FREIXAS AND ROCHET (2008) MICROECONOMICS OF BANKING, CHAPTER 2

THE ROLE OF FINANCIAL INTERMEDIARIES

Alberto Ortiz

Financial Intermediaries

- Def^{n}: an economic agent who specializes in the activities of buying and selling (at the same time) financial claims.

Why do financial intermediaries exist?

- The Classical Theory
  - Due to transaction costs (Benston and Smith, 1976)
    - costs of becoming informed
    - costs of structuring, administering and enforcing financial contracts
    - cost of transferring financial claims
  - Transformation of assets (Gurley and Show, 1960)
    - maturity
    - convenience of denomination
    - risk (indivisibilities) (Merton, 1989)

It is implicitly assumed that these asset transformation services are provided more efficiently outside the firm

Why do financial intermediaries exist?

- First Generation
  - The delegated monitoring approach (Diamond 1984)
- Second Generation
  - Co-existence of financial intermediaries and financial markets
- So financial intermediaries exist due to their role in economizing on transaction costs, providing intertemporal insurance, and their role in screening and monitoring.

2.3 Coalitions of Borrowers and the Cost of Capital

- Information asymmetry: entrepreneurs are better informed than investors about the quality of the projects they want to develop.
- Adverse selection: entrepreneurs with low quality projects will be more likely to issue equity (try to sell them instead of self-financing).
- Under certain conditions, investors with high quality projects can signal the quality of their project by self-financing part of it.
  - This partly overcomes the adverse selection problem as we can have separation of "good" and "bad" projects.
  - However, signaling is costly.
- This motivates the formation of coalitions of good borrowers in order to get better financing conditions than by borrowing individually.

2.3.1 A Simple Model of Capital Markets with Adverse Selection

Set up :

Large number of entrepreneurs, each endowed with a risky project, requiring an investment of 1 and with random gross return $\tilde{R}(\theta) = 1 + \tilde{r}(\theta)$, with $\tilde{r}(\theta) \sim N(\theta, \sigma^2)$.

Whereas σ^2 is the same for all projects, θ differs across projects and is privately observed by each entrepreneur. However, the statistical distribution of θ in the population of entrepreneurs is common knowledge.

Investors are risk - neutral (only care about expected return) and have access to a costless storage technology (this sets the lower bound for the required return).

A Simple Model of Capital Markets with Adverse Selection

Set up (cont.):

Entrepreneurs have enough initial wealth W_0 to finance their projects $(W_0 > 1)$ but they would prefer to sell these projects because they are risk-averse.

Preferences are given by $u(w) = -e^{-\rho w}$, where w is final wealth and $\rho > 0$ is the (constant) absolute index of risk aversion.

This model uses the fact that if $\tilde{x}$ is a random variable, and $u(w) = -e^{-\rho w}$, then

$$E\{u(\tilde{x})\} = u\left(E\{\tilde{x}\} - \tfrac{1}{2}\rho \operatorname{var}(\tilde{x})\right)$$

A Simple Model of Capital Markets with Adverse Selection

If θ were observable, each entrepreneur would sell its project to the market at a price $P(\theta) = \mathrm{E}\{\tilde{r}(\theta)\} = \theta$ and would be perfectly insured with final wealth $W_0 + \theta$ and utility $u(W_0 + \theta)$.

If θ is private information and entrepreneurs are indistinguishable by investors, the price will be the same for all firms and in general only entrepreneurs with a lower expected return will sell their projects (adverse selection).

A Simple Model of Capital Markets with Adverse Selection

By self - financing its project, entrepreneur θ obtains

$$E\{u(W_0 + \tilde{r}(\theta))\} = u\left(W_0 + \theta - \tfrac{1}{2}\rho\sigma^2\right)$$

whereas by selling it to the market, he obtains

$$u(W_0 + P).$$

Therefore, entrepreneur θ will go to the financial market if and only if

$$\theta < \hat{\theta} = P + \tfrac{1}{2}\rho\sigma^2 \qquad (2.11)$$

This means that only those entrepreneurs with a relatively low expected return $\left(\theta < \hat{\theta}\right)$ will issue equity (adverse selection).

