Lecture 1B: Liability Side of Banking and Debt Structure

Zhiguo He

University of Chicago
Booth School of Business
September 2017, Gerzensee
Most people remember Diamond-Dybvig’s model as a model of bank runs.

"Bank runs" are basic economic phenomena. Diamond-Dybvig cannot be the first one to point out "bank runs". A book in 1930’s after Great Depression even talked about it.

The real contribution of Diamond-Dybvig is to propose a model with liquidity shock. Under this setting, banking turns out to be the "optimal" solution to the problem of uncertain consumption preferences. Demandable deposits provide great consumption flexibility. But, unfortunately, although banking is the "optimal" solution, it suffers from the bank run problem.

It shows the fragility of banking structure is, in some sense, unavoidable.
Investment Technology

- Three periods, \( t = 0, 1, 2 \)
- Two investment technologies
  - Short-term riskless saving technology
  - Long-term risky investment technology: invest 1 dollar at \( t = 0 \), get \( R > 1 \) at \( t = 2 \)
- For long-term technology, at \( t = 1 \) you can terminate and get 1 dollar back
  - Other models (Allen-Gale) have a more realistic assumption that you can only get \( \gamma < 1 \) back
  - \( \gamma = 1 \) blurs the distinction between long-term illiquid asset and short-term liquid asset
  - Timing still matters, as you lose the investment opportunity of \( R \) after seeing your preference realization
- The planner invests 1 dollar at \( t = 0 \) and withdraws \( \alpha \in (0, 1) \) at \( t = 1 \)
  - The society gets \( y_1 = \alpha \) at \( t = 1 \) and \( y_2 = (1 - \alpha) R \) at \( t = 2 \)
Depositors

- One unit measure of agents and can get access to the above technology
- They face uncertain preferences. Denote date $t$ consumption by $C_t$
  - With probability $\pi$, the agent is early type, with utility of $u(C_1)$
  - With probability $1 - \pi$, the agent is late type, with utility of $\rho u(C_1 + C_2)$ and $\rho < 1$
- Suppose there is no banking. Autarky
- Each invests their unit endowment and wait for the preference shock; early eats 1 and late eats $R$
- Autarky welfare:
  \[
  \mathbb{E}\left[u\left(\widehat{C}\right)\right] = \pi u(1) + (1 - \pi) \rho u(R)
  \]
- Question: Does the spot market (which opens ex post on $t = 1$) help?
**Bank’s Problem**

- All agents pool their endowment together to form a bank
- Competitive banking industry, so each bank solves a planner’s problem at $t = 0$
- Choose $C_1^*$ and $C_2^*$ to maximize the agent/depositor’s utility

\[
\max_{C_1^*, C_2^*} \pi u(C_1^*) + (1 - \pi) \rho u(C_2^*)
\]

\[
s.t. \quad \pi C_1^* + \frac{(1 - \pi) C_2^*}{R} = 1 \iff (1 - \pi) C_2^* = (1 - \pi C_1^*) R(1)
\]

- Intuiting for budget constraint (1):
  - Withdraw $\pi C_1^*$ at $t = 1$, so actual long-term investment is $1 - \pi C_1^*$
  - It generates $(1 - \pi C_1^*) R$ to be shared by $1 - \pi$ measure of late depositors
Rewriting the optimization problem

\[
\max_{C_1^*, C_2^*} \pi u(C_1^*) + (1 - \pi) \rho u(C_2^*)
\]

\[
s.t. \quad C_2^* = \frac{(1 - \pi C_1^*) R}{1 - \pi}
\]

**FOC**

\[
u'(C_1^*) = \rho R u'(C_2^*) = \rho R u' \left( \frac{1 - \pi C_1^*}{1 - \pi} R \right)
\]

Assume \( \rho R > 1 \) and \( -\frac{cu''(c)}{u'(c)} > 1 \) (for power utility, \( CRRA > 1 \)), one can show that

\[
1 < C_1^* < C_2^* < R
\]

\( CRRA > 1 \Rightarrow \) consumption smoothing is preferable

\( CRRA > 1 \Rightarrow \) what we need is Elasticity of Intertemporal Substitution (EIS) less than \( 1 \Rightarrow C_1^*, C_2^* \) are not that far away
Banking Solution: Demandable Deposits

- Bank can implement the above optimal solution by issuing demandable deposits.

