need to be.

Informed manipulation:

- The interest in manipulation occurs only when the entrepreneur learns that she has low ability.
- The no-manipulation constraint:

$$z^r(q_H - \tau)R_b \le z^q q_H R_b \Leftrightarrow$$

$$\frac{z^r}{z^q} \le \frac{1}{1-\frac{\tau}{q_H}}$$

- This constraint is harder to satisfy than in the case when manipulation is uninformed, which is natural.

- In the case of uninformed manipulation: is the no-manipulation constraint binding? – Yes, if

$$\frac{1}{z^*} > \frac{1}{1-\frac{\tau}{(1-\alpha)q_H}} \Leftrightarrow 1 - z^* > \frac{\tau}{(1-\alpha)q_H}$$

    - Increasing z^q above z^* is not possible, since this reduces pledgeable income, and so the breakeven constraint would fail to hold.
    - Reducing z^r below 1 also reduces pledgeable income, and so z^q needs to be reduced even more.
    - In the end, it may not be possible to find a pair $\{z^r, z^q\}$ satisfying both the breakeven constraint and the no-manipulation constraint.
    - The ability to cook the books later on may jeopardize the firm's possibility to obtain funding in the first place. And even when funding is feasible, this ability reduces project NPV and therefore firm value.

- *Golden parachute* – making the entrepreneur more interested in liquidation when ability is low. Could it be useful here?
    - It would relax the no-manipulation constraint.
    - It means giving away some of the liquidation value: $L^q < L$.
    - Unless L is very low, it is better to reduce z^q than L^q.

- *Career concerns*
    - Explicit vs implicit incentives
    - Suppose the manager is driven solely by career concerns – monetary compensation plays no role, but there is a value to keeping the job.
    - Impossible to keep manager from manipulating earnings – the loss in profit that follows does not affect a manager who does not care about money.

Other forms of posturing

- *Risk taking*
  - Suppose only career concerns matter.
  - Two periods, two projects each period: Each project has a return in period t equal to R_t if success, equal to 0 if failure.
  - No moral hazard. Funding is certain.
  - Manager obtains a benefit B per period in the job.
  - Manager's ability unknown to everyone. Initially, probability of high ability (with success probability for a project equal to r) is α, and probability of low ability (success probability $q < r$) is $(1 - \alpha)$.
  - Before the two periods, the manager chooses the correlation between the two projects – for simplicity: either independence (*hedging*) or perfect correlation (*gambling*).
  - After the first period, investors observe outcomes and choose whether or not to fire the manager. An alternative manager is available whose expected ability is $\hat{\alpha}$.
  - *Hedging equilibrium*: manager chooses independence, and investors rationally anticipate this. Can this be an equilibrium?
    - Suppose investors believe manager chooses independence – would manager prefer to deviate?
  - The probability that manager has high ability given success in <u>one</u> project in the first period:

$$\alpha_1^H = \frac{\alpha r(1-r)}{\alpha r(1-r)+(1-\alpha)q(1-q)}$$

  - If $\hat{\alpha} < \alpha_1^H$, then one success is enough for keeping the job.
    - Gambling would increase the probability of two failures, and therefore of losing the job.
  - If $\hat{\alpha} > \alpha_1^H$, then two successes are needed for keeping the job. Gambling would increase the probability of two successes.

- In summary: the manager is conservative and chooses uncorrelated projects if her position is secure ($\hat{\alpha}$ low), and gambles if her position is threatened ($\hat{\alpha}$ high).
- Empirical analysis: mutual-fund managers – very important for them to be among top performers.
  - Poor performance in first three quarters: gamble for resurrection.
  - Good performance in first three quarters: conservative.

- *Herding*: doing what others do.
  - *Statistical* herding: Observing other people's action reveals something about the information they have. In the end, when making up one's own mind, more weight is put on others' choices than the information one has collected oneself. This may lead to everybody choosing the wrong action.
  - *Reputational herding*: Managers' job is to collect information for the investors. But suppose only smart managers receive (the same) informative signals. By doing what others do, you keep up the possibility that you have the same information as others, and therefore that you are smart.

"... it is the long-term investor, he who most promotes the public interest, who will in practice come in for most criticism, wherever investment funds are managed by committees or boards or banks. For it is in the essence of his behavior that he should be eccentric, unconventional, and rash in the eyes of average opinion. If he is successful, that will only confirm the general belief in his rashness; and if in the short-run he is unsuccessful, which is very likely, he will not receive much mercy. *Worldly wisdom teaches that it is better for reputation to fail conventionally than to succeed unconventionally*."

J.M. Keynes, *General Theory* ch. 12, my emphasis.

Effort and risk taking

- Managers – through their decisions – do not only affect project quality, but also project riskiness.
- Would incentives to work hard on quality also lead the manager to take too high risks?
- A simple way to model the issues: three possible outcomes – success, middle, and failure – with returns R^S, R^M, and R^F.
- A *two-dimensional* moral-hazard problem
    - *Effort* increases the probability of success and reduces the probability of failure, but makes the manager incur a loss of private benefit.
    - *Risk taking* increases the probabilities of success and failure, and reduces the probability of the middle outcome.
- Otherwise, the fixed-investment model. Investment required: I. Entrepreneur is risk neutral and has cash $A < I$. Limited liability.
- Without efforts by the entrepreneur, all three outcomes are equally likely, that is, have a probability 1/3 each, and the investment is not profitable:

$$\frac{1}{3}(R^S + R^M + R^F) + B < I.$$

- Efforts raise the probability of success, and lowers the probability of failure, by $\theta > 0$, making the investment profitable:

$$(\tfrac{1}{3} + \theta)R^S + \tfrac{1}{3}R^M + (\tfrac{1}{3} - \theta)R^F > I.$$

- Risk taking, which can be done with or without efforts, increases the probability of success by α, increases the probability of failure by β, and lowers the probability of the middle outcome by $\alpha + \beta$. Risk taking lowers the project's profitability:

$$\alpha R^S + \beta R^F < (\alpha + \beta)R^M \Leftrightarrow$$

$$\alpha(R^S - R^M) < \beta(R^M - R^F)$$

- Contract $\{ R_b^S, R_b^M, R_b^F \}$. Put $R_b^F = 0$.

- Suppose first that *risk taking should be discouraged*.
    - Incentive constraint with respect to effort:

$$(\frac{1}{3} + \theta) R_b^S + \frac{1}{3} R_b^M \geq \frac{1}{3} R_b^S + \frac{1}{3} R_b^M + B \Leftrightarrow$$

$$\theta R_b^S \geq B$$

    - Incentive constraint with respect to risk taking:

$$(\frac{1}{3} + \theta) R_b^S + \frac{1}{3} R_b^M \geq (\frac{1}{3} + \theta + \alpha) R_b^S + (\frac{1}{3} - \alpha - \beta) R_b^M \Leftrightarrow$$

$$(\alpha + \beta) R_b^M \geq \alpha R_b^S$$

    - Combining the two incentive constraints:

$$\frac{\alpha + \beta}{\alpha} R_b^M \geq R_b^S \geq \frac{B}{\theta}$$

        - The entrepreneur should be paid in case of success, in order to provide incentives for effort, but not too much, in order to discourage risk taking.
    - The third incentive constraint, making efforts and no risk taking preferable to no effort and risk taking, is redundant:

$$(\frac{1}{3} + \theta) R_b^S + \frac{1}{3} R_b^M \geq (\frac{1}{3} + \alpha) R_b^S + (\frac{1}{3} - \alpha - \beta) R_b^M + B \Leftrightarrow$$

$$[\theta R_b^S - B] + [(\alpha + \beta) R_b^M - \alpha R_b^S] \geq 0$$

- In case of funding, the entrepreneur retains the NPV for the project, which without risk taking is:

$$U_b^1 = (\tfrac{1}{3} + \theta)R^S + \tfrac{1}{3}R^M + (\tfrac{1}{3} - \theta)R^F - I.$$

- Pledgeable income with no risk taking:

$$(\tfrac{1}{3} + \theta)(R^S - \tfrac{B}{\theta}) + \tfrac{1}{3}(R^M - \tfrac{\alpha}{\alpha+\beta}\tfrac{B}{\theta}) + (\tfrac{1}{3} - \theta)R^F$$