A Simple Model of Capital Markets with Adverse Selection

At equilibrium, the average return on equity will equal P (because investors are risk - neutral):

$$P = E\left\{\theta \middle| \theta < \hat{\theta}\right\} \qquad (2.12)$$

Def^{n} : The equilibrium of the capital market with adverse selection is thus characterized by a price of equity P and a cutoff level $\hat{\theta}$ such that

$$\theta < \hat{\theta} = P + \tfrac{1}{2}\rho\sigma^2 \qquad \text{and} \qquad P = E\left\{\theta \middle| \theta < \hat{\theta}\right\}$$

are satisfied.

In general, the equilibrium outcome is inefficient as it does not provide insurance to those entrepreneurs who prefer to self - finance.

A Simple Model of Capital Markets with Adverse Selection

To understand the inefficiency consider that

$$\theta = \begin{cases} \theta_1 \ \text{(low) with probability } \pi_1 \\ \theta_2 \ \text{(high) with probability } \pi_2 = 1 - \pi_1 \end{cases}$$

Since investors are risk - neutral and entrepreneurs are risk - averse, first best efficiency requires that all entrepreneurs get 100% financing.

This will require $\hat{\theta} > \theta_2$. In that case, the price of equity equals

$$P = E\{\theta\} = \pi_1\theta_1 + \pi_2\theta_2$$

This is only possible when

$$P + \tfrac{1}{2}\rho\sigma^2 \geq \theta_2 \quad \Leftrightarrow \quad \pi_1(\theta_2 - \theta_1) \leq \tfrac{1}{2}\rho\sigma^2 \qquad (2.13)$$

i.e. the risk premium $\left(\frac{1}{2}\rho\sigma^2\right)$ has to outweigh the adverse selection $\pi_1(\theta_2 - \theta_1)$.

If this condition is not satisfied, some entrepreneurs self - finance, and the equilibrium outcome is inefficient.

2.3.2 Signaling through Self-Financing and the Cost of Capital

When the previous condition is not satisfied, entrepreneurs with good quality projects $(\theta = \theta_2)$ prefer to self - finance rather than to sell the entirety of their projects at a low price $P = E\{\theta\}$.

In fact, they can limit themselves with partial self - finance if they can convince investors that the other entrepreneurs have no interest in doing the same (mimic).

If α denotes the fraction of the project beign self - finance, the "no mimicking" conditioning is

$$\underbrace{u(W_0 + \theta_1)}_{\text{utility reporting thruthfully}} \geq \underbrace{E\{u(W_0 + (1-\alpha)\theta_2 + \alpha\tilde{r}(\theta_1))\}}_{\text{utility mimicking}} \qquad (2.14)$$

Separating Equilibrium

With normal returns and exponential utility the "no mimicking" condition is :

$$u\left(W_0+\theta_1\right)\geq u\left(W_0+\left(1-\alpha\right)\theta_2+\alpha\theta_1-\tfrac{1}{2}\rho\sigma^2\alpha^2\right)$$

so we need that

$$\theta_1\geq\left(1-\alpha\right)\theta_2+\alpha\theta_1-\tfrac{1}{2}\rho\sigma^2\alpha^2 \quad\Leftrightarrow\quad \tfrac{\alpha^2}{1-\alpha}\geq\tfrac{2\left(\theta_2-\theta_1\right)}{\rho\sigma^2} \qquad (2.15)$$

Result 2.2 (Leland and Pyle 1977) : When the level of projects' self - financing is observable, there is a continuum of signaling equilibria, parameterized by a number α fulfilling (2.15), and characterized by a low price of equity $P_1=\theta_1$ for entrepreneurs who do not self - finance and a high price of equity $P_2=\theta_2$ for entrepreneurs who self - finance a fraction α of their projects.

Ranking Equilibria

So there is a continuum of equilibria parameterized by the level of self-financing of good projects α.

These equilibria can be Pareto-ranked.

- Given that all lenders break even and
- θ_1 entrepreneurs get the same outcome as in the full-information case.
- We only need to focus on type θ_2 entrepreneurs whose utility is reduced from

$$u(W_0 + \theta_2) \quad \text{to} \quad u\left(W_0 + \theta_2 - \tfrac{1}{2}\rho\sigma^2\alpha^2\right)$$

due to the risk associated with the self-financing.

Expressed in terms of lost income, their informational cost of capital is therefore

$$C = \tfrac{1}{2}\rho\sigma^2\alpha^2 \qquad (2.16)$$

which is increasing in the level of self-financing.

