Advanced Topics

Banking

Gazi Kabas
Tilburg University
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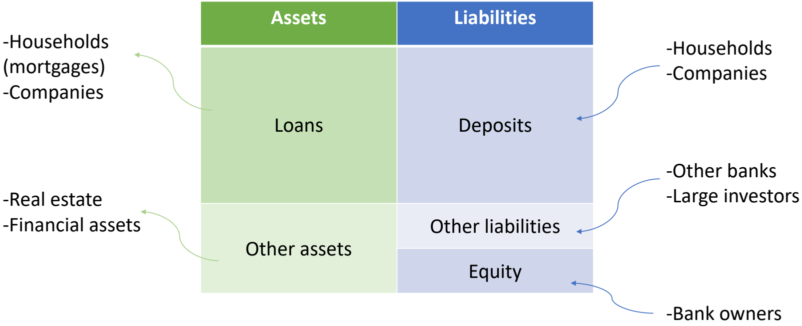
What is a bank?

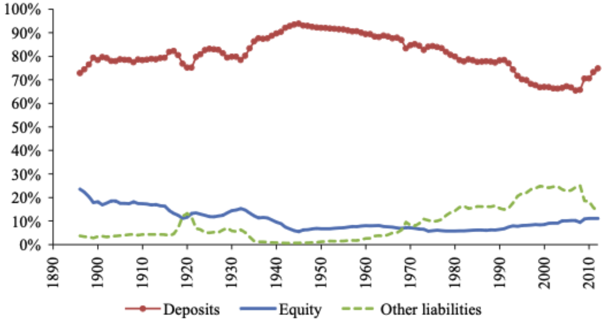
- Banks collect deposits from households/companies that have savings and distribute loans to households/companies
  $\rightarrow$ Banks are the main lenders of households and small firms
- A typical bank balance sheet



Bank balance sheet

Panel A: All banks	VW Average	90th %-tile	10th %-tile
Loans (gross)	52.9%	78.1%	42.2%
Real estate	25.2%	62.0%	19.7%
Residential	16.2%	26.1%	3.6%
Commercial	9.0%	43.1%	9.7%
C&I	9.7%	20.7%	3.0%
Consumer	9.3%	9.2%	0.2%
Other	8.7%	8.8%	0.1%
Less reserves	−1.2%	−0.6%	−1.9%
Loans (net)	51.7%	75.9%	41.7%
Liquid assets	35.2%	50.9%	16.4%
Cash and reserves	10.2%	16.8%	2.2%
Reverse repos	4.1%	1.4%	0.0%
Securities	20.8%	40.7%	6.9%
Treasuries	1.6%	1.4%	0.0%
Agencies	1.2%	10.2%	0.0%
MBS Passthroughs	6.8%	14.5%	0.2%
CMOs and CMBS	5.2%	14.9%	0.0%
Other securities	6.1%	13.4%	0.3%
Trading assets (net)	3.8%	0.1%	0.0%
Other assets	9.3%	11.6%	3.5%
TOTAL ASSETS	100.0%		
Deposits	75.6%	88.9%	73.6%
Transaction	10.2%	22.6%	4.0%
Savings	44.5%	63.0%	23.7%
Time	9.4%	38.3%	8.6%
Foreign	11.5%	0.0%	0.0%
Repos	3.4%	6.2%	0.0%
Subordinated debt	1.0%	0.5%	0.0%
Other borrowed money	5.7%	9.4%	0.0%
Other liabilities	2.9%	2.2%	0.3%
Equity	11.4%	14.9%	8.2%

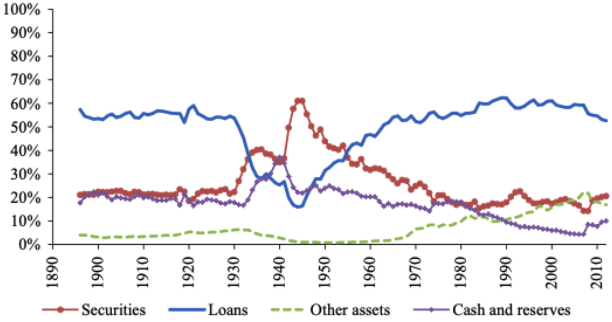
Bank liabilities



- Banks rely on deposits homogeneously

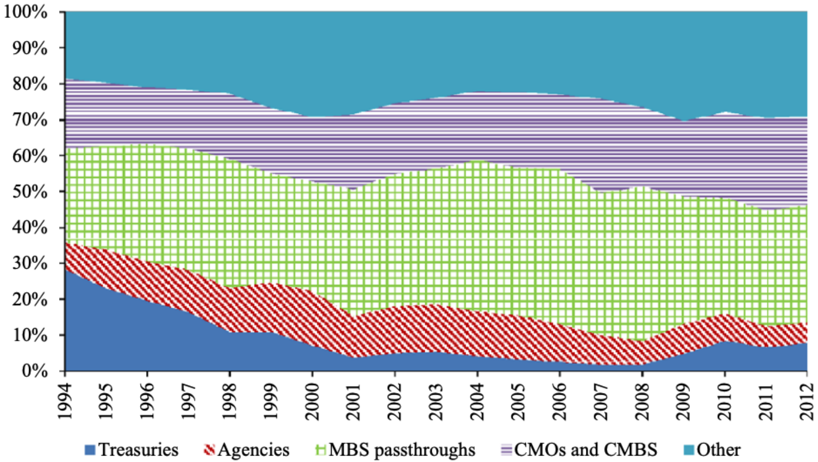
  → Their economic value creation takes place on the liability side via deposits

Bank asset holdings



- The asset side is more heterogeneous
  $\rightarrow$ Implication: Bank size is determined by the deposit franchise. Q: How to invest deposits?