 Demandable deposits
  - Save one dollar at bank; first period interest rate $R_1 = C_1^*$; second period interest rate $R_2 = C_2^*/C_1^*$
  - Each depositor can decide when to withdraw his/her deposits.

- A good equilibrium: early type withdraws at $t = 1$ and eat $C_1^*$; late type withdraws at $t = 2$ and eat $C_2^*$
  - Since $C_1^* < C_2^*$, late type gets more in consumption units, so truthful reporting is incentive compatible
  - Better than Autarky.

- Banking is a better ex-ante insurance solution, dominating the ex post spot market solution
  - This should remind you the Hirshleifer effect.
However, a **bad equilibrium** also emerges in this implementation!

If everyone believes everyone else is withdrawing at $t = 1$ independent of types, everyone will indeed withdraw at $t = 1$!

- Suppose I am late type. If I do not withdraw, there is nothing left in the bank
- Sequential service constraint etc.

In this bad equilibrium, $\pi u (1) + (1 - \pi) \rho u (1)$ because long-term project is never used. Worse than Autarky

How to stop bank runs?

- Suspend convertibility after say $\pi$ people withdraw
  - Then, late type will not rush, because they know there are enough resource remaining
  - But, what if $\pi$ itself is random?

Deposit insurance is another solution
Follow-up Literature

- Gorton-Pennacchi: JF 1980
  - With private information, early type will favor debt since it is less information sensitive
  - We will get back to this in Week 9

- Jacklin-Bhattacharya: another implementation
  - All equity firm, at $t = 1$ issue dividends of $\pi C_1^*$
  - Each investor gets dividends, but late types simply buy shares from early type using their dividends

- Allen and Gale have written many many papers on this model
The Famous Jacklin Critique

- Jacklin 1987: Banking solution cannot coexist with competitive market solution
  - What if there is an anonymous market to trade bank’s demandable deposits? Do I want to participate in the banks?
  - Answer: knowing other people participate in the bank, I want to save with myself at $t = 0$

- The following deviating strategy dominates saving in the bank
  - Invest one dollar in long-term project at $t = 0$
  - At $t = 1$, if I am late then quite happy
  - If I am early, I can use my yet-to-mature project which yields $R$ dollar to buy demandable deposits from other late types (who participate in the bank), then claim $t = 1$ consumption from the bank
  - It is like insurance but somehow allows you to opt out

- Diamond (1997, JPE) offers a response, saying that market and banks coexist if some investors cannot always get access to market
What Is Diamond-Dybvig Missing

- Demandable deposits seem costly given bank failures
- Diamond-Dybvig explains demandable deposit from consumer side
  - Consumption flexibility, liquidity
- There are two features that Diamond-Dybvig model lacks about bank failure
  - Bank failure often associated with fraud and conflict of interests
  - Bank failure often caused by withdrawals of informed depositors
- Finally, why the so-called "sequential service constraint" (first-come, first-served)?
  - In non-bank bankruptcies, "automatic stay" prohibits payment in anticipation of bankruptcy
Demandable debt incentivizes investors to monitor the bank

- Investors can withdraw funding immediately given the information they collect

A project requires $Y$ dollars at $t = 0$ and yields $r^H Y$ or $r^L Y$ at $t = 2$

There are $Z$ investors who can acquire information with a cost of $I$

- At $t = 1$, $K$ of them acquire informative signal $\tilde{\sigma} \in \{g, b\}$ about date 2 return $\tilde{r} \in \{r^H, r^L\}$; good signal prob. $\lambda$
- $Z - K$ of them decide not to (so sleepy)

Mechanism design approach with revelation principle

IC and IR (sleepy investors are treated as reporting $\hat{g}$ always)

\[
1 = \lambda U(\hat{g}, g) + (1 - \lambda) U(\hat{g}, b) \\
1 + I = \lambda U(\hat{g}, g) + (1 - \lambda) U(\hat{b}, b) > \text{misreporting}
\]
Agency Problem and Ex post Absconding