Pareto-dominating signaling equilibrium

The Pareto - dominating signaling equilibrium corresponds to the minimum possible value of α, consistent with the "no mimicking" condition which is defined implicitly by transforming (2.15) into an equality :

$$\frac{\alpha^2}{1-\alpha} = \frac{2(\theta_2 - \theta_1)}{\rho\sigma^2} \qquad (2.17)$$

This Pareto - dominating equilibrium, allows the definition of the (minimum) cost of capital

$$C(\sigma) = \tfrac{1}{2}\rho\sigma^2\alpha^2(\sigma) \qquad (2.18)$$

where $\alpha(\sigma)$ is defined implicitly by (2.17).

2.3.3 Coalitions of Borrowers

Main idea : in the presence of adverse selection coalitions of borrowers can do better than individual borrowers.

Suppose that N identical entrepreneurs of type θ_2 form a partnership and collectively issue securities im order to finance their N projects.

If the individual returns of each project are *i.i.d.* and if the N entrepreneurs share equally both the proceeds of security issuing and the final returns, the expected return is still θ_2 but the variance per project is now $\frac{\sigma^2}{\mathrm{N}}$ (due to diversification).

Since the function $\sigma \to C(\sigma)$ defined by (2.18) is increasing, then :

Result 2.3 (Diamond 1984) : In the Leland - Pyle model (1977), the unit cost of capital decreases with the size of the coalition of borrowers.

2.4 Financial Intermediation as Delegated Monitoring

- Monitoring:
  - Screening project a priori (adverse selection)
  - Preventing opportunistic behavior (moral hazard)
  - Punishing or auditing a borrower who fails to meet contractual obligations

- These monitoring activities improve the efficiency of lender-borrower contracts with asymmetric information.

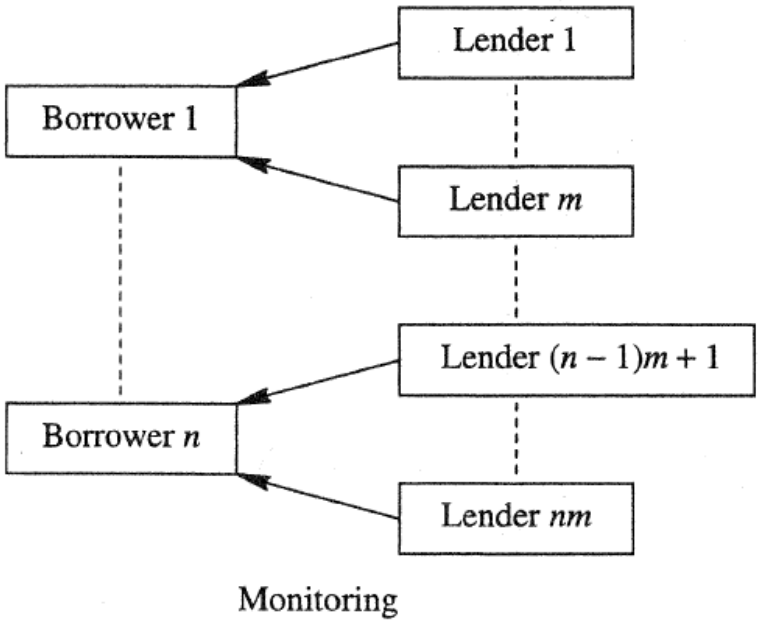
Why Delegated Monitoring?

- Monitoring activities could be performed by the individual lenders themselves.

- Delegated monitoring theory: "banks have a comparative advantage in these monitoring activities." True if:
  - Scale economies in monitoring
  - Small capacity of investors
  - Low cost of delegation (cost of monitoring banks relative to surplus gained)

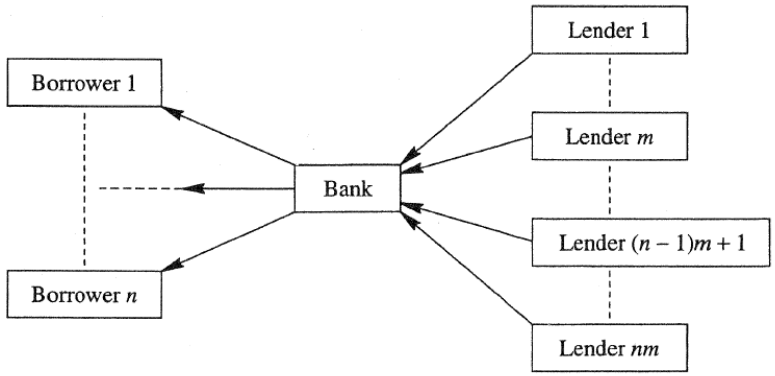
Direct Finance vs Delegated Monitoring

Direct finance: each lender monitors its borrower (total cost nmK)