- Suppose, alternatively, that *risk taking is not to be avoided*.
  - Now, returns to the entrepreneur are only if success:

$$R_b^M = R_b^F = 0.$$

  - A single incentive constraint, with respect to effort:

$$\theta R_b^S \geq B.$$

  - The entrepreneur again retains the NPV, which now is smaller than without risk taking:

$$U_b^2 = U_b^1 + [\alpha(R^S - R^M) - \beta(R^M - R^F)] < U_b^1$$

  - Pledgeable income with risk taking:

$$(\tfrac{1}{3} + \theta + \alpha)(R^S - \tfrac{B}{\theta}) + (\tfrac{1}{3} - \alpha - \beta)\, R^M + (\tfrac{1}{3} - \theta + \beta)R^F$$

- Of course, the entrepreneur prefers a contract that does not induce risk taking, since risk taking here lowers value.
  - This requires sufficient own cash:

$$(\tfrac{1}{3} + \theta)(R^S - \tfrac{B}{\theta}) + \tfrac{1}{3}(R^M - \tfrac{\alpha}{\alpha+\beta}\tfrac{B}{\theta}) + (\tfrac{1}{3} - \theta)R^F \geq I - A \Leftrightarrow$$

$$A \geq (\tfrac{1}{3} + \theta)\tfrac{B}{\theta} + \tfrac{1}{3}\tfrac{\alpha}{\alpha+\beta}\tfrac{B}{\theta} - U_b^1$$

  - If not, funding may still be possible, if risk taking increases pledgeable income and is not too costly in terms of NPV.
    - In fact, risk taking does increase pledgeable income if $U_b^2 \approx U_b^1$.

Investor monitoring

- Comparative corporate governance
    - *The Anglo-Saxon model*: A well-developed stock market, strong investor protection, disclosure requirements, shareholder activism, takeovers. May suffer from short-termism, by both managers and investors.
    - *The German-Japanese model*: Building on banks, long-term relationships, cross-shareholding. May suffer from collusion and favor entrenchment by managers.
    - A text in English: M. Becht, P. Bolton, and A. Röell, "Corporate Governance and Control", *Handbook of the Economics of Finance, Vol 1A: Corporate Finance*, 2003, pp. 1-109.
    - A text in Norwegian: T. Nilssen, "Hvordan skaffe kapital til næringslivet? Bank kontra aksjemarked", *Norsk Økonomisk Tidsskrift* 109 (1995), 27-50; available at: http://folk.uio.no/toreni/research/kap_ban_aks.pdf
- A crucial aspect of the debate on corporate governance: the role of *monitoring* in reducing informational asymmetries between firms and investors.
- *Two kinds of outsiders' monitoring*: active and passive
- Correspondingly, *two kinds of information* that outsiders should collect about a firm.
    - *Prospective information*
        - Value-enhancing, strategic.
        - Information that is relevant for the future development of the firm.
        - Information that is needed before decisions are made
            - structural decisions: investments, etc.
            - strategic decisions: advertising, pricing, etc.
            - personnel decisions: replacements, downsizing
        - *Active monitoring* is collecting prospective information and using it to influence decisions.
            - Done by board of directors, venture capitalists, raiders, shareholder activists.

        - *Retrospective information*
            - Value-neutral, speculative.
            - Information that is not directly relevant for the future development of the firm and therefore not needed before decisions are made.
            - Measurements of past managerial performance.
                - Basis for managerial compensation.
            - Has no value in itself, in contrast to prospective information.
            - *Passive monitoring* is collecting retrospective information.
                - Done by speculators, rating agencies
- Passive vs active monitoring
    - Exit vs voice
        - Albert Hirschman (1970): *Exit, Voice, and Loyalty*.
    - Comparative corporate governance
        - Short-termism in the Anglo-Saxon model – too much passive monitoring, too little active?
        - Active monitoring can have short-term effects – so even short-term investors may benefit from it, like in takeover raids.
    - Some information is both prospective and retrospective, particularly in situations where management has private information.
- Some key questions:
    - Are the two kinds of monitoring complements or substitutes? If outsiders do more of one kind of monitoring, does that mean the optimum of the other kind now is more or less than before?
    - Should monitoring be delegated? Information is a public good, and so information collection is a natural monopoly. How does this affect corporate governance?

- Entry into corporate governance
    - Active monitoring is done by either
        - enlisted monitors, or *incumbents*, such as boards of directors, or
        - unenlisted monitors, or *entrants*, such as raiders.
    - Why is this distinction important?
        - Monitoring by incumbents may be inefficient, for example because of collusion with management, or because of incentive problems similar to those of management.
        - Replacement of monitors may be necessary
            - Monitoring skills may be unknown
            - Liquidity shocks may occur among monitors
        - Entry into monitoring is costly
            - Coordination problems, for example giving rise to multiple raiders
            - Lack of trust – the flip side of collusion with management by incumbents
            - Rents to entrants – they act on new information and arrive therefore only when there is something to gain, whereas incumbents are there for both upside and downside risks.
            - May affect incumbents' investment incentives
- Incentives to monitors
    - Passive monitors acquire retrospective information only to the extent that they can profit from it.
    - If speculators have collected positive information, then they will buy shares.
    - If there are many *liquidity traders* in the stock market – traders that buy or sell *not* based on retrospective information – then speculative trading will not have a great impact on the share price, and speculators can earn a lot.

Passive monitoring: Monitoring early performance

- Investment projects may take many years in order for returns to arrive and uncertainty to be realized.
- In order to provide the manager with proper incentives, it is necessary to find ways to monitor her early performance,
  - because the manager is not able to wait until returns finally arrive with getting compensation.
  - in order to improve on incentive schemes.
- A model of early-performance monitoring.
  - Fixed-investment model: Investment I, own cash A, borrowing from investors $I – A$. Returns R if success, 0 otherwise. Probability of success p_H if entrepreneur's effort is high, p_L if it is low, with $\Delta p = p_H – p_L$. Low effort provides benefit B to the entrepreneur.
  - After the entrepreneur's choice of effort, but before the project returns are known, information can be acquired that is informative about the final outcome.
    - The information is *retrospective* since it aims at revealing whether the entrepreneur put in effort. It is informative about the final outcome because this depends on effort.
  - *Signal*: high or low. A high signal is an indication of a future success.
  - The probability of a high signal depends on effort.
  - σ_{ij} is the probability that the signal is j if effort is i, where i and $j \in$ {High, Low}; $\sigma_{iH} + \sigma_{iL} = 1$.
  - ν_j is the probability of project success if signal is j; assume that this probability does not depend on effort.
  - *Ex ante* probabilities p_H and p_L:

$$p_H = \sigma_{HH}\nu_H + \sigma_{HL}\nu_L$$

$$p_L = \sigma_{LH}\nu_H + \sigma_{LL}\nu_L$$

  - The high signal enhances the confidence in success:

$$\nu_H > p_H, \text{ and } \nu_L < p_L$$

- *Benchmark*: the signal is freely available.
  - Now, in principle, the contract can be made dependent on both the signal and the final outcome.
  - But the signal is a *sufficient statistic*: all information about the entrepreneur's effort is in the signal – knowing the final outcome too does not provide more information about effort. Formally, ν_j is independent of effort – when you know the signal, there is not more to learn about effort.
  - So the contract depends on signal only, and not on final outcome: R_b if high signal, 0 otherwise (risk neutrality, limited liability).
  - Incentive constraint for borrower:

$$(\sigma_{HH} - \sigma_{LH})R_b \geq B \Leftrightarrow R_b \geq \frac{1}{\sigma_{HH} - \sigma_{LH}} B$$

  - The entrepreneur receives R_b with probability σ_{HH}, so pledgeable income is

$$p_H R - \frac{\sigma_{HH}}{\sigma_{HH} - \sigma_{LH}} B$$

  - Note:

$$\frac{p_H}{p_H - p_L} = \frac{\sigma_{HH}\nu_H + \sigma_{HL}\nu_L}{(\sigma_{HH} - \sigma_{LH})\nu_H + (\sigma_{HL} - \sigma_{LL})\nu_L}$$
$$= \frac{\sigma_{HH}(\nu_H - \nu_L) + \nu_L}{(\sigma_{HH} - \sigma_{LH})(\nu_H - \nu_L)} > \frac{\sigma_{HH}}{\sigma_{HH} - \sigma_{LH}}$$

  - The existence of a signal increases expected pledgeable income and makes funding easier.