* In Calomiris-Kahn, return $\tilde{r}$ is unobservable, and the banker can divert to get $(1 - \alpha)\tilde{r}Y$ with him
* Given required payment $P$, the bank absconds if
  \[(1 - \alpha)\tilde{r}Y > \tilde{r}Y - P \Rightarrow \tilde{r} < \frac{P}{\alpha Y}\]

* So in low state the banker is more likely to commit fraud
* Hence, bad signals at $t = 1$ give warning signs for fraud
* At the end of $t = 1$ we can also liquidate the bank
  * Bank should be liquidated given enough bad signals
* Optimal contract (solved by mechanism design approach)
  * Some investors acquire signals
  * Whoever reports $\sigma = b$ gets a constant $R$; whoever report $\sigma = g$ split the remaining funds at $t = 2$
  * The bank is liquidated if total withdrawals exceed $NR$
The Incentive Role of First-Come-First-Serve Contract

- The optimal contract looks like demandable deposits
- The so-called "sequential service constraint" (first-come, first-served) is essential to provide incentives for acquiring signal or monitoring
  - If acquiring signal, given the bad realization, I can get out first from the sinking boat before others
- From this view, "sequential service constraint becomes intelligible as a way to make monitoring depositors interested in registering their no-confidence votes at the first opportunity"

Calomiris-Kahn wrote

- The ease with which banks may be forced into liquidation, far from being an unfortunate consequence of the contracting structure, turns out to be central to the structure
- By submitting to the threat of liquidation under appropriate circumstances, the banker can reduce his cost of capital
Fragility of Banking Liability Might Be a Good Thing

- Well, it is not exactly right to call "runs" in Calomiris-Kahn "threat"
  - Along the equilibrium path, withdrawal given bad signal occurs
- Diamond-Rajan (2001, JPE) deliver a similar point: The fragility of demandable deposits gives banker the right incentive
  - It is based on incomplete contracting—no uncertainty or private information needed!
  - And, "threat" only—along the equilibrium path, banker will not renegotiate and there is no run
Debt Maturity Structure

- The study of debt maturity was focusing on non-financial institutions.
- Financial institutions (say, banks) are different, but share certain core issues.
- The first-order principle is to match liability maturity (duration) with asset maturity.
  - But, keep in mind that in frictionless world, maturity (mis)match does not matter.
  - Well, you can refinance short-term debt or sell long-term debt.
- What determines how often borrowers refinance their debt relative to the timing of their cash flows?
Diamond (1991, QJE): Big Picture

- Benefit of short-term debt (for good firms)
  - Asymmetric information, high quality pooled with low quality. Public news (ratings) in interim period
  - High quality firm is more likely to receive favorable ratings in interim period...
  - This pushes high type to use short-term debt, as better to refinance again given good rating

- Cost of short-term debt
  - If public news is unfavorable, somehow the firm cannot "rollover" its short-term debt

- But, if public news is unbiased, then "failure to rollover" should be efficient on average—i.e., it is efficient for lenders to pull the plug
  - So we need something lost when failing to refinance
  - In Diamond, that something is control rent. It can be modeled via moral hazard (or more generally)
Model Setting

- Risk neutral world, zero discount rate
- Firms need 1 dollar to finance a long-term project which pays out cash at date 2 only
- Firms have private information about their types
  - Type $G$: date 2 cashflow $X > 1$ occurs for sure
  - Type $B$: date 2 cashflow $X > 1$ occurs with probability $\Pi$; otherwise nothing
  - Independent of type, always a control rent of $C > 0$ at date 2
- At date 1 there will be public information about the firm’s type
  - If borrowing short-term debt, then refinancing occurs after the release of public information
- At date 1, the project can be liquidated for $L \geq 0$
To generate a success, we need the manager’s unobservable effort.

- The manager can choose to work or shirk:
  - If work, success with prob. $p$.
  - If shirk, private benefit of $b$, but success prob. becomes $p - \Delta$.