Monitoring

Intermediated finance: delegated monitoring (total cost nK +C_n)



n: number of projects
m: number of investors required to finance each project
K: monitoring costs
C_n: auditing costs

Diamond (RES 1984): Financial Intermediation and Delegated Monitoring

- **Result 2.4:** If monitoring is efficient (monitoring cost: $K<C_1$: cost of auditing the bank), investors are small ($m>1$), and investment is profitable ($E(y)>1+r+K$), financial intermediation (delegated monitoring) dominates direct lending as soon as the number of projects (n) is large enough.

2.5 The Choice between Market Debt and Bank Debt

- Study the choice between direct and intermediate finance.
- Direct debt is less expensive than bank loans
  - Loan applicants are only those agents that cannot issue direct debt on financial markets.
- Illustrate with a model of moral hazard.

2.5.1 A Simple Model of the Credit Market with Moral Hazard

- Setup:
  - Firms seek to finance investment projects of size 1.
  - The riskless rate of interest is normalized to zero.
  - Firms have a choice between a good technology (produces G with probability π_G , 0 otherwise), and a bad technology (produces B with probability π_B , 0 otherwise).
  - Assume that only good projects have a positive expected NPV: $\pi_G G > 1 > \pi_B B$; but that $B > G$ which implies that $\pi_G > \pi_B$.

A Simple Model of the Credit Market with Moral Hazard

- Setup (cont.):
  - Assume that the success of the investment is verifiable by outsiders, but not the firm's choice of technology nor the return.
  - Thus the firm can promise to repay some fixed amount ***R*** only in case of success.
  - The firm has no other source of cash, so repayment is zero if the investment fails.

Effect of Required Return on Technology Choice

- Key insight: *R* determines the choice of technology.
  - In the absence of monitoring, the firm will choose the good technology if and only if this gives it a higher profit:

$$\pi_G(G-R)>\pi_B(B-R)$$

  - Since $\pi_G>\pi_B$ this is equivalent to

$$R< R_C =(\pi_G G-\pi_B B)/(\pi_G-\pi_B)$$

where R_C denotes the critical value of nominal debt above which the firm chooses the bad technology. From the lender's viewpoint, the probability π of repayment therefore depends on R:

$$\pi(R)=\begin{cases}\pi_G & \text{if} \quad R \le R_C \\ \\ \pi_B & \text{if} \quad R > R_C\end{cases}$$

Equilibrium under Moral Hazard without Monitoring

- In the absence of monitoring, a competitive equilibrium of the credit market is obtained for R such that

$$\pi(R)R=1$$

- Because $\pi_B R<1$ for $R \leq B$, equilibrium is only possible when the G technology is implemented. This implies $R<R_c$ and thus $\pi_G R_c \geq 1$, which is only satisfied when moral hazard is not too important.
- If $\pi_G R_c <1$, the equilibrium involves not trade, and the credit market collapses because good projects cannot be financed, and bad projects have a negative net present value (NPV).

Introducing Monitoring

- At a cost **C**, banks can prevent borrowers from using the bad technology.
- Assuming perfect competition between banks, the nominal value of bank loans at equilibrium is determined by the break-even condition:

$$\pi_G R_m = 1 + C$$

- For bank lending to appear at equilibrium, two conditions are needed:
  - The nominal repayment on bank loans R_m at equilibrium has to be less than the return G of successful firms.

$$\pi_G G > 1 + C$$

  - Direct lending which is less costly, has to be impossible:

$$\pi_G R_C < 1$$

Bank Lending under Moral Hazard

- For bank lending to appear at equilibrium, two conditions are needed:
  - The nominal repayment on bank loans R_m at equilibrium has to be less than the return G of successful firms.

$$\pi_G G > 1 + C$$

  - Direct lending which is less costly, has to be impossible:

$$\pi_G R_C < 1$$

- Therefore, bank lending appears at equilibrium for intermediate values of the probability

$$\pi_G \left(\pi_G \in \left[\frac{1+C}{G}, \frac{1}{R_C} \right] \right),$$

provided this interval is not empty.