  - Suppose investors' claims are shares traded on a stock exchange, and let the number of shares equal 1. The interim value of shares is either $\nu_H R$ or $\nu_L R$.

- *Implementation*: Set aside a fraction x of the shares that is given to the borrower in case of a high signal, where

$$x\nu_H R = R_b^*,$$

  and R_b^* solves the breakeven constraint:

$$p_H R - \sigma_{HH} R_b^* = I - A.$$

  In case of a low signal, investors keep all shares.
    - This is a *stock option* for the entrepreneur.

- *Costly monitoring*: collecting information incurs a private and nonobservable cost c.
  - The entrepreneur can *hire a monitor* – such as a board member. But the monitor must be provided with incentives to monitor, and to reveal the information collected.
  - If the monitor collects positive information, which happens with probability σ_{HH} if the entrepreneur works, then the value of the firm increases with $\nu_H R - p_H R$.
  - The monitor gets incentives to collect information for example from a stock option on s^* shares with a *strike price* of the *ex-ante* par value $p_H R$, where

$$s^* = \frac{c}{\sigma_{HH}(\nu_H - p_H)R}$$

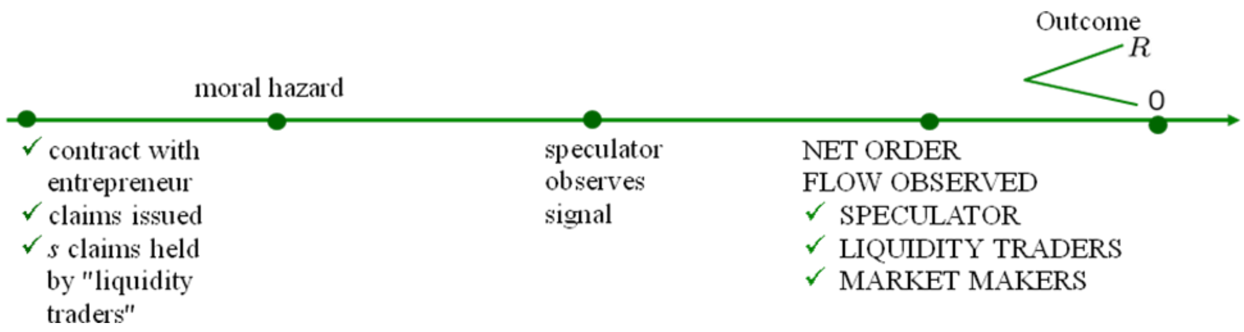
- Collusion between monitor and entrepreneur
  - The two can make an agreement where the monitor does not monitor but still exercises the stock option; the entrepreneur does not work; and the monitor loses less from not monitoring than the entrepreneur gains from shirking if information costs is sufficiently small, and the number of options therefore is small.
  - But what resources does the entrepreneur have to bribe the monitor?
  - Market monitoring is immune to collusive activities.

- Excessive speculation
    - There can be *too much* collection of information.
    - Speculative monitors may be interested in information that is purely about the firm's exogenous shocks. Such information is not informative about managerial effort.
        - Suppose that the monitor, at some extra cost, can obtain not only an informative signal but certainty about the final outcome.
        - If the extra cost is small, then the monitor will choose to acquire certain information.
    - This extra information is *not* helpful in terms of early performance measurement.
        - One can no longer base the contract upon an informative signal. Certain information at the intermediate date is equivalent, in terms of incentives, to the case of no monitoring.
    - Excessive speculation reduces expected pledgeable income relative to the case of no monitoring. Pledgeable income must cover not only incentives for effort but also the cost of monitoring.
    - Relatedly, the monitor may have incentives to acquire the *wrong* information: When multiple measures of performance are available, monitors may be mostly interested in those that mainly inform about exogenous information, so that the monitoring is of little help for incentives and expected pledgeable income.

Market monitoring

- Sometimes, enlisted monitors are not available.
- The alternative is market monitoring – done by a monitor whose identity is unknown, at least *ex ante*.
- Again, the question is how to provide both the monitor with incentives to monitor, and the entrepreneur with incentives to put in effort.
- The entrepreneur issues shares that are publicly tradeable.
- There is a single, anonymous monitor, called *the speculator*.
- The effect of his presence depends on initial investors' *liquidity trading*.
    - A liquidity trade is a sale of shares in order to get cash. Liquidity traders are shareholders with need for cash.
- Suppose first that initial investors have no liquidity needs before the project is finalized – there is no liquidity trading in the share.
- If the speculator acquires the retrospective information and it is positive, then he knows the firm is undervalued by $(v_H - p_H)R$ per share and wants to buy shares from the initial investors.
- But initial investors do not want to sell at price $p_H R$. Anyone wanting to buy at a higher price must be a speculator with positive retrospective information, so they will only sell at price $v_H R$.
- Hence, the speculator cannot profit from his information and will have no incentives to collect it.
    - A *no-trade theorem*.
    - Note the difference from the enlisted monitor, who can be offered a stock option with a strike price different from the market price. The unenlisted monitor – the speculator – has an endogenous strike price – the market price.
- In order for speculation to be profitable, the market price must not respond too much to the speculator's purchase order. – The stock market for this share must be *deep*.

- *Market depth* obtains when
    - there are liquidity traders among the initial investors
    - their total supply of shares is not known.
- A case of a deep market:
    - A fraction s of initial investors are *liquidity traders*: with probability λ, they will all need to sell their shares before the final outcome is realized; with probability $(1 - \lambda)$, none of them faces a liquidity need.
    - The other investors – the *long-term investors* – have no information whether or not there is liquidity trading.
- Two comments
    - perfect correlation among liquidity traders
    - the rationality of liquidity traders
- Suppose long-term investors cannot tell the speculator's order apart from liquidity traders' order.



- Speculator's demand for shares: y
- Liquidity traders' demand for shares: z
    - $z = -s$ in case of a liquidity shock; $z = 0$ otherwise.
- The speculator wants to hide his presence. So if he decides to buy, he will want to buy s shares
    - $y = s$ in case of positive retrospective information, $y = 0$ otherwise.

- Summarizing the four possible states of the world:

		Prob. σ_{HH}	Prob. $1 - \sigma_{HH}$
		High signal	Low signal
Prob. λ	Liquidity sales	Stock price: P Net order: 0	Stock price: $v_L R$ Net order: $-s$
Prob. $1 - \lambda$	No liquidity sales	Stock price: $v_H R$ Net order: s	Stock price: P Net order: 0

- Net order flow = supply – demand
- Two instances of zero net order:
  - Liquidity traders have a shock, and the speculator has positive information
  - Liquidity traders have no shock, and the speculator has negative information.
- The market price following a zero net order is

$$P = \left[\frac{\lambda\sigma_{HH}}{\lambda\sigma_{HH} + (1-\lambda)\sigma_{HL}}\right] v_H R + \left[\frac{(1-\lambda)\sigma_{HL}}{\lambda\sigma_{HH} + (1-\lambda)\sigma_{HL}}\right] v_L R$$

- The speculator's expected profit:
  - With probability $\lambda\sigma_{HH}$, he learns positive information *and* a liquidity shock occurs so that he can disguise his demand,
  - … in which case his earning per share is

$$v_H R - P = \left[\frac{(1-\lambda)\sigma_{HL}}{\lambda\sigma_{HH} + (1-\lambda)\sigma_{HL}}\right](v_H - v_L)R$$

  - So expected profit is

$$\lambda\sigma_{HH}\left[\frac{(1-\lambda)\sigma_{HL}}{\lambda\sigma_{HH} + (1-\lambda)\sigma_{HL}}\right](v_H - v_L)Rs$$

- If information collection costs c, the speculator needs at least s^{**} shares – that is, at least a fraction s^{**} of liquidity traders among initial investors, where s^{**} solves:

$$\lambda\sigma_{HH}\left[\frac{(1-\lambda)\sigma_{HL}}{\lambda\sigma_{HH}+(1-\lambda)\sigma_{HL}}\right](\nu_H-\nu_L)Rs^{**}=c \iff$$

$$s^{**}=\frac{c}{\lambda\sigma_{HH}R(\nu_H-\nu_L)\dfrac{(1-\lambda)\sigma_{HL}}{\lambda\sigma_{HH}+(1-\lambda)\sigma_{HL}}}$$

  - Comparison reveals that $s^{**} > s^*$ – the speculator needs a larger "option" than the enlisted monitor to break even.
- Comparison enlisted monitor/speculator
  - The speculator needs a higher option in order to perform.
  - Expected pledgeable income is the same (as long as entrepreneur is risk neutral).
  - Market monitoring less subject to collusion.
  - Enlisted monitor may not be available after all or may not have the ability to monitor.
- Relation to empirical findings
  - Firms with liquid shares have manager compensation tied to share prices, while firms with illiquid shares use bonuses
  - The *equity premium*: holding shares has consistently a higher return than holding debt
    - Liquidity traders lose in expectation in the presence of a speculator. In order to attract liquidity traders, shares must be sold at a low price. Thus, long-term traders obtain an extra profit.