Bank security holdings



- The security holdings of banks are diverse
  → They don't hold cash-like assets to avoid bank runs.

Why do we have banks?

- Until the GFC, financial intermediation was ignored in macro models
  $\rightarrow$ In the Arrow-Debreu model with complete markets, banks don't have any effect on other agents
  $\rightarrow$ To study banking, we need incomplete financial markets, frictions, or bank services
- The prevalence of banks in the economy indicates that we do not live in an AD model. Reasons for this prevalence
  $\rightarrow$ Services: Money creation, information creation, liquidity provision, payment services
  $\rightarrow$ Frictions: Asymmetric information, incomplete markets

Liquidity provision and banks

Diamond Dybvig 1983

- Banks are pools of liquidity that provide households with insurance against idiosyncratic shocks
- The main requirement is that idiosyncratic shocks must not be perfectly correlated
  $\rightarrow$ Can idiosyncratic shocks be perfectly correlated?
- This process enables banks to fund illiquid (long-term) investments with liquid (short-term) financing
- Yet, this nature of banking may lead to problems
  $\rightarrow$ What could these problems be?
- Let's look at the model, optimal allocation, market economy, and financial intermediation

Diamond Dybvig 1983

The model (simplified)

- One good, three-period economy with identical agents who have one unit of good endowment at t=0.
- Liquidity shock is modeled as follows: at t=1, the agents learn if they have to consume at t=1 or t=2.
- Agents maximize
$$U = \pi_1 u(C_1) + \pi_2 u(C_2) \tag{1}$$
where π_1 means that agent has to consume at t=1 and π_2 means at t=2
- Investment tech. exists: I amount of investment yields R at t=2, but only l at t=1, where R>1 and ℓ<1 (costly liquidation)
- What is the optimal allocation?
$\rightarrow$ How much should an agent invest at t=0?
- $u'(C) > 0$ and $u''(C) < 0$

Diamond Dybvig 1983

Efficient allocation without early liquidation
$\rightarrow$ Efficient allocation maximizes the expected utility of agents while utilizing the economy's resources optimally through risk-sharing.

- Agents maximize

$$
\begin{aligned}
max \pi_1 u(C_1) + \pi_2 u(C_2) \quad s.t. \\
\pi_1 C_1 = 1 - I \\
\pi_2 C_2 = RI
\end{aligned}
$$

- This gives us

$$u'(C_1^*) = Ru'(C_2^*)$$

  where $\pi_1 + \pi_2 = 1$
  $\rightarrow$ Pareto-optimal allocation condition: The marginal rate of substitution equals the return on the investment
  $\rightarrow$ Pareto-optimal line: $\pi_1 C_1 + \pi_2 \frac{C_2}{R} = 1$

Diamond Dybvig 1983

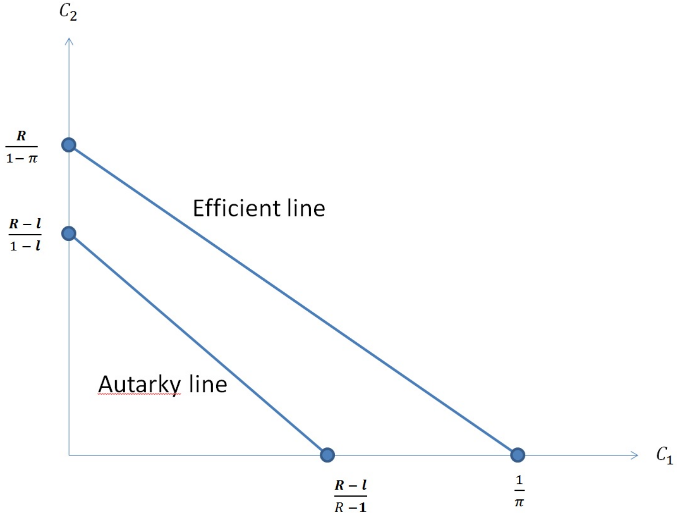
Autarky (ie, no trade) with costly liquidation

- Agents maximize

$$
\begin{aligned}
max \pi_1 u(C_1) + \pi_2 u(C_2) \quad s.t. \\
C_1 = 1 - I + \ell I = 1 - I(1-\ell) \\
C_2 = 1 - I + RI = 1 + I(R-1)
\end{aligned}
$$

- where $\ell < 1$ (the cost of early liquidation)
- Autarky line: $\frac{R-1}{R-\ell} C_1 + \frac{1-\ell}{R-\ell} C_2 = 1$
- In autarky, agents cannot reach the efficient allocation as the investment process is inefficient.