Equilibrium under Moral Hazard with Monitoring

Result 2.5 : Assume that the monitoring cost C is small enough so that

$$\frac{1+C}{G} < \frac{1}{R_C}$$

There are three possible regimes of the credit market at equilibrium :

1. If $\pi_G > \frac{1}{R_C}$ (high probability of success),
   firms issue direct debt at rate $R_1 = \frac{1}{\pi_G}$.

2. If $\pi_G \in \left[\frac{1+C}{G}, \frac{1}{R_C}\right]$ (intermediate probability of success),
   firms borrow from banks at a rate $R_2 = \frac{1+C}{\pi_G}$.

3. If $\pi_G < \frac{1+C}{G}$ (low probability of success),
   the credit market collapses (no trade equilibrium).

2.5.2 Monitoring and Reputation

- Adapted from Diamond (JPE 1991) "Monitoring and reputation: The choice between bank loans and directly placed debt."

- Objective: show, in a dynamic extension of the previous model (with two dates, $t=0,1$), that successful firms can build reputation that allows them to issue direct debt instead of using bank loans which are more expensive.

Diamond (1991 JPE)

- Setup:
  - Almost the same as in previous model.
  - But now assume that firms are heterogeneous:
    - Only a fraction ***f*** of them has the choice between the two technologies.
    - The rest have access only to the bad one, and bank monitoring has no effect on them.
  - Under some conditions of the parameters, the equilibrium of the credit market will be such that
    - at $t=0$, all firms borrow from banks;
    - at $t=1$, the firms that have been successful at $t=0$ issue direct debt while the rest still borrow from banks;
    - banks monitor all the firms that borrow from them.

Monitoring and Reputation

From result 2.5, we know that successful firms will be able to issue debt if and only if

$$\pi_S > \frac{1}{R_C}$$

where π_S is the probability of repayment at date 1 conditional on success at $t = 0$.

Bayes' formula gives the following:

$$\pi_S = \frac{P(\text{success at t=0 and t=1})}{P(\text{success at t=0})} = \frac{f\pi_G^2 + (1-f)\pi_B^2}{f\pi_G + (1-f)\pi_B}$$

If $\pi_S > \frac{1}{R_C}$ is satisfied, successful firms will be able to issue direct debt at a rate $R_S = \frac{1}{\pi_S}$.

Monitoring and Reputation

On the other hand, the probability of success at $t = 1$ of the firms that have been unsuccessful at $t = 0$ is

$$\pi_{\mathrm{U}} = \frac{P(\text{success at t=1})}{P(\text{failure at t=0})} = \frac{f\pi_G(1-\pi_G)+(1-f)\pi_B(1-\pi_B)}{f(1-\pi_G)+(1-f)(1-\pi_B)}$$

Result 2.5 implies that if

$$\frac{1+\mathrm{C}}{\mathrm{G}} < \pi_{\mathrm{S}} < \frac{1}{\mathrm{R_C}}$$

these unsuccessful firms will borrow from banks, at a rate $R_U = \frac{1+C}{\pi_{\mathrm{U}}}$.

Monitoring and Reputation

Result 2.6 Under the following assumptions,

$$\pi_0 \le \frac{1}{R_C^0}, \quad \pi_S > \frac{1}{R_C}, \quad \text{and} \quad \frac{1}{R_C} > \pi_U > \frac{1+C}{G}$$