Passive monitoring with debt

- *Demandable debt*: an option for a holder of a debt claim to convert a long-term debt into a short-term debt that has to be paid before the project is finalized.
  - May provide incentives for the debt holder to collect retrospective information
  - Suppose a debtholder has a claim equal to D. He can be enlisted as a monitor, with information cost c, if an option to turn the claim into short-term debt d when monitoring reveals negative information is preferable to not monitoring and either always demanding the debt or always rolling it over:

    $$c \leq \sigma_{HH}(v_H D - d)$$

    - always demanding the debt has a cost when retrospective information is positive

    $$c \leq \sigma_{HL}(d - v_L D)$$

    - always rolling over has a cost when retrospective information is negative
  - In combination, the two constraints say that a debt-holding monitor can be provided with incentives if there exists a d such that

    $$v_L D + \frac{c}{\sigma_{HL}} \leq d \leq v_H D - \frac{c}{\sigma_{HH}},$$

    which is the case if c is relatively small.

- *Debtholders vs equityholders as monitors*
  - Monitoring by debtholders affects liquidity, whereas monitoring by equityholders does not.
    - Monitoring by equityholders is *liquidity neutral*.
    - Monitoring by debtholders is *liquidity managing*.
  - Calling in liquidity in case of negative retrospective information, collected by a debtholding monitor, may be good for the funding of the firm.

Investor activism

- The costs and benefits of active monitoring
- Incentives of an active monitor

- Important topics in corporate governance
  - Banks vs stock markets
  - Concentrated vs dispersed ownership

- Costs and benefits of active monitoring
  - Costs
    - Monitoring costs
    - Scarcity rents to monitors
    - Monitor illiquidity
  - Benefits
    - Learning by lending
    - Externalities to non-monitoring investors
    - Control (chapter 10)

Basic model of investor activism

- Fixed-investment model
  - Risk neutral entrepreneur has assets A and a project needing $I > A$. Project yields R if success, 0 if failure. Success probability p_H if entrepreneur works, $p_L = p_H - \Delta p$ if not.
- No monitoring
  - Benefit from shirking B.
  - Funding to project if expected pledgeable income exceeds investors' expenses:

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

- Monitoring
  - The monitor moves first.
  - The extent of moral hazard is reduced.
  - The benefit from shirking reduced from B to $b < B$.
  - Monitor's private cost: c
  - Interpretation
    - Manager picks among three projects: good, bad and Bad.

	Pr (success)	Private benefit
Bad	p_L	B
bad	p_L	b

    - By incurring cost c, monitor eliminates Bad project but still cannot tell good from bad.

- With a monitor present, entrepreneur's incentive constraint is

$$R_b \geq \frac{b}{\Delta p}$$

- Incentives for the monitor
  - Also monitor is risk neutral
  - When not incurring cost c, the monitor cannot prevent shirking
  - Monitor's reward R_m must satisfy

$$R_m \geq \frac{c}{\Delta p}$$

- Suppose first that *monitoring capital is abundant*: there is a large supply of monitors willing to invest their capital.
  - A monitor is available supplying investment I_m such that his net payment equals his costs:

$$p_H R_m - I_m = c$$

- Funding possible if non-monitoring investors' breakeven constraint is satisfied:

$$p_H(R - R_b - R_m) \geq I - A - I_m \Leftrightarrow$$

$$p_H(R - \frac{b}{\Delta p}) - (I_m + c) \geq I - A - I_m \Leftrightarrow$$

$$p_H(R - \frac{b}{\Delta p}) \geq I - A + c$$

  - Monitoring reduces the moral-hazard problem – at cost c.

- Investment by monitor: blockholding

$$I_m = p_H R_m - c = p_H \frac{c}{\Delta p} - c = c(\frac{p_H}{\Delta p} - 1) = \frac{p_L}{\Delta p} c$$

  - Return on the investment: $\frac{p_H R_m}{I_m} = \frac{p_H \, c/\Delta p}{p_L c/\Delta p} = \frac{p_H}{p_L}$

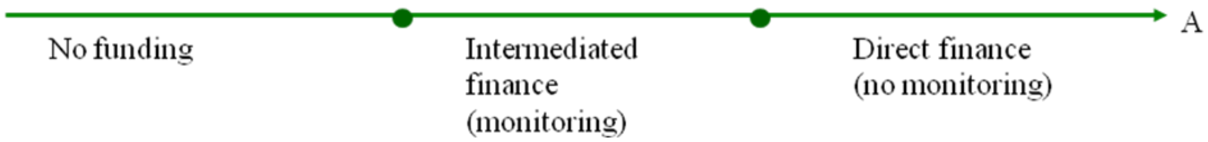
- Monitoring has a role to play when it increases pledgeable income, which happens when

$$p_H \frac{b}{\Delta p} + c < p_H \frac{B}{\Delta p} \Leftrightarrow c < \frac{p_H}{\Delta p}(B - b)$$

- Entrepreneur's utility equals NPV under monitoring

$$U_b = p_H R - I - c.$$

  - The entrepreneur will only enlist a monitor when this is necessary to obtain funding.
  - Strong firms are financed without monitoring.



- Empirical evidence: Legal systems with poor investor protection have also concentrated ownership.
  - High *B* leads to high needs for monitoring by a monitor holding a block of shares.

<u>Overmonitoring</u>

- The monitor exerts two kinds of externalities
  - A positive externality on other investors
  - A negative externality on the entrepreneur
- A model of *variable monitoring intensity*.
  - The monitor identifies the Bad project with prob x, and learns nothing with prob $1 - x$.
  - The greater monitoring costs incurred, the greater is the probability x:

$$c = c(x),\ c' > 0,\ c'' > 0.$$

- Borrower's utility equals NPV and depends on x:

$$U_b(x) = xp_H R + (1 - x)(p_L R + B) - I - c(x)$$

- NPV is maximized at monitoring level x^*, where

$$c'(x^*) = (\Delta p)R - B$$

- Suppose that this monitoring level is sufficient for funding, while no monitoring is not.
- The monitor's incentives: he maximizes

$$[xp_H + (1 - x)p_L]R_m - c(x)$$

- In order to get the monitor to choose the correct monitoring level, it is necessary for the entrepreneur that

$$(\Delta p)R - B = c'(x^*) = (\Delta p)R_m \Leftrightarrow R_m = R - \frac{B}{\Delta p}$$

- The entrepreneur not getting funding without monitoring implies that $R_b < \frac{B}{\Delta p}$. Therefore:

$$R_m = R - \frac{B}{\Delta p} < R - R_b \Leftrightarrow R_b + R_m < R$$

- In order to get the proper monitoring level, the entrepreneur needs other, non-monitoring investors in addition to the monitor.
  - If the monitor holds all external shares, there is no positive externality on other outside investors, only a negative externality on the entrepreneur – *excessive monitoring*.
- A large monitoring investor may also
  - aggravate the problem of soft budget constraints, by facilitating renegotiations
  - dampen the entrepreneur's incentives to come up with new ideas.

Scarce monitoring capital

- People with *both* skills in monitoring *and* own capital to invest may be scarce.
- Polar case – monitor has no own capital: $I_m = 0$.
  - Example: monitors as non-owning board members.
  - Monitor's incentive constraint: $R_m \geq \frac{c}{\Delta p}$
  - Monitor earns a *rent*: $p_H R_m - c = \frac{p_L}{\Delta p} c$.
  - Borrower's utility is no longer equal to NPV.