Diamond Dybvig 1983



Diamond Dybvig 1983

Market economy: agents can trade a riskless bond at t=1 with price p that yields one unit of good at t=2

- Agents maximize

$$max \pi_1 u(C_1) + \pi_2 u(C_2) \quad s.t.$$
$$C_1 = 1 - I + pRI$$
$$C_2 = \frac{1-I}{p} + RI = \frac{1}{p}(1 - I + pRI)$$

- This gives us $C_2 = \frac{C_1}{p}$ and $p = \frac{1}{R}$. (Why?)
- What is the equilibrium allocation and investment in this market economy?
  $\rightarrow C_1^M = 1$ and $C_2^M = R$, $I^M = \pi_2$

Diamond Dybvig 1983

- Is the market allocation Pareto-optimal?
  $\rightarrow$ PO condition: $u'(C_1^*) = Ru'(C_2^*)$
  $\rightarrow$ No! (Unless, $u'(1) = Ru'(R)$)
- Intuition: The market opens at t=1 after the agents learn their types. But, uncertainty exists at t=0. The agent has to make a decision about her investment without knowing her type. Yet, the bond payout is the same for everybody. Hence, the market outcome is non-contingent (ie, doesn't depend on type). Therefore, risk-sharing is not efficient.
- Consumption smoothing can be improved.
- Let's look at whether a financial intermediary helps

Diamond Dybvig 1983

Financial intermediation

- Suppose that a financial intermediary offers the following contract
  $\rightarrow$ Collect deposits at t=0. Pay C_1^* at t=1 and C_2^* at t=2
- To be able to do so, FI stores $\pi_1 C_1^*$ and invests $I = 1 - \pi_1 C_1^*$
- This is an equilibrium under important assumptions
  $\rightarrow$ Idiosyncratic shocks are independent (would this FI contract work if an aggregate shock existed?)
  $\rightarrow$ Investment (loans) is not risky
  $\rightarrow$ There are no early withdrawals

Diamond Dybvig 1983

- The last assumption (no early withdrawals) is crucial for bank stability!
  $\rightarrow$ A change in this assumption creates multiple equilibria
- Consider the patient consumer. Does she have an incentive to withdraw at t=1?
  $\rightarrow$ No, because withdrawing gives her 1 unit of goods, whereas waiting gives R unit of goods and R>1
  $\rightarrow$ Thus, by LLN, the ratio of withdrawals at t=1 is π_1 and $\pi_1 C_1^*$ amount of reserves is enough to ensure that the bank is solvent with probability 1.
- Yet, if the patient consumer expects the other consumers to withdraw their deposits, the picture changes
  $\rightarrow$ If the FI liquidates its assets, it'd have $\pi_1 C_1^* + (1 - \pi_1 C_1^*)\ell$, which is lower than its liabilities (1), leading to an inefficient bank run

Diamond Dybvig 1983

- There are two ways to prevent bank runs in this simple setting
  $\rightarrow$ Banks can commit to providing withdrawals for at most π_1 of the depositors
  $\rightarrow$ We can create a deposit insurance
  $\rightarrow$ Both methods fix the incentives of the patient depositors
- Bank runs can be efficient if the run is driven by worsening bank assets (eg Gorton (1985))

The Role of Demandable Debt

Calomiris and Kahn 1991

- Bank runs are a side effect of maturity mismatch in the bank balance sheets: deposits have a shorter duration than loans.
  $\rightarrow$ Why do banks prefer to issue shorter debt that can be dangerous for them?
  $\rightarrow$ Because short-term debt can be used as a disciplining device!
- Main intuition is related to the inalienability of human capital
  $\rightarrow$ Inalienability of human capital: The entrepreneur cannot commit to not walking away from the project. Therefore, a contract that specifies that the entrepreneur stays with the project until completion would not be credible: we need a disciplining device!
  $\rightarrow$ Diamond and Rajan (2001) argue that the threat of bank runs works as a disciplining device and convinces depositors to put their money in banks.

Calomiris and Kahn 1991

Results

- Banker has an investment opportunity with two possible payoffs ($T_2 > T_1$ with T_2 probability γ). The banker can run away with a fraction of the payoff ($T_i(1-A)$)
  $\rightarrow$ When the banker offers P to depositors, this contract provides an option to the banker: a payment of P or a reduction in her assets by A. For which value of T is the banker more likely to run away?
- The depositor also makes a decision about how much effort she puts into investigating the success of the banker (denoted by e). This effort is costly.
  $\rightarrow$ Putting deposits in a bank is a voting with feet.
  $\rightarrow$ The sequential service constraint is important (first-come, first-served). Thus, a higher e enables the depositor to withdraw her money before the bank run happens
- Runable deposits discipline the banker and higher returns of depositor monitoring incentives the large deposit holders

Deposit insurance

- In Diamond Dybvig, deposit insurance prevents irrational panics. According to Calomiris and Kahn, deposit insurance reduces depositors' incentive to monitor.
  $\rightarrow$ Monitoring effort is costly. If the depositor gets her money from the insurance, the effort becomes unnecessary.
- Without monitors, there are no runs. Without the threat of a run, the banker's "option" to pay P or lose A becomes irrelevant.
- Risk in the system is higher with deposit insurance, because nobody monitors the banker. Hence, deposit insurance reduces welfare.
- Canada vs US: Deposit insurance is funded by the government in the US, and by the banks in Canada. Hence, banks are the monitoring depositors in Canada.
  $\rightarrow$ Which country has a more stable banking system?