- For incentive purpose, creditors need to leave some bonus $C$ for the manager in success.

- The manager’s IC condition:

  $$ pC \geq (p - \Delta)C + b \Rightarrow C \geq \frac{b}{\Delta} $$

- $C$ is the manager’s unpledgeable rent.
Credit Ratings and Long-term Debt

- Credit rating $f \in [0, 1]$: prob. of being type $G$ given public information
- Initial credit rating at date 0 denoted by $f_0$
- In equilibrium type $G$ and $B$ always pooled
  - Assumption: $B$ has negative NPV. If $B$ reveal themselves then no way get financing
  - Hence focus on $G$’s decision, as $B$ will mimic whatever $G$ is doing
- What if the firm uses long-term debt?
- We only need to figure out debt face value $\rho_L < X$ which gets paid out given success
- For investors to break even, we need

$$\rho_L \left( f_0 \left( \begin{array}{c}
\text{type } G \\
\text{type } B
\end{array} \right) + (1 - f_0) \Pi \right) = 1 \Rightarrow \rho_L = \frac{1}{f_0 + (1 - f_0) \Pi}$$

- Date 1 public news affects LT debt price only, but no real effect
At date 1, the firm gets either an upgrade or downgrade

| News     | Pr (G | News) | Pr (News | B) | Pr (News | B) |
|----------|--------|---------|--------|-----|--------|
| Downgrade| $f_d < f_0$ | 1       | $e$    |     |        |
| Upgrade  | $f_u = 1 > f_0$ | 0       | $1 - e$ |     |        |

Type B for sure receives downgrade; but even type G might be unlucky to get a downgrade

Bayesian rule:

$$f_d = \frac{f_0 e}{f_0 e + 1 - f_0} \Rightarrow e = \frac{f_d (1 - f_0)}{f_0 (1 - f_d)}$$

total prob. downgrade

Taking $f_d$ given, the higher the $f_0$ the lower the $e$

If a firm is on average better, then it is less likely for type G to get downgrade
Short-term Debt

- If borrowing with short-term debt with face value $\rho_S \geq 1$, it needs to be refinanced at date 1.
- Given downgrade, posterior prob. of being type $G$ is $f_d$.
- Refinancing face value at that state should be

$$r_d = \frac{\rho_S}{f_d + (1 - f_d) \Pi} \geq \frac{1}{f_d + (1 - f_d) \Pi}$$

- But $r_d$ is feasible iff $r_d < X$.
- Refinancing fails given downgrade and hence the control goes to creditors if

$$\frac{1}{f_d + (1 - f_d) \Pi} > X$$

- In this event, both parties can renegotiate. Creditors get

$$\max \left[ (f_d + (1 - f_d) \Pi) X, L \right]$$

  - Creditors will not take into account the control rent $C$.
  - If $(f_d + (1 - f_d) \Pi) X > L$ then liquidation occurs, $C$ is lost.
Results and Empirical Implications

- Type $G$ firm trade-off: a better chance of repricing against liquidity risk in case of downgrade
- Always pooling equilibrium, with $G$’s preferred debt structure
  - Confusion: people thought Diamond '91 is a **signaling** model with separating equilibrium
- Comparative statics with respect to $f_0$, i.e., the average date-0 rating
  - Not with type $G$ or type $B$. Underlying types are unobservable any way!
  - Another tricky part to test models with asymmetric information
- For sufficiently high $f_0$, short-term debt is preferred by $G$ (commercial papers?)
- For medium $f_0$, long-term debt is preferred (corporate bonds?), as the chance of downgrade for $G$ has $e'(f_0) < 0$
- For sufficiently low $f_0$, only short-term debt is feasible (bank debt?)
  - If $\rho_L = \frac{1}{f_0 + (1-f_0)\Pi} < X$, long-term debt is simply infeasible
What Do We Learn from Diamond (1991)

- Short term debt makes firms more sensitive to new information, but exposes firms to loss of control rents
  - The firm who cannot refinance might be solvent (including control rents) but illiquid
  - Illiquidity: cannot raise money from the part of future value unpledgeable to outside investors

- If the firm has private information about its future credit rating, there is a trade off between these two effects

- By linking future refinancing cost to today’s information, short-term debt also provides working incentive
  - E.g., a bad decision (or low effort today) reduces the chance that the borrower can refinance in the future
  - Or, short-term debt investors can withdraw their funding promptly (demand deposit); Diamond-Rajan
We have implicitly assumed that credit market is competitive...