    NPV = $p_H R - I - c$

    $$U_b = p_H R - I - c - \frac{p_L}{\Delta p} c = p_H R - I - \frac{p_H}{\Delta p} c$$
  - A decrease in the scope for monitoring, and an increase in the occurrence of no funding.
- More generally, a high return on monitor's investment, because of investment opportunities elsewhere:

$$\chi = \frac{p_H R_m}{I_m} > \frac{p_H}{p_L}$$

  - Monitor's rent:

$$M = p_H R_m - I_m - c = p_H R_m - \frac{p_H R_m}{\chi} - c =$$

$$p_H \frac{c}{\Delta p}(1 - \frac{1}{\chi}) - c = (p_L - \frac{p_H}{\chi})\frac{c}{\Delta p} > 0.$$

  - Borrower's utility: $p_H R - I - c - M$.
  - Funding possible if

$$p_H(R - \frac{b}{\Delta p}) - c - M \geq I - A$$

  - The scarcer monitor capital is, the higher is χ, the higher is M, and therefore the more difficult it is to get funding.

Monitor-entrepreneur collusion

- *A three-tier hierarchy*
    - principal-supervisor-agent
    - here: investor-monitor-entrepreneur
    - two incentive problems: agent and supervisor
    - in addition: the agent may try to persuade the supervisor into not performing
    - *Ex ante* collusion: the agreement to collude is made before the monitor decides to collect information.
    - *Ex post* collusion: the monitor collects information and then offers to the entrepreneur to be cooperative, by not ruling out the Bad project.
- A model of *ex post* collusion
    - The entrepreneur bribes the monitor into colluding by diverting corporate resources. The diversion creates a gain $G > 0$ to the monitor but uniformly reduces the success probability by $\tau > 0$: from p_H to $p_H - \tau$ if entrepreneur works, from p_L to $p_L - \tau$ if not.
    - The diversion is wasteful: $G < \tau R$. Direct payments not possible.
    - Collusion occurs if both monitor and entrepreneur gain from it:

$$G \geq (\Delta p + \tau)R_m$$

$$B \geq (\Delta p + \tau)R_b$$

    - In order to prevent collusion, monitor's stake must be raised from $\frac{c}{\Delta p}$ to $\frac{G}{\Delta p + \tau}$, if the latter is higher.

The monitor as advisor

- Board members and others perform *two* tasks: monitoring and advising.
- Advisory activity is *productive*, like that of the entrepreneur.
  - A double-sided moral hazard problem
  - The advisor increases NPV and is useful even without own capital.
  - Strong entrepreneurs do not need *pure monitors* to get funding and are therefore more interested in a *pure advisor*.
- A model of pure advising
  - Fixed investment I, entrepreneur's own funds $A < I$.
  - Success probability is $p + q$
    - Entrepreneur determines $p \in \{p_H, p_L\}$ and earns B when misbehaving.
    - Advisor determines $q \in \{q_H, q_L = 0\}$ and incurs non-verifiable cost c to give a useful advice raising success probability by q_H.
  - Suppose advising is socially efficient:

$$(\Delta q)R = q_H R > c.$$

  - Crucial difference between entrepreneur and advisor: Entrepreneur owns the idea and decides whether or not to hire advisor.
  - Benchmark: no advisor.
    - Funding if $A \geq \overline{A} = I - p_H(R - \frac{B}{\Delta p})$
    - Borrower's utility: $U_b^{nm} = p_H R - I$.

- Suppose that advisors' capital is abundant.
- In case of success, entrepreneur receives R_b, advisor R_m, and other investors $R - R_b - R_m$.
- Advisor's incentive constraint binding: $R_m = \frac{c}{\Delta q}$.
- Investment demanded from advisor:

$$I_m = (p_H + q_H)R_m - c = (p_H + q_H)\frac{c}{\Delta q} - c = \frac{p_H}{q_H}c$$

- Borrower's utility equals NPV, since advisor does not receive rent: $U_b^m = (p_H + q_H)R - I - c$.
- The entrepreneur prefers advising as long as she can afford it, since $U_b^m > U_b^{nm}$.
- But does advising make funding easier?
- Other investors' breakeven constraint with advising:

$$(p_H + q_H)\left(R - \frac{B}{\Delta p} - \frac{c}{\Delta q}\right) \geq I - A - I_m \Leftrightarrow$$

$$(p_H + q_H)\left(R - \frac{B}{\Delta p}\right) - c \geq I - A \Leftrightarrow$$

$$A \geq \hat{A} = I - (p_H + q_H)\left(R - \frac{B}{\Delta p}\right) + c$$

- Funding facilitated by advising if and only if

$$q_H\left(R - \frac{B}{\Delta p}\right) > c$$

- Two cases
  - If $q_H R > c > q_H\left(R - \frac{B}{\Delta p}\right)$, then advising increases NPV but makes funding more difficult. Advisor hired by strong firms only.
  - If $q_H\left(R - \frac{B}{\Delta p}\right) > c$, then advising helps on funding. Advisor hired by all funded firms.

A monitor arising endogenously

- Suppose, instead of the entrepreneur enlisting him (a *private deal*), the monitor needs to arise through share purchases in the stock market.
- To start with, external shares are held by dispersed owners.
- A potential large monitor makes *an unconditional and unrestricted tender offer* of price *P* per share on all external shares.
    - Unconditional and unrestricted: the offer stands irrespective of how many shares it attracts.
- A free-rider problem
    - Getting a monitor enhances the value of the firm.
    - Selling to the potential monitor supplies a public good to other current share owners.
- In order to attract any shares, the potential monitor has to offer a price corresponding to the ex post value of the firm.
- The potential monitor has himself to bear the full cost of monitoring.
- In equilibrium, there will no monitoring.
- Ways to monitoring in equilibrium
    - Liquidity traders, making it possible for the potential monitor to disguise his offer.
    - Risk aversion among current investors.
    - The entrepreneur selling shares.

Learning by lending

- An additional effect from monitoring
  - Not only alleviating the moral hazard problem
  - But also providing the monitor with information about the borrower that the monitor can profit from later on.
- Competition among asymmetrically informed investors.
- Model: Fixed investment. Two periods. Discount factor β. No cash initially: $A = 0$. No savings between periods. Short-term contracts only.
- Date 1: Entrepreneur has a project requiring $I > 0$. Private benefit without monitoring, B, is large: no funding unless a monitor is enlisted. With monitor, private benefit $b < B$. No scarcity of monitors.
  - Assume pledgeable income sufficient even with no continuation project:

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

- Date 2: Independently of what happens at date 1, the entrepreneur has a new project, statistically independent of the first project, and identical to it, with one difference:
  - With probability α, the date-2 profitability is high: success probability has increased uniformly by τ. If the entrepreneur behaves, the success probability is $p_H + \tau$; if not, it is $p_L + \tau$. But B is so large that the project still gets no funding without monitoring.
  - With probability $(1 - \alpha)$, the success probabilities are unchanged from date 1.

- Symmetric information: no-one learns date-2 profitability. No gain to the borrower from having the same monitor in both periods.
- Asymmetric information: only the date-1 monitor (the incumbent) learns date-2 profitability.
  - Suppose the entrepreneur auctions off the position as active monitor.
  - The incumbent has an informational advantage.
  - Sequential-move bidding game where incumbent moves last: pure-strategy equilibrium.
    - Stage 1 of date-2 bidding game: Entrepreneur offers a monitor a stake $R_m^2 = c/\Delta p$ in the date-2 project and seeks bids of investment contribution I_m^2 for the position of active monitor.
    - Stage 2: New investors bid.
    - Stage 3: Incumbent monitor bids.
    - Stage 4: Uninformed investors contribute the residual investment: $I - I_m^2$.
  - Adverse selection: it never pays for uninformed investors to bid according to a higher date-2 success probability than p_H; if it is in fact higher, uninformed bidders will be outbid.
  - Monitor investment at date 2:

$$I_m^2 = p_H R_m^2 - c = p_H \frac{c}{\Delta p} - c$$

  - Date 1: Because of the expected informational rent at date 2, investors are willing to contribute up to

$$I_m^1 = p_H \frac{c}{\Delta p} + \beta\alpha\tau \frac{c}{\Delta p} - c = (p_L + \beta\alpha\tau) \frac{c}{\Delta p}$$

  - The monitor position acquired at a premium and maintained at a discount.