Hanson, Shleifer, Stein, Vishny 2015

- How do traditional banks interact with shadow banks when they compete for the same purpose (creating money-like claims for households)?
  → Money-like claims: (Shadow) bank liabilities that can be used for transactions. Hence, they are 100% safe: deposits for banks, shares for MMFs.
- How do these two types of intermediaries provide the same service?
  → Traditional banks: Hold illiquid assets. Use a costly equity cushion and rely on deposit insurance (so that depositors can be sleepy).
  → Shadow banks: Hold more liquid assets that wouldn't suffer from big discounts when sold. Rely less on the government safety net and equity.
- Two features
  → Sleepy depositors: Stable funding
  → Fire sales: Push asset prices below fundamental value

Hanson, Shleifer, Stein, Vishny 2015-Model Environment & Preferences

The Setup:

- Three dates: $t = 0$ (invest), $t = 1$ (news), $t = 2$ (payoff).
- Risky assets have a fixed supply. Fundamental value depends on news at $t = 1$:
  - **Optimistic (p):** Pays R (Good state).
  - **Pessimistic ($1 - p$):** Pays z_i (Bad state) or 0 (Disaster state).

Household Demand for Money:

- Households are risk-neutral but demand **risk-free** claims for transactions.
- Utility Function:

$$U = C_0 + \beta E[C_2] + \gamma M$$

- **Constraint:** Only completely safe claims (M) earn the premium γ. Riskier assets are discounted at β.

Hanson, Shleifer, Stein, Vishny 2015-Timing of the Model

Time $t = 0$

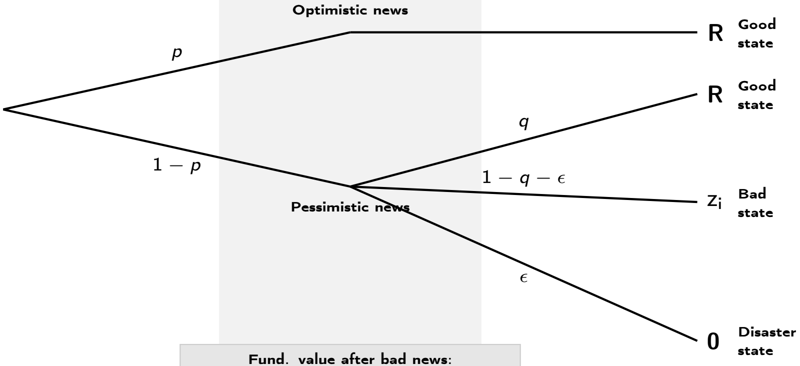
Banks buy asset
& issue claims.

Time $t = 1$

Pessimistic news $(1 - p)$.
Unstable banks sell (k_i).
Stable banks hold.

Time $t = 2$

Payoffs revealed.



Fund. value after bad news:
$F_i = qR + (\mathbf{1} - q - \epsilon)z_i$
Market price: $k_i F_i \leq F_i$

The Critical Moment ($t = 1$): News is Pessimistic.

Traditional Banks (Stable)

- **Strategy:** Hold-to-Maturity.
- **Safety:** Guaranteed by deposit insurance + equity capital.
- **Outcome:** Depositors stay "sleepy." No liquidation needed.

Shadow Banks (Unstable)

- **Strategy:** Early Exit Option.
- **Safety:** Guaranteed by ability to run/withdraw early.
- **Outcome:** Forced liquidation (Fire Sale) at price $k_i F_i < F_i$.

Traditional Bank Value (V^B): Banks pay insurance/capital costs to back stable money (z_i).

$$V_i^B = \underbrace{\beta[pR + (1-p)F_i]}_{\text{Exp. Cash Flows}} + \underbrace{\gamma z_i}_{\text{Money Premium}} - \underbrace{\text{Ins. Costs}}_{\text{Capital/Regs}}$$

Shadow Bank Value (V^S): Shadow banks incur fire-sale losses (k_i) to create hot money ($k_i F_i$).

$$V_i^S = \underbrace{\beta[pR + (1-p)k_i F_i]}_{\text{Exp. Cash Flows (w/ Fire Sale)}} + \underbrace{\gamma k_i F_i}_{\text{Money Premium}}$$

Intuition: Traditional banks maximize cash flow (hold-to-maturity) but create less money (z_i is small). Shadow banks destroy cash flow (fire sales) but create more money ($k_i F_i > z_i$).

Hanson, Shleifer, Stein, Vishny 2015-Equilibrium: The Marginal Trade-off

In equilibrium ($V^B = V^S$), the marginal benefit of stability equals its marginal cost:

$$\underbrace{(1-p)\beta[1-k(\mu^*)]F_i}_{\text{Benefit of Stable Funding}} = \underbrace{\gamma[k(\mu^*)F_i - z_i]}_{\text{Cost of Stable Funding}}$$

- **LHS (Benefit):** Traditional banks avoid the fire-sale discount $(1-k)$ by riding out shocks.
- **RHS (Cost):** Traditional banks are constrained to create less money (z_i) than shadow banks (kF_i).
- **Result:** Assets partition based on this trade-off.