If there is a lending monopoly, then the ability to refinance may not respond to news about credit worthiness

Say new information is observed only by the firm and the incumbent (bank) lender
  - A partial information monopoly of the lender

Rajan (1992) studies public debt vs bank debt
  - Incomplete contracting and hold-up problem
  - Ex post monopoly (imperfect competition) due to private information

  - What is the potential benefit of lending monopoly?
  - With frictions, in general market failure occurs
Rajan (1992), Setting

- Three dates 0, 1, and 2. Risk neutral, no discounting
- A project requires initial investment of \( I \); at \( t = 2 \) the payoff is either \( X \) or nothing
- At \( t = 0 \) the agent exerts an effort at a cost of \( \beta \)
- At \( t = 1 \) there will be an imperfect signal about success
  - With prob \( q \) the signal is \( G \), success for sure
  - With prob \( 1 - q \) the signal is \( B \), success with prob. \( p_B \)
- Effort affects the prob. of signal \( G \), modeled as \( q(\beta) \in (0, 1) \) with \( q'(\beta) > 0, q''(\beta) < 0 \)
- At \( t = 1 \) the project can be liquidated at \( L < I \), with \( p_B X < L \)
  - Given \( G \), efficient to let the project continue; terminate given \( B \)
  - The agent always wants to continue (a tiny control rent suffices)
- Nash bargaining with agent’s bargaining power \( \mu \)
Arm’s Length Debt and First-Best

- Arm’s length investors, i.e., public debt, assumed to be long-term debt maturing at $t = 2$
  - Arm’s length investors cannot observe interim signal anyway; the project always gets continued
- For welfare, both state-contingent continuation policy and ex ante effort $\beta$ matter
  - Rich, but less clean
- The first-best effort chosen by planner is
  \[
  \max_{\beta} q(\beta) X + (1 - q(\beta)) L - \beta \Rightarrow q'(\beta^{FB}) = \frac{1}{X - L}
  \]
- If public debt with face value $D$, agent is solving
  \[
  \max_{\beta} q(\beta) (X - D) + (1 - q(\beta)) (p_B (X - D)) - \beta \Rightarrow q'(\beta^{Public}) = \frac{1}{(1 - p_B)(X - D)}
  \]
  - Easy to show $(1 - p_B)(X - D) < X - L$, so $\beta^{Public} < \beta^{FB}$ too low effort with public debt
  - Consistent with long-term debt provides less incentive
Short-term Bank Debt

- Short-term bank (private) debt. The creditor observes the interim signal.
- At $t = 1$ the firm is cashless, so failure to pay any specified payment may trigger renegotiation.
- **Threat point** (outside option) if renegotiation fails

$$\begin{pmatrix} 0 \\ L \end{pmatrix}$$

- Agent’s payoff, creditor’s payoff

- Whether renegotiation occurs depends on the state
  - At state $B$, liquidation is efficient, no renegotiation.
  - At state $G$, liquidation is inefficient, renegotiation occurs for surplus $X - L$, and agent gets $\mu (X - L)$ in expectation.

- Ex ante the agent is solving

$$\max_q q (\beta) \mu (X - L) + (1 - q (\beta)) 0 - \beta \Rightarrow q' (\beta^{\text{Bank}, \text{ST}}) = \frac{1}{\mu (X - L)}$$
Long-term Bank Debt

- Say long-term debt face value $D$
- State $G$, continuation is efficient, no renegotiation
  - Payoff pair is (debtor, creditor) = $(X - D, D)$
- In state $B$ continuation is inefficient, renegotiation occurs with threat point $(p_B (X - D), p_B D)$
- Surplus $L - p_B X$, so final payoff pair is

\[
\left( p_B (X - D) + \mu (L - p_B X), p_B D + (1 - \mu) (L - p_B X) \right)
\]

- Agent’s problem is

\[
\max_q q(\beta) (X - D) + (1 - q(\beta)) \left[ p_B (X - D) + \mu (L - p_B X) \right] > \beta
\]

\[
\Rightarrow q' \left( \beta^{Bank,LT} \right) = \frac{1}{(1 - p_B) (X - D) - \mu (L - p_B X)} > \frac{1}{X - L}
\]

- Relative to FB, lower reward softer penalty $\Rightarrow$ less effort
What if Agent Has a Greater Bargaining Power?