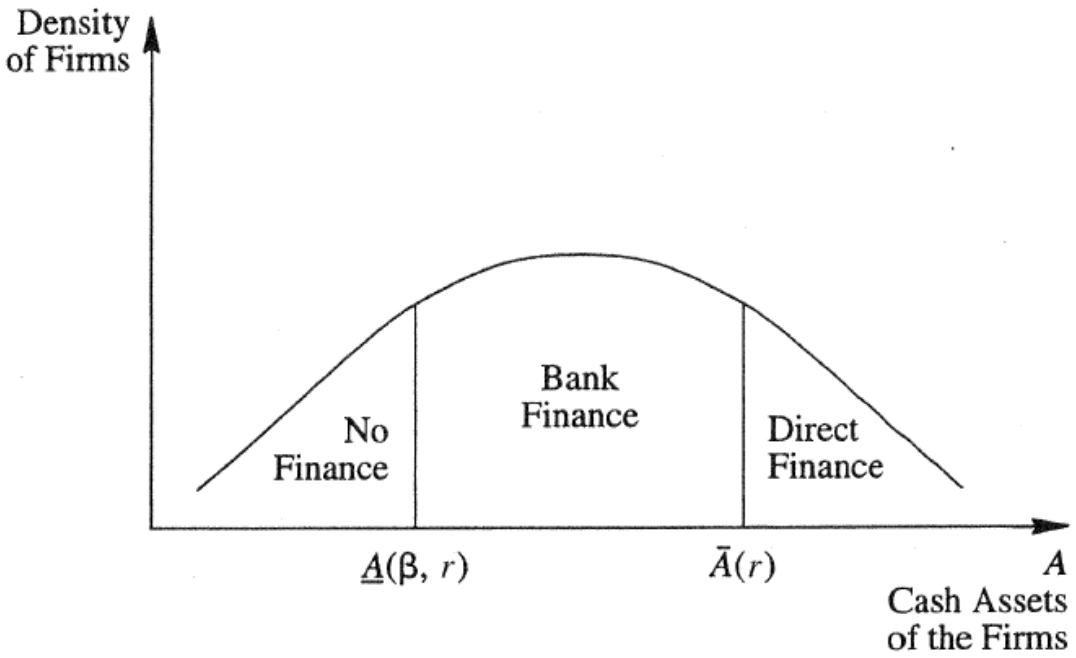
the equilibrium of the two-period of Diamond's model is characterized as follows:

1. At $t = 0$, all firms borrow from banks at rate $R_0 = \frac{1+C}{\pi_0}$

2. At $t = 1$, successful firms issue direct debt at a rate $R_S = \frac{1}{\pi_S}$, whereas the rest borrow from banks at a rate $R_U = \frac{1+C}{\pi_U} > R_0$.

Monitoring and Capital

Result 2.7 (Holmström and Tirole 1997) At equilibrium, only well capitalized firms can issue direct debt. Firms with intermediate capitalization borrow from banks, and undercapitalized firms cannot invest.



2.5.5 Credit Risk and Dilution Costs

- Based on Bolton and Freixas (JPE 2000) **Equity, bonds, and bank debt: Capital structure and financial market equilibrium under asymmetric information**
  - **This paper proposes a model of financial markets and corporate finance, with asymmetric information and no taxes, where equity issues, bank debt, and bond financing coexist in equilibrium. The relationship banking aspect of financial intermediation is emphasized: firms turn to banks as a source of investment mainly because banks are good at helping them through times of financial distress. This financial flexibility is costly since banks face costs of capital themselves (which they attempt to minimize through securitization). To avoid this intermediation cost, firms may turn to bond or equity financing, but bonds imply an inefficient liquidation cost and equity an informational dilution cost. We show that in equilibrium the riskier firms prefer bank loans, the safer ones tap the bond markets, and the ones in between prefer to issue both equity and bonds. This segmentation is broadly consistent with stylized facts.**

Credit Risk and Dilution Costs

- Set up:
  - For simplicity, all investors are risk-neutral, and riskless interest rates are normalized to zero.
  - A continuum of firms have to choose whether to be financed by a bank loan, by issuing equity, or by issuing a bond.
  - Required investment of 1 at $t=0$ with return $y>1$ in case of success or 0 in case of failure, both at times $t=1$ and $t=2$. So examples of sequences are $(-1,y,y)$ or $(-1,0,y)$.
  - Projects can be liquidated at $t=1$ for a resale value $A>0$.

Credit Risk and Dilution Costs

- Set up (cont):
  - Firms are heterogeneous and differ by the (observable) probability p of success at t=1.
    - p: credit rating distributed in the interval $[\underline{p},1]$, with $\underline{p}<1/2$.
  - There is adverse selection regarding time $t=2$ cash flows.
    - There are two type of firms:
      - Good ones (in proportion v), which are successful (obtain a return y) at time t=2 with probability 1.
      - Bad ones (in proportion 1-v), which have zero probability of success.
    - Each firm knows its type, but creditors' belief (at $t=0$) are uniform across firms.

Credit Risk and Dilution Costs

- Set up (cont):
  - Due to adverse selection, the cost of borrowing \$1 at $t=1$ is a promised repayment of $\$(1/v)$.
  - Yet, good borrowers know they will repay at $t=2$ with certainty, so that under full information their cost of borrowing \$1 should be \$1.
    - The dilution cost is thus $1/v - 1$ per dollar borrowed.