- Discussion: Learning by lending
  - Endogenous date-2 profitability: a *hold-up problem*
    - Suppose the entrepreneur, through an effort, can affect the chance of increased date-2 profitability. The incumbent monitor's informational advantage deteriorates the entrepreneur's incentives to perform.
  - Empirical studies indicate a value to being associated with a long-term investor.
    - Firms with close ties to investors are less liquidity constrained than others.
    - Firms with a bank relationship observe positive reactions in stock price.
  - The possibility of commitment.
  - The entrepreneur's own knowledge about date-2 profitability.
  - Competition among investors: with imperfect competition among available investors, the possibility for the monitor to recoup expenses later on is further increased, facilitating funding at date 1 even more.
    - Empirical evidence: concentrated banking markets may facilitate funding for weak firms.

Liquidity needs among monitors

- Tradeoff: commitment vs liquidity
- Comparative corporate governance
    - Market-based systems: lack of investor commitment
    - Bank-based systems: lack of investor liquidity
- A monitor may have liquidity needs before project returns arrive. Liquidity vs accountability – just as with the borrower (chapter 4).
    - Late compensation to the monitor is good for accountability, since more information about the project is known, but bad for monitor liquidity.
- Performance measures along the way may give the monitor an exit option.
    - A role for *passive monitoring* in providing liquidity to the active monitor.
- A model of monitor liquidity
    - Basic model of investor activism, with monitor liquidity needs added.
- Fixed-investment model. Risk neutral entrepreneur has asset A and a project needing $I > A$ at date 0. Project yields R if success, 0 if failure, at date 2. Success probability p_H or p_L.
- At date 1, the monitor faces a liquidity shock with probability λ: An investment opportunity transforming an intermediate compensation r_m into μr_m, where $\mu > 1$.
- Strategic exit: the monitor may choose to exit even without a liquidity shock.

- Imperfect performance measurement at date 1: After the monitor learns about the liquidity shock, speculative information arrives which is informative about effort, but which is *not* a sufficient statistic: the final outcome is even more informative.
  - The probability of an H signal is q_H with effort and q_L without effort, where

$$\frac{q_H - q_L}{q_H} < \frac{p_H - p_L}{p_H}$$

- Scarce monitoring capital
  - Monitor earns a gross surplus $U_m = \kappa I_m$, where κ is the monitor's return on alternative investments; we assume $\kappa \geq \lambda\mu + 1 - \lambda$.

- *Illiquid contract*: Monitor receives R_m at date 2, if success, and nothing at date 1.
  - Participation constraint of monitor: $p_H R_m - c = \kappa I_m$
  - Incentive constraint of monitor: $R_m \geq \frac{c}{\Delta p}$
  - The cost of enlisting an active monitor exceeds the cost of monitoring

$$C^{IL} = p_H R_m - I_m = \frac{p_H - \frac{p_L}{\kappa}}{p_H - p_L} c \geq c$$

  - Borrower's utility: $U_b = p_H R - I - C^{IL}$
  - Pledgeable income: $p_H(R - \frac{b}{\Delta p}) - C^{IL}$

- *Liquid contract*: $\{r_m, R_m\}$. The monitor receives
  - r_m at date 1 if signal is H and nothing at date 2, in the case of a liquidity shock.
  - R_m on date 2 if success and nothing at date 1, in the case of no liquidity shock.
- Assume p_L is so low that, if he does not monitor, the active monitor prefers receiving r_m to waiting for an unlikely R_m, even without a liquidity shock.
- Without monitoring, he earns

$$\lambda\mu q_L r_m + (1 - \lambda)q_L r_m = [\lambda\mu + 1 - \lambda]q_L r_m$$

- Truth-telling constraint when there is no liquidity shock:

$$p_H R_m \geq q_H r_m$$

- With monitoring, the active monitor earns

$$U_m = \lambda q_H \mu r_m + (1 - \lambda)p_H R_m - c$$

- Incentive constraint for the monitor:

$$\lambda q_H \mu r_m + (1 - \lambda)p_H R_m - c \geq [\lambda\mu + 1 - \lambda]q_L r_m$$

- The constraint is binding, and so the monitor earns

$$U_m = [\lambda\mu + 1 - \lambda]q_L r_m$$

- The cost of hiring the monitor with a liquid contract is

$$C^L = \lambda q_H r_m + (1 - \lambda)p_H R_m - I_m =$$

$$\lambda\mu q_H r_m + (1 - \lambda)p_H R_m - \lambda(\mu - 1)q_H r_m - I_m =$$

$$U_m + c - \frac{U_m}{\kappa} - \lambda(\mu - 1)q_H r_m =$$

$$c + r_m[(1 - \frac{1}{\kappa})(\lambda\mu + 1 - \lambda)q_L - \lambda(\mu - 1)q_H] =$$

$$c + Kr_m > c \text{ if and only if } K > 0.$$

- Providing the monitor with liquidity – that is, giving him a liquid contract – is optimal if $C^L < C^{IL}$.
    - Simple case: $p_L = 0 \rightarrow C^{IL} = c$.
    - We have $C^L < c = C^{IL}$ if and only if

$$(1 - \frac{1}{\kappa})(\lambda\mu + 1 - \lambda)q_L < \lambda(\mu - 1)q_H \Leftrightarrow$$

$$\frac{q_H - q_L}{q_H} > \frac{1}{\kappa - 1}\left(\frac{\kappa}{\lambda\mu + 1 - \lambda} - 1\right)$$

    - The liquid contract is more likely to be the optimal one when
        - The monitor's liquidity shock is likely: λ high
        - The value of the monitor's reinvestment opportunity is high: μ high
        - Speculative information is of high quality: $\frac{q_H - q_L}{q_H}$ high
            - Speculative activity helps in providing liquidity for large, monitoring shareholders.
        - Monitoring capital is not too scarce: κ low
            - When scarcity is high, too much of the benefit from liquidity is kept by the monitor and not returned to the entrepreneur.

- Liquid monitors: market-based corporate governance.

Control rights

- *Control right*: the right to make decisions that affect the firm's activities after the firm has started.
    - Day-to-day management, choice of personnel, etc.
    - Refinancing; dividend policy
    - Investments; mergers

- Ownership; authority; constitution/charter.

- *Contingent control rights*: contingent on some future event

- *Partial control rights*: covering some decisions and not others.

- *Induced control rights*: controlling decision *A* may give some bargaining power with respect to decision *B*.

- *Key question*: what is the *optimal* allocation of control rights?
    - Between entrepreneur and investors.
    - Between various investors.

<u>Pledgeable income and the allocation of control rights</u>

- Fixed-investment model
  - Risk neutral entrepreneur has asset A and a project needing $I > A$. Project yields R if success, 0 if failure. Success probability p_H if entrepreneur works, $p_L = p_H - \Delta p$ and a private benefit B if not.
- Modelling day-to-day management:
  - An *interim action* (that cannot be contracted upon at the financing stage) raises the success probability by $\tau > 0$, to $p_H + \tau$ or $p_L + \tau$, but costs $\gamma > 0$ for the entrepreneur.
  - A scope for *renegotiation* on the interim action, since it is not included in the initial contract.
- Entrepreneur and investors can agree in advance who is to decide on the interim action.
  - Two conflicts of interests – over success probability and interim action; choosing the latter need not be delegated to the entrepreneur.
- Allocating control over the interim action affects the chances of getting funding.
- Suppose the interim action is *not* optimal: $\tau R < \gamma$.
  - The action costs the entrepreneur more than it gains the project.