- With public debt, no renegotiation, the agent’s bargaining power $\mu$ does not matter
- With bank debt, $\mu$ does matter. Interestingly, effect depends on short-term or long-term

- In short-term debt, $q' \left( \beta^{\text{Bank},ST} \right) = \frac{1}{\mu(X-L)}$
  - A greater $\mu$ implies a higher effort $\beta^{\text{Bank},ST}$
  - Renegotiation occurs at state $G$; a greater $\mu$ implies greater bonus for good performance, more reward

- In long-term debt, $q' \left( \beta^{\text{Bank},LT} \right) = \frac{1}{(1-p_B)(X-D)-\mu(L-p_BX)}$
  - A greater $\mu$ implies a lower effort $\beta^{\text{Bank},LT}$
  - Renegotiation occurs at state $B$; a greater $\mu$ implies a higher payoff for poor performance, less penalty
What Do We Learn from Rajan (1992)

- Modeling wise, interaction between information and incomplete contract
  - The difference between public debt and private debt is about interim information
- Nice benefit/cost of private bank debt
  - The first best has someone to pull the plug given bad information, which favors private bank debt
  - But bank may bargain ex post in good time to get some rent
  - The firm suffers from hold-up problem, which distorts its effort ex ante
- So far, we assume the bank can expropriate some rent ex post. What if the bank faces some competition?
  - But, ex post the bank has some private information about the firm, so called relationship lender
  - Rajan further microfounded this story in the paper
Ex Post Competition of Two Banks in Rajan (1992)

- At \( t = 0 \) the informed bank faces competition from another uninformed bank
- Say short-term bank debt. Without competition, in state \( G \) the bank gets some rent by threatening to shut down the firm
- Given competing banks, now the firm can set up an auction
  - Two banks submit their bids, and the lower bid wins
- Uninformed bank suffers from winner’s problem
  - The uninformed competing bank bids unconditionally
  - The incumbent informed bank withdraws given bad signal, and bid something given \( G \)
  - Equilibrium must have mixed strategies
- Results
  - Informed bank still gets positive profit, but less due to competition
  - Continuation policy might be inefficient—project may survive even after \( B \)
Competition in Banking Industry: Empirical

- In general, competition- and relation-based financial systems both have advantages
  - The German and Japanese systems were heavily relation-based, but becoming more competitive
- In US, elimination of restrictions on bank branching (across states) since the 1970s
  - Unlike most other recent episodes of deregulation that occurred at a national level—such as in railroads, trucking, airlines, long-distance telecommunications, securities brokerage, petroleum, and natural gas—bank branching regulation operated on a state-by-state basis, and deregulation has taken place gradually across the states
  - Branching deregulation thus provides a much greater source of cross-sectional and time-series variation than other types of deregulation
Competition in Banking Industry: Theory

- The analysis in Rajan (1992) has illustrated one dark side of banking competition
  - Sometimes, the relationship bank cannot exercise its (efficient) control given competition
- Petersen and Rajan (1995) illustrate another important benefit of lending monopoly
  - The paper is half theory half empirical, both are quite good
- In short, lending monopoly allows a bank to fund some firms at low interest rate initially, then recoup profits later on
  - In competitive market, banks need to break even period-by-period
- Well, what is the benefit of low interest rate early on and high interest rate later?
  - Because of some moral hazard problem (Stiglitz and Weiss, 1981)
Petersen and Rajan (1995)