Hanson, Shleifer, Stein, Vishny 2015-Main Takeaways

1. **Asset Sorting**
   - **Traditional Banks:** Hold assets with low fundamental risk (high z_i) but high illiquidity (high fire-sale risk).
   - **Shadow Banks:** Hold highly liquid assets (low fire-sale risk).
2. **Balance Sheet Synergy**
   - There is a synergy between **stable liabilities** (deposits) and **illiquid assets**.
   - A patient investor (Bank) creates value by shielding illiquid assets from non-fundamental price volatility.
3. **Fire Sales as the Driver**
   - The discount k_i is endogenous. High shadow bank ownership $\implies$ deeper fire sales.

Delegated Monitoring

Diamond 1984

- Banks exist because depositors delegate the monitoring duty to the banks
  $\rightarrow$ Scale economies in monitoring, small capacity of depositors, low cost of delegation
- Delegating monitoring avoids paying **inefficient replication costs** when several investors monitor the same borrower
- However, delegating monitoring generates the **additional cost**: that of **providing incentives to the monitor**
  $\rightarrow$ These incentives are provided by the threat of default for the bank
- In equilibrium, the bank defaults when its return on assets is too low
  $\rightarrow$ The probability of default decreases when asset diversification increases
- Hence, delegating monitoring is efficient - enough independent projects can be financed by each bank.

Diamond 1984

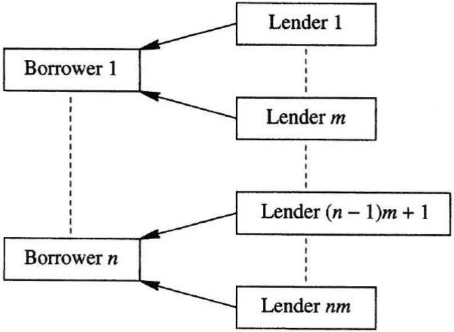
Model

- n identical risk-neutral firms seek to finance risky projects
  - Initial investment normalized to 1
  - Risk-free rate normalized to zero
  - Net returns $\tilde{y}$ are identically and independently distributed
- (Small) Investors
  - Each investor can invest only $1/m \rightarrow m$ investors are needed to finance one project
  - Investors are risk neutral
- Direct monitoring
  - Lenders can monitor borrowers at a cost K
  - Projects are profitable $\Rightarrow \underbrace{E[\tilde{y}]}_{\text{Expected Return}} \geq \underbrace{1+K}_{\text{Project Cost}}$

Diamond 1984

Direct monitoring

- Each investor monitors the firm he has financed $\Rightarrow$ Total monitoring cost is $n \times m \times K$=number of projects $\times$ number of investors $\times$ cost of monitoring



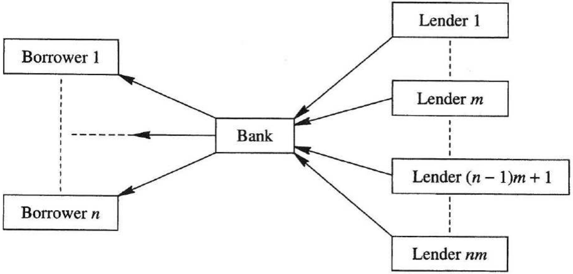
Monitoring

Diamond 1984

Delegated monitoring

- The bank monitors each project $\Rightarrow$ With a cost of nK
- Depositors monitor the bank $\Rightarrow$ With a cost of mK

  $\rightarrow$ We can remove the second cost with an audit technology. (Bank offers a deposit rate to depositors and is audited only if it cannot pay the deposit rate)



Diamond 1984

- The bank's incentives to repay depositors are provided by the threat of default
- Default occurs when

$$\underbrace{\tilde{y}_1 + \tilde{y}_2 + ... + \tilde{y}_n}_{\text{Return to the portfolio of loans}} \quad - \quad \underbrace{nK}_{\text{Monitoring Cost}} \quad < \quad \underbrace{n}_{\text{Return to Depositors}}$$

- Default induces a bankruptcy cost γ
- $\Longrightarrow$ Total expected cost of default is

$$C_n = \gamma \Pr\left(\tilde{y}_1 + \tilde{y}_2 + ... + \tilde{y}_n - nK < n\right)$$

Diamond 1984

- **Financial intermediation dominates direct lending if**

$$\underbrace{\boldsymbol{nK}}_{\text{Cost of Delegated Monitoring}} + \underbrace{\boldsymbol{C_n}}_{\text{Cost of Default}} < \underbrace{\boldsymbol{mnK}}_{\text{Cost of Direct Monitoring}}$$

$$\Leftrightarrow \boldsymbol{K} + \frac{C_n}{n} < \boldsymbol{mK}$$

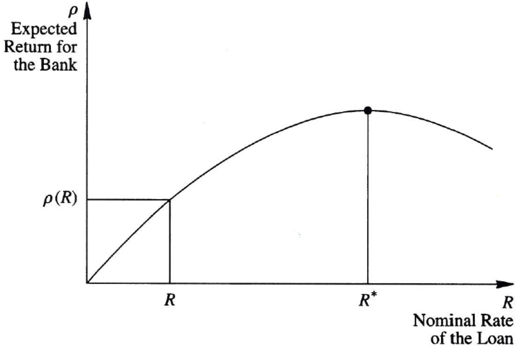
- $\frac{C_n}{n} = \gamma \times \Pr\left(\frac{\tilde{y}_1+\tilde{y}_2+\ldots.+\tilde{y}_n}{n} - K < 1\right)$
- When $n \to \infty$, $\frac{\tilde{y}_1+\tilde{y}_2+\ldots.+\tilde{y}_n}{n} \to E[\tilde{y}]$ (law of large numbers)
- Therefore, when $n \to \infty$, $\frac{C_n}{n} \to \gamma \times Pr\Big(E[\tilde{y}] - K < 1\Big) = 0$ given our assumption that investment is profitable ($E[\tilde{y}] \geq 1 + K$)