- *Investor control*: Investors get part of the gain and none of the cost and will therefore carry out the action.
    - No renegotiation, since the entrepreneur has no cash to compensate investors for the loss of the action not being carried out.
    - Pledgeable income: $(p_H + \tau)(R - \frac{B}{\Delta p})$
    - Borrower utility equals NPV: $U_b = (p_H + \tau)R - I - \gamma$.
- *Entrepreneur control*: The entrepreneur will not carry out the action.
    - $\tau R < \gamma$ and $R_b \leq R$ imply that $\tau R_b < \gamma$.
    - Pledgeable income: $p_H(R - \frac{B}{\Delta p})$
    - Borrower utility: $U_b = p_H R - I > (p_H + \tau)R - I - \gamma$.
- Investor control reduces borrower utility but increases pledgeable income.
- Investor control is necessary for funding if

$$p_H(R - \frac{B}{\Delta p}) < I - A < (p_H + \tau)(R - \frac{B}{\Delta p})$$

- If the interim action *is* optimal, $\tau R > \gamma$, then investor control is surely better.
- <u>Going public</u>
    - A family owned firm may have to surrender control to outsiders in order to finance further growth.
- <u>Multiple control rights</u>
    - Suppose there are *many* intermediate actions, $k \in \{1,\ldots, K\}$. The entrepreneur surrenders control over those with the highest ratios $\tau_k R/\gamma_k$.
    - Strong firms (with high A) abandon fewer rights.

- <u>Contingent control rights</u>
    - Transfer of control rights made contingent on verifiable information.
    - Resemblance with multiple rights: control rights in multiple states of nature.
    - In addition: control rights contingent on a measure of performance can boost incentives and therefore the entrepreneur's borrowing capacity.
    - Fixed-investment model with a suboptimal interim action: $\tau R < \gamma$.
    - Before the interim action is decided upon, a measure of performance is obtained.
        - A signal that is high or low.
        - The probability that the signal is j when effort is i is: σ_{ij}, where $i, j \in \{H, L\}$.
        - Note: $\sigma_{iH} + \sigma_{iL} = 1$, $i \in \{H, L\}$.
    - The signal is a sufficient statistic of effort: the entrepreneur should be rewarded based on the signal only. The entrepreneur receives R_b if signal is high, 0 if it is low.
    - Non-contingent investor control
        - Entrepreneur's incentive compatibility constraint:

$$(\sigma_{HH} - \sigma_{LH})R_b \geq B$$

        - Pledgeable income:

$$(p_H + \tau)R - \sigma_{HH}\frac{B}{\sigma_{HH} - \sigma_{LH}}$$

- <u>Contingent control</u>: the entrepreneur has control if signal is high, investors if signal is low.
  - When signal is high, entrepreneur both receives R_b and avoids costs γ. Incentive compatibility constraint:

$$(\sigma_{HH} - \sigma_{LH})(R_b + \gamma) \geq B$$

  - Pledgeable income:

$$(p_H + \sigma_{HL}\tau)R - \sigma_{HH}\left(\frac{B}{\sigma_{HH} - \sigma_{LH}} - \gamma\right)$$

- Contingent control facilitates funding.
  - The statement is true whenever

$$(p_H + \sigma_{HL}\tau)R - \sigma_{HH}\left(\frac{B}{\sigma_{HH} - \sigma_{LH}} - \gamma\right) >$$

$$(p_H + \tau)R - \sigma_{HH}\frac{B}{\sigma_{HH} - \sigma_{LH}}$$

$$\Leftrightarrow \ \sigma_{HH}\gamma > (1 - \sigma_{HL})\tau R \ \Leftrightarrow \ \gamma > \tau R$$

<u>Noncontractible investments</u>

- Suppose the interim action requires *managerial initiative*.
- Fixed-investment model.
- After project start, entrepreneur may spend $c > 0$ in order to find an alternative way to run the project – the managerial initiative.
- If she spends c, she finds two versions of the modification
    - Borrower friendly: Success probability increases by τ_b and creates a private benefit, $-\gamma_b > 0$, for the entrepreneur.
    - Lender friendly: Success probability increases by τ_l and creates a private benefit, $-\gamma_l > 0$, for the entrepreneur.
- Further assumptions:
    - Both versions are good for the entrepreneur, since costs are now benefits: $-\gamma_b > -\gamma_l > 0$.
    - Investors prefer lender-friendly version: $\tau_l > \tau_b > 0$.
    - Entrepreneur prefers borrower-friendly version, for relevant values of R_b: $\tau_b R_b - \gamma_b > \tau_l R_b - \gamma_l > 0$.
    - Managerial initiative is desirable, and investor control is first-best optimal: $\tau_l R - \gamma_l > \tau_b R - \gamma_b > c$.
    - If the entrepreneur spends c, the entrepreneur and the investor may renegotiate over the version, with the entrepreneur making *take-it-or-leave-it offers* to the investors.
- Incentive compatibility requires $R_b \geq B/\Delta p$.

- Investor control
  - No scope for renegotiation, since entrepreneur cannot compensate investors.
  - Investors choose lender-friendly version in case there is an interim action to take.
  - The entrepreneur shows managerial initiative if and only if

$$\tau_l R_b - \gamma_l \geq c \iff$$
$$(\tau_l R - \gamma_l) - c \geq \tau_l (R - R_b)$$

    - The increase in NPV from the managerial initiative is greater than what the investors get out of it.
- Entrepreneur control
  - Investors are willing to accept a higher return $R_b' > R_b$ to the entrepreneur as compensation for the entrepreneur choosing the lender-friendly version of the interim action, as long as

$$(p_H + \tau_l)(R - R_b') \geq (p_H + \tau_b)(R - R_b) \Rightarrow$$
$$R_b' = \frac{\tau_l - \tau_b}{p_H + \tau_l} R + \frac{p_H + \tau_b}{p_H + \tau_l} R_b$$

  - So, with managerial initiative, the entrepreneur obtains utility

$$(p_H + \tau_l) R_b' - \gamma_l - c =$$
$$(\tau_l - \tau_b) R + (p_H + \tau_b) R_b - \gamma_l - c$$

  - Without managerial initiative, the entrepreneur obtains $p_H R_b$.

- The entrepreneur shows managerial initiative as long as

$$(\tau_l - \tau_b)R + (p_H + \tau_b)R_b - \gamma_l - c \geq p_H R_b \Leftrightarrow$$
$$(\tau_l R - \gamma_l) - c \geq \tau_b(R - R_b)$$

  - Again, the increase in NPV from the managerial initiative must be greater than what the investors get out of it.

- The difference between investor control and entrepreneur control is not the outcome, because of the renegotiation. Rather, it is the split of the gain that differs – with entrepreneur control, investors get less:

$$\tau_b(R - R_b) < \tau_l(R - R_b)$$

- With entrepreneur control, the entrepreneur appropriates more of the gain from her non-contractible investment – the managerial initiative.
- As a result, entrepreneur control may *increase* pledgeable income and therefore be good for funding.
- A large literature on buyer-supplier relationships
  - Incomplete contracts and relationship-specific investments.
  - The hold-up problem: disincentives to invest in investments that do not pay off with other partners, if such investments worsen the bargaining position in a subsequent renegotiation.
  - Costs and benefits of *integration*.
  - Building on Ronald Coase, "The Nature of the Firm", 1937.

Real control to managers

- Suppose investors have *formal control*.
- But investors do not know which interim action to take: There exist many possible actions, characterized by various combinations $\{\tau, \gamma\}$.
- Suppose the manager has information about the various actions that can be taken. Should the investors go along with the manager's proposal – that is, should they give her *real control*?
- The investors can only know that an action proposed by the manager has $\tau R_b - \gamma \geq 0$. They will say yes if and only if $E(\tau \mid \tau R_b - \gamma \geq 0) \geq 0$.
- The higher is R_b, the more *congruent* are the objectives of manager and investors.
- Managers with higher R_b – that is, with more high-powered incentives – have more real control.
- Entrepreneurs in strong firms – with a high A – have more real control than those in weak firms.
- An active monitor with similar interests to other investors collects information about the possible actions.
  - A proposal which is also backed by the monitor conveys even more information.
  - Active monitoring – by blockholding shareholders or relationship lenders – is particularly useful for weak firms.

- Supplementary section to chapter 10 is *not* required reading.

The market for corporate control: Takeovers

- Takeovers: Hostile vs friendly
- Two motivations for takeovers
  - The *ex-post* rationale: benefits from a new management team.
  - The *ex-ante* rationale: disciplining effect on incumbent management.
- *Tradeoff efficiency vs rent extraction*: Firms want to enjoy benefits from takeovers, but want to limit (or appropriate parts of) raiders' gain.