Firms' Financial Choice

- Firms choose among bond, equity, and bank debt.
  - Assume that firms cannot combine them.
  - Since bad firms will mimic the good ones, we only have to care about the choices of the good firms:
- Bond financing implies a repayment R at $t=1$ (in case of success) and nothing at $t=2$. In case of default at $t=1$, the firm is declared bankrupt and is liquidated.
- Equity issue: a share $\alpha \in [0,1]$ of the cash flows generated by the firm is sold to investors.
- Bank debt implies a repayment $\check{R}$ at $t=1$, and nothing at $t=2$. If the firm defaults at $t=1$, there is renegotiation and the bank is able to extract the entire surplus at $t=2$ because it can observe the probability of success at date 2.

Bond Financing

The zero - profit condition for investors is

$$1 = pR + (1-p)A$$

This nominal return R is feasible $(R < y)$ if $py + (1-p)\mathrm{A} > 1$, and the expected profit of good firms is then

$$\Pi_{\mathrm{B}} = p(y-R) + py$$

Replacing R by its value (given by the investors' zero profit condition), we get

$$\Pi_{\mathrm{B}} = 2py - 1 + (1-p)A$$

Equity Issue

A fraction a of the firm's capital is sold to outside investors. Because of adverse selection about the probability of success at $t = 2$, there is a dilution cost. Outside shareholders only anticipate an expected cash flow vy at $t = 2$.

The zero - profit condition for outside shareholders is

$$1 = a[py + vy]$$

and the expected profit of good firms is

$$\Pi_E = (1 - a)[py + y]$$

Replacing a by its value (given by the banks' zero - profit condition), we get

$$\Pi_E = \left(y - \frac{1}{p - v}\right)[p + 1]$$

Bank Debt

The zero - profit condition for bank is

$$1+\gamma = p\breve{R} + (1-p)\left[A + v(y-A)\right]$$

and the expected profit of good firms is

$$\Pi_{BL} = p\left(y - \breve{R}\right) + py$$

Replacing $p\breve{R}$ by its value given by investors' zero - profit condition, we get

$$\Pi_{BL} = 2py - 1 - \gamma + (1-p)\left[A + v(y-A)\right]$$

Bonds vs. Bank Debt

To determine when bond issuing is preferred to bank debt we must compare the expected profits under both alternatives. Bond issuing will dominate bank debt if

$$\Pi_B > \Pi_{BL}$$

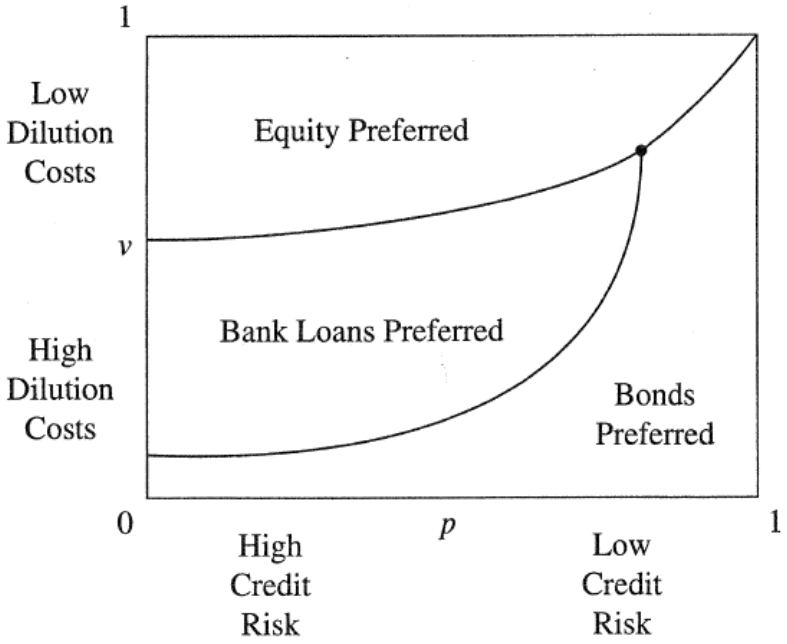
$$2py - 1 + (1-p)A > 2py - 1 - \gamma + (1-p)(A + v(y-A))$$

$$\frac{\gamma}{v(y-A)} > 1 - p$$

which is more likely when v is small (high dilution costs)
or when p is high (low credit risk).