- High information asymmetry and uncertainty about firm quality for young/distressed firms
  - Stiglitz and Weiss (1981): a high interest rate must be charged to compensate for the risk...
  - But, high interest rate $\Rightarrow$ distortion. Quantity rationing in equilibrium
- How about charge a "teaser" rate first, then charge a higher rate once the bank learns more about the firm?
  - Relationships typically involve subsidizing young/distressed firms
- In a monopolistic credit market, banks help out if they know they share some rent once the firm becomes successful
- In competitive credit markets (but contracts are incomplete), the firm cannot commit to staying with its bank after good news
  - Banks have to break even period by period
- Credit market competition may reduce the availability of credit
  - In Diamond (1994), competition makes the price of credit information sensitive
Model in Petersen and Rajan (1995)

- A combination of Diamond (1991, QJE) and Diamond (1992, JPE, on monitoring and reputation)
- Two types of projects with initial investment $I$
  - A safe project generates $R$
  - A risky project generates $X$ with probability $p$ and 0 otherwise
  - $R > I > pX$, but $X > R$
- Two types of agent, $BG$ with probability $\theta$ or $B$ $(1 - \theta)$
  - $B$ only has risky project; $BG$ can choose risky/safe projects
  - In Diamond (1992), there is type $G$ as well who always succeed (no risk shifting)
Stiglitz and Weiss (1981) Revisited

- Consider standard debt contract only (not an innocuous assumption)
- Face value $F$, break even condition implies

$$\theta F + (1 - \theta) pF = I \Rightarrow F = \frac{I}{\theta + p (1 - \theta)}$$

- But, we need to make sure that BG type does not risk-shift

$$R - F \geq p(X - F) \Rightarrow F \leq \frac{R - pX}{1 - p}$$

- Therefore we need

$$\frac{I}{\theta + p (1 - \theta)} \leq \frac{R - pX}{1 - p} \Rightarrow \theta \geq \hat{\theta} \equiv \frac{l (1 - p) - (R - pX) p}{(R - pX) (1 - p)}$$

- Distressed firms are associated with lower $\theta$
  - Low quality $\Rightarrow$ high break-even debt face value $\Rightarrow$ may induce risk shifting
  - What if you use equity financing? (resolve the problem completely)
Potential Cross-Subsidy over Periods

- The above model is only one period
- What if we have another period to continue, and at that time some bad guys are weeded out?
- If the bank has monopolist power, it can establish a relationship lending with at $t = 0$ even for $\theta < \hat{\theta}$
  - It can lend at a lower face value at $t = 0$, hence no risk shifting. Subsidized lending
  - At $t = 1$ if the firm is $BG$ type, then charge a rate above the break-even rate
  - Overall it makes zero profit
- But if there is a competitive lending market, at $t = 1$ those $BG$ firm will opt out if the original bank over charges ex post
  - Well, then the bank will not lend ex ante
- Bottomline: Banks have to break even period by period given competition
- Conclusion: given agency problems, credit market competition reduce the availability of credit
Empirical Predictions

- Banks in monopolistic credit markets finance firms of lower credit quality
  - As banks can offer a lower interest rate early on, there is less distortion in the entrepreneur’s project choice
- Interest rate charged to youngest or lowest quality firms will be lower in a concentrated market
  - Especially for firms with the most extreme information asymmetry
  - This is in contrast to most simple IO model
- Average interest rates decline faster as a firm grows older in a competitive market
  - This decline is dampened in a concentrated market
  - Subsidy early on (lower relative rates), but recover these subsidies later (higher relative rates)
Empirical Result

Loan Rates Across Market Structures

- \(*\) Most Concentrated
- \(\quad\) Most Competitive

<table>
<thead>
<tr>
<th>Firm Age</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.0</td>
</tr>
<tr>
<td>2</td>
<td>12.5</td>
</tr>
<tr>
<td>3</td>
<td>12.0</td>
</tr>
<tr>
<td>4</td>
<td>11.5</td>
</tr>
<tr>
<td>5</td>
<td>11.0</td>
</tr>
<tr>
<td>6</td>
<td>10.5</td>
</tr>
</tbody>
</table>

Firm Age: 1 through 20

Percent: 13.0 to 10.5