- Model: Fixed investment. Intermediate date: raider appears. Initial date: corporate charter design; investment.
- If no takeover
  - investors' value: $v = p_H(R - R_b)$
  - incumbent's benefit: $w = p_H R_b$
  - total: $v + w = p_H R$
- If takeover: investors' value: $\hat{v}$; raider's private benefit: $\hat{w}$.
- *Corporate charter*: defining the terms under which the raider can take control – for what values $\hat{v}$ and $\hat{w}$ should a transfer occur?
  - Obviously, a narrow view of the corporate charter.
- Raider is not credit rationed.
- Investors' value in case of a takeover, $\hat{v}$, is publicly known. Raider's value, $\hat{w}$, is raider's private information. Cumulative distribution function $H(\hat{w})$, density $h(\hat{w})$.

- Suppose first also incumbent manager is not credit constrained.
- The firm commits to a sale price P of the firm to a potential raider such that $\hat{v} + \hat{w}^* = P$, where $\hat{w}^*$ is a cutoff value for the raider's gain: The raider takes over the firm and pays P if and only if $\hat{w} \geq \hat{w}^*$.
- The probability of takeover: $1 - H(\hat{w}^*) = 1 - H(P - \hat{v})$.
- Entrepreneur's utility equals NPV

$$U_b = (v + w)H(\hat{w}^*) + (\hat{v} + \hat{w}^*)[1 - H(\hat{w}^*)] - I$$

- The entrepreneur chooses the P, implicitly the $\hat{w}^*$, that maximizes U_b.
    - Resemblance with monopoly pricing: View $[1 - H(\hat{w}^*)]$ as a demand curve. The higher is $\hat{w}^*$, the higher is the gain if the firm is sold, but then also the lower is the chance that the firm *is* sold.
- Socially inefficient P – too few takeovers.
- Other forces work the other way.
    - Agency problems in the raiding firm, say with managers exerting real control, may lead to too many raids.
    - Raider costs related to preparing a bid for the firm: Suppose $\hat{w}$ is known to the raider only after he incurs c. If c is too high, then the target firm may have to lower P in order to get the raider to participate.
    - When the incumbent manager is credit rationed, lowering P increases the chances for a takeover and therefore increases pledgeable income.

Incentive effects of takeover threats

- Two views
  - Takeovers are good for governance – they get incumbent managers to work hard.
  - Takeover threats lead to short-term behavior among managers – *myopia*.
- A model of takeover-induced myopia
  - Myopia – putting too much weight on the present relative to the future – here in the form of underinvestment in future profitability.
  - Success probability under incumbent management is $p + \tau$, where $p \in \{p_H, p_L\}$, depending on manager effort, and τ is the result of an investment made by manager before any takeover takes place.
  - Choice of τ is unobservable.
  - Investment cost $\gamma(\tau)$, convex.
  - R_b is the entrepreneur's return if success.
  - H is the probability of no takeover.
  - The entrepreneur chooses τ to maximize

    $$\tau R_b H - \gamma(\tau)$$
  - Two reasons for underinvestment
    - The entrepreneur needs outside capital and lets investors in, so that $R_b < R$.
    - There is a chance for a takeover, so that $H < 1$.
  - Related forms of myopic managerial behavior
    - Entrenchment – creating obstacles for the takeover.
    - Posturing – obtaining good short-term results in order to appear more efficient than one is.

Takeovers in practice

- Single bidder.
- *Tender offer*: the raider makes the price offer, shareholders individually decide whether or not to accept.
    - Even now, the corporate charter may influence the price, though.
    - *Restricted offer*: restricted to a certain fraction of outstanding shares; or unrestricted
    - *Conditional offer*: conditional on the raider acquiring a certain fraction of the shares; or unconditional.
- Suppose raider needs a fraction κ in order to gain control, $0 < \kappa < 1$.
- Investor value with a takeover: $\hat{v}$; without: v.
- A *value-enhancing takeover*: $\hat{v} > v$.
    - A value-decreasing takeover: $\hat{v} < v$.
- Free-riding shareholders
- Assume $\hat{v} - v = 1$.
- No private benefit to raiders: $\hat{w} = 0$.
- Redefine P as the premium over v offered by the raider, that is, raider offers $v + P$, $0 \le P \le 1$.
- A *continuum* of shareholders, of *mass* 1.
    - Continuum: no shareholder is *pivotal*.

- Let β be the probability, according to shareholders, that the takeover will be successful.
    - Continuum of shareholders implies that β is not affected by any single shareholder's decision to accept or not.
- In equilibrium, $\beta = P \Leftrightarrow \beta\hat{v} + (1 - \beta)v = v + P$
    - Shareholders are indifferent between selling and keeping shares
- In equilibrium, raider buys a fraction κ of the shares.
- Raider earns nothing from the value enhancement:

$$\pi = \kappa[\beta(\hat{v} - v) - P] = \kappa[\beta - P] = 0.$$

- Free-riding shareholders take the entire value enhancement that the raider creates.
- Private benefit to raider: $\hat{w} > 0$
    - No change in equilibrium beliefs among shareholders: $\beta = P$.
    - So the raider gets to keep all his private benefit:

$$\pi = \kappa[\beta - P] + \beta\hat{w} = P\hat{w}.$$

    - Therefore, it pays for raider to increase the price, and so $P = 1$, and therefore $\beta = 1$.
    - With *dispersed ownership*, a raider keeps all his private benefit and gets none of the value enhancement.
    - With a large current shareholder, even some of the private benefit of the raider may end up at this large shareholder.

- *Toehold*: The raider already owns a fraction $\theta < \kappa$ of the firm's shares.

    - The raider's profit is:

$$\begin{aligned}\pi &= (\kappa - \theta)[\beta(\hat{v} - v) - P] + \theta\beta(\hat{v} - v) \\ &= \theta P, \\ &\text{since } \hat{v} - v = 1 \text{ and } \beta = P.\end{aligned}$$

    - The optimal bid is $P = 1$, so $\pi = \theta$.
    - The raider retains the value enhancement of his initial shares.
    - The implication is that block shareholding facilitates takeovers by block shareholders.

- *Dilution* of minority shareholders' value

    - Examples: tunneling; minority buyout.
    - Suppose the raider is able to expropriate a fraction ϕ of minority owners' value increase.
    - Without dilution: $\hat{v} - v = 1$, and $\hat{w} = 0$.
    - With dilution: raider gets $\hat{w} = \phi(\hat{v} - v) = \phi$, and current shareholders get $(1 - \phi)(\hat{v} - v) = 1 - \phi$.
    - Shareholders' beliefs about the probability of a successful raid is again such that they are indifferent between selling and holding shares:

$$\beta(1 - \phi) = P$$

- The raider will not have to bid more than $P = 1 - \phi$. For bids $P \leq 1 - \phi$, his profit, when buying a fraction κ of the shares to obtain control, is:

$$\pi = [\kappa + (1 - \kappa)\phi]\beta - \kappa P$$
$$= [\kappa + (1 - \kappa)\phi]\beta - \kappa\beta(1 - \phi) = \beta\phi.$$

- Raider maximizes profit at $P = 1 - \phi$, getting $\pi = \phi$.
    - He gets the dilution value on *all* shares.

- Takeover defenses
    - They work in the opposite direction of dilution, making it harder for the raider to acquire the firm.
    - An example of a *poison pill*: a scheme allowing shareholders to buy new shares at a discount in case of a takeover.
        - Making it possible for current shareholders to appropriate all or part of raider's private benefit, $\hat{w}$.

- A finite number of shares
    - Calculating each shareholder's equilibrium strategy.
    - One vs many shares per shareholder.
        - When a shareholder holds several shares, his tendering one of his shares increases the value of his other shares. This increases his incentives to tender, and therefore reduces the free-rider problem and increases the scope for takeovers.

- Value-decreasing takeovers: $\hat{v} < v$.
    - Necessarily, the raider must have private benefits from the takeover: $\hat{w} > 0$.
    - Suppose price P is such that $\hat{v} - v < P < 0$.
        - Tendering an offer exerts a *negative externality* on non-tendering shareholders – the same way as there is a positive externality when the takeover is value-enhancing.
    - If a value-decreasing takeover takes place, it is best for current shareholders that the raider buys as many shares as possible: *one share – one vote*.

- Takeovers with multiple bidders: *bidding contests*.
    - Preemptive behavior:
        - early high price
        - toehold

- Managerial resistance to takeovers
    - Conflict of interest
    - Formal vs real authority