Diamond 1984

- Delegated monitoring dominates direct lending if
  1. Investors are small ($m > 1$)
  2. The number n of projects is high enough: diversification eliminates risk in the limit
- The unit cost of monitoring K **does not depend on the number of projects** to be monitored. This implies that it would be **optimal to have only one bank**, which is not what we observe in reality.
- If the costs of monitoring increase with the size of the bank (for example, because monitoring is performed by loan officers who have to be monitored by bank managers, which increases the costs of delegation), an optimal size of banks exists.

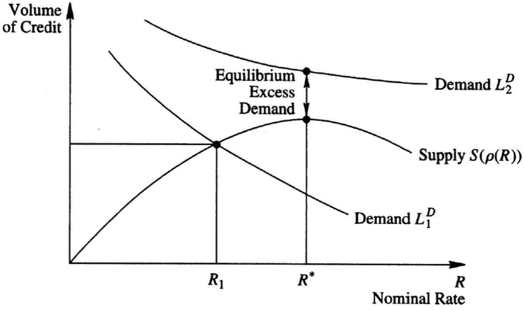
Credit Rationing

- Credit rationing is a case where a borrower's demand is turned down, even if this borrower is willing to pay all the price and nonprice elements of the loan contract.
  $\rightarrow$ This can occur if the expected return on a loan is not a monotonic function of the interest rate of this loan



Credit Rationing

- In the figure below, if the demand curve is the second one, an equilibrium with credit rationing occurs
  $\rightarrow$ The backward bending supply curve can be driven by adverse selection, costly state verification, and moral hazard



Credit Rationing

Stiglitz and Weiss 1981

- Firms have different risk, θ and bank can observe only the risk distribution
- Bank offers a standardized loan contract whose terms change the loan applicant pool
- Firm profit: $\pi(y) = max(-C, y - R)$, y is the return of the project, R is loan payment, C is collateral, and $\pi(y)$ is increasing in θ.
- Assume that firms have a reservation profit level, $\bar{\pi}$. Since $\pi(y)$ is increasing in risk, θ, firms whose $\bar{\pi}$'s lower than θ^* $(E(\pi(y)|\theta^* = \bar{\pi})$ will not apply for a loan
- Thus, a higher loan rate
  $\rightarrow$ increases bank's profit for any given loan
  $\rightarrow$ but discourages safer borrowers from applying for a loan, changing the loan applicant pool
  $\rightarrow$ If the second effect dominates, a higher rate reduces bank profits, leading to a backward-bending supply curve

Credit Rationing

- Another argument for credit rationing is about the relationship between loan default and loan rates. Simply, a higher loan rate can increase loan defaults, which reduces bank profits.
- Moral hazard can lead to credit rationing if the riskier project has a higher profit but lower success probability. The reason is that higher loan rates can induce borrowers to pursue riskier projects. Due to the risk profile of this project, this choice of the borrower can lower the bank's profits.

How banks improve access to credit

Holmstrom and Tirole (1997)-Model

- Moral hazard $\rightarrow$ **credit rationing**. Banks, by monitoring borrowers, reduce this problem
- Firms have the same tech but different initial capital A.
- There are two projects (good and bad) with two states of nature (success or failure).
- Each project costs $I > 0$ and generates a return Y **in case of success**, **0 in case of failure**. The good project has a **probability of success** p_H and the bad one a **probability of success** p_L, with $p_H > p_L$. The bad project generates a **private benefit** B to the borrower

The investment project

	Probability of Success	Return if Success	Private benefit to the borrower
Good project	p_H	Y	0
Bad project	p_L	Y	B

Holmstrom and Tirole 1997

- Assumption: Only good projects have a positive net present value: $p_H Y - I > 0$, $p_L Y + B - I < 0$
- First, we consider the model without banks
- Financial contract: loan amount $L = I - A$. The profit of the borrower in case of success $Y - R$
- Borrowers' **Incentive Compatibility Constraint** (ICC)

$$\underbrace{p_H\left(Y - R\right)}_{\text{Borrower's payoff with the good project}} \geq \underbrace{p_L\left(Y - R\right) + B}_{\text{Borrower's payoff with the bad project}}$$