Optimal Firms' Financial Choice

- By comparing these expected profits for different values of *p* and *v*, we derive the optimal financing choice of firms.



- Equity financing dominates when dilution costs are low.
- Bond financing dominates when credit risk is low or dilution costs are high.

2.6 Liquidity Provision to Firms

- Holmström and Tirole (JPE 1998) Private and public supply of liquidity.
  - **Banks allow firms to insure against liquidity shocks by committing to finance them in the future (through credit lines), even if such funding is not profitable ex post.**
    - **By doing so, they allow more firms to continue their projects, thus improving the overall efficiency of the economy.**

2.6 Liquidity Provision to Firms

- Holmström and Tirole (JPE 1998) Private and public supply of liquidity.
  - **This paper addresses a basic, yet unresolved, question: Do claims on private assets provide sufficient liquidity for an efficient functioning of the productive sector? Or does the state have a role in creating liquidity and regulating it either through adjustments in the stock of government securities or by other means? In our model, firms can meet future liquidity needs in three ways: by issuing new claims, by obtaining a credit line from a financial intermediary, and by holding claims on other firms. When there is no aggregate uncertainty, we show that these instruments are sufficient for implementing the socially optimal (second-best) contract between investors and firms. However, the implementation may require an intermediary to coordinate the use of scarce liquidity, in which case contracts with the intermediary impose both a maxi- mum leverage ratio and a liquidity constraint on firms. When there is only aggregate uncertainty, the private sector cannot satisfy its own liquidity needs. The government can improve welfare by issuing bonds that commit future consumer income. Government bonds command a liquidity premium over private claims. The government should manage debt so that liquidity is loosened (the value of bonds is high) when the aggregate liquidity shock is high and is tightened when the liquidity shock is low. The paper thus suggests a rationale both for government-supplied liquidity and for its active management.**

Event Study Methodology

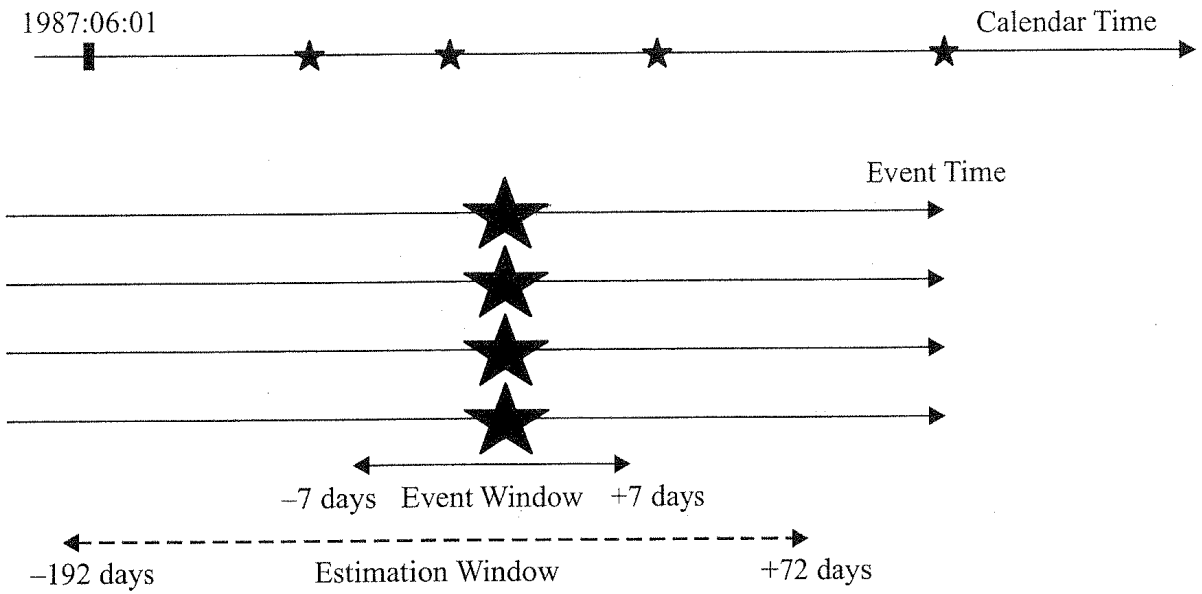


Figure 2.1. Event and estimation windows in calendar and event time. Stars represent events.

Loan Announcements