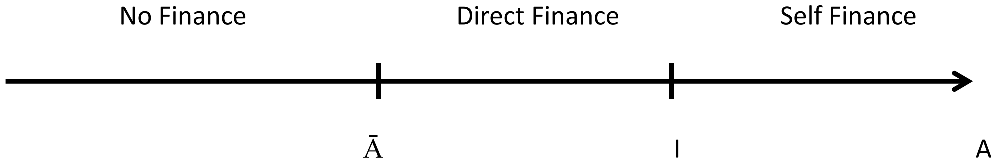
$$\Leftrightarrow R \leq \underbrace{Y - \frac{B}{\Delta p}}_{\text{Pledgeable Income}}$$

Holmstrom and Tirole 1997

- Lender's Participation Constraint (PC)

$$\underbrace{p_H R}_{\text{Lender's return to the good project}} \geq \underbrace{I - A}_{\text{Lender's investment in the project}}$$

- A market for loans exists if and only if both the (ICC) and (PC) constraints are satisfied
- Borrowers with $A \leq \overline{A}$ are credit constrained: they cannot credibly commit to investing in the good project



Holmstrom and Tirole 1997

- Let's introduce the banks
- Banks monitor firms, where monitoring **decreases the private benefit** of selecting the bad project from B to b, with $b < B$ and costs c.
- Monitoring allows to reduce informational rents of borrowers from $\frac{p_H}{\Delta p}B$ to $\frac{p_H}{\Delta p}b$
- We assume that monitoring is efficient for lenders: $c \leq \frac{p_H}{\Delta p}\left(B - b\right)$

- The borrowers' ICC is now

$$p_H (Y - R) \geq p_L (Y - R) + b$$
$$\Leftrightarrow R \leq Y - \frac{b}{\Delta p} \qquad \textbf{(ICC)}$$

- Bank's Participation Constraint (PC)

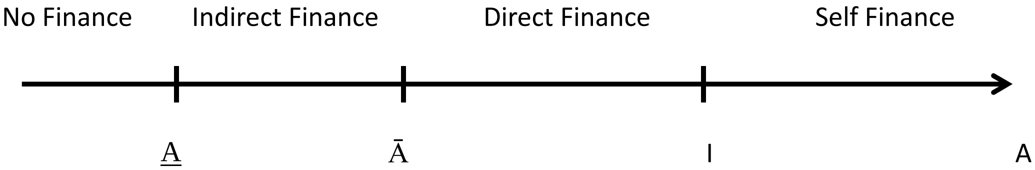
$$\underbrace{p_H R}_{\text{Expected return on assets}} \geq \underbrace{I - A + c}_{\text{Amount invested plus monitoring cost}}$$

- These imply

$$I - A + c \leq p_H \left(Y - \frac{b}{\Delta p} \right)$$
$$\Leftrightarrow A \geq \underline{A} = I + c - p_H \left(Y - \frac{b}{\Delta p} \right)$$

- The assumption $c + \frac{p_H b}{\Delta p} \leq \frac{p_H B}{\Delta p}$ implies that $\underline{A} \leq \overline{A}$. What about R?

Holmstrom and Tirole 1997



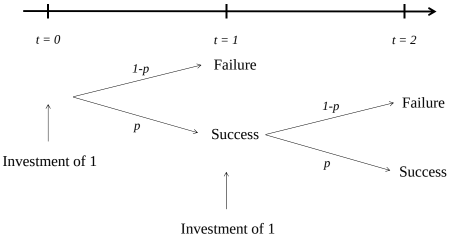
- This setting allows us to study a credit crunch (a decrease in bank capital), and a collateral squeeze (a decrease in firm capital)
  $\rightarrow$ Credit crunch decreases borrower's return and increases bank's return. Whereas, a collateral squeeze decreases both returns.
- This model also suggests that depositors would require the bank to participate in lending with bank capital.
  $\rightarrow$ The role of bank capital and economies of scope between monitoring and lending

Relationship Banking

- Relationship banking: long-term contractual relations between a bank and a borrower
  → Banks invest in obtaining **customer-specific information** by **multiple interactions** with the same borrower over time
- **The "bright side"**: Relationships **mitigate informational asymmetries** between **firms** and **banks**
  → Less credit rationing and better loan terms, especially for small and opaque firms
- **The "dark side"**: Relationships **create informational asymmetries** between **inside** and **outside** banks
  → Inside (incumbent) banks may capture monopoly rents
- Sharpe (1990), Rajan (1992)

A simple model

- A two-period, risk neutral and zero-interest rate environment
  $\rightarrow$ Firms have an investment project that requires 1 unit of investment and is successful with a probability p. In case of success, the firm invests again 1 in the second period in the same project.



Relationship Banking

- Important parameter: Banks have to collect information about the borrower before lending, and this is a one-time cost "M"
  $\rightarrow$ Keeping the lending relationship with the same bank avoids duplication of monitoring costs. Yet, it also creates an ex-post monopoly power for the incumbent bank.
- R_1 and R_2 are rates for the two periods. $\rho > 1$ is the expected gross return. Banks invest 1+M at t=0 and 1 at t=1 if the project is successful. Total investment by banks is 1+M+p.
- Ex ante competition implies that all banks should obtain ρ on their investment.
  $\rightarrow pR_1 + p^2 R_2 = \rho(1 + p + M)$

Relationship Banking

- The interesting angle in this model is the relationship between R_1 and R_2
- What would happen if the firm switches to another bank? The new bank would require ρ as the return and has to make monitoring that costs M
  $\rightarrow pR_2 = \rho(1+M) \Rightarrow R_2 = \frac{\rho(1+M)}{p}$
- Incumbent bank charge the same R_2! This implies that
  $\rightarrow R_1 = \frac{\rho(1+M(1-p))}{p}$ and $R_1 < R_2$
- Implications: Lower R_1 implies higher risk taking at t=0.
  $\rightarrow$ Higher capture power by banks at t=1 implies lower R_1, increasing loan supply at t=0.
  $\rightarrow$ This model implies inefficiencies if firms have to switch to another bank for exogenous reasons, justifying credit registers.

Relationship Banking

- The hold-up problem suggests that firms with good projects should prefer a loan from the financial markets (issuing bonds) since doing so would prevent the hold up.
- Hauswald and Marquex (2003) consider two types of information: public and private. They argue that an improvement in public information should increase bank competition. Yet, better private information should increase the monopoly power of the incumbent banks.
- The repeated nature of relationship banking also provides an insurance mechanism (Berling Mester (1999)). Banks are more diversified and providing loans to firms in bad situations can enable them to capture a higher monopoly rent afterwards.

"Time for a Change": Loan Conditions and Bank Behavior when Firms Switch Banks

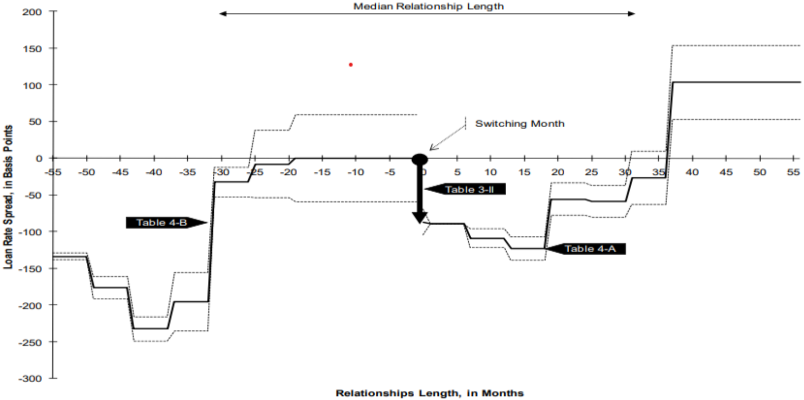
VASSO IOANNIDOU and STEVEN ONGENA*

ABSTRACT

This paper studies loan conditions when firms switch banks. Recent theoretical work on bank–firm relationships motivates our matching models. The dynamic cycle of the loan rate that we uncover is as follows: a loan granted by a new (outside) bank carries a loan rate that is significantly lower than the rates on comparable new loans from the firm's current (inside) banks. The new bank initially decreases the loan rate further but eventually ratchets it up sharply. Other loan conditions follow a similar economically relevant pattern. This bank strategy is consistent with the existence of hold-up costs in bank–firm relationships.

Relationship Banking

Figure 4. Spread before and after Switching. The figure displays the spread (in basis points) between the interest rate on new loans obtained by the switcher and interest rates on loans obtained by matched firms from inside- or outside banks before, around and after the switch. The solid lines are the coefficient estimates from Tables III-II, IV-A and IV-B, while the dashed lines indicate minus and plus one standard error around the coefficient estimate. The estimates of Table IV-A are anchored at the -87 spread from Table III-II. The estimates of Table IV-B are anchored at zero. The horizontal arrowed line indicates the estimated median length of relationships in the sample.



Bernanke, Gertler 1989, Kiyotaki Moore 1997

- The main result will be that the effect of an adverse shock to the economy will be amplified by the conditions in the financial markets
  $\rightarrow$ This gives important role to financial markets
- Main intuition: Borrowing is limited by collateral value. Since an asset is used as a collateral, the price of the asset is important for borrowing capacity. Yet, the demand to this asset also depends on demand of the consumers (firms and households), which in turn depends on the amount of borrowing.

Financial Accelerator

Model

- Two period, open small economy (meaning that prices are given) with consumers (firms)
- Consumers solve

$$\max_{c_1, c_2, d_1} u(c_1) + \beta u(c_2) \; s.t.$$

$$c_1 = y_1 + d_1$$

$$y_2 = c_2 + d_1(1 + r^*)$$

$$d_1 \leq \kappa y_1, \quad 0 \leq \kappa$$

where, c: consumption, y: income, d: debt

κ: borrowing constraint parameter, r: interest rate

- With no borrowing constraint ($\kappa = \infty$), and $\beta(1 + r^*) = 1$, we have

$$u'(c_1) = u'(c_2) \Rightarrow c_1 = c_2 = \frac{1 + r^*}{2 + r^*}(y_1 + \frac{y_2}{1 + r^*})$$
$$d_1^u = c_1 - y_1 = \frac{y_2 - y_1}{2 + r^*}$$

- Consumer borrows when $y_2 > y_1$ and saves when $y_1 > y_2$

- When there is a borrowing constraint ($\kappa y_1 < d_1^u$), we have

$$c_1 = (1+\kappa)y_1, \quad c_2 = y_2 - \kappa y_1(1+r^*)$$

- Consumer does not smooth consumption perfectly since $c_1 < c_1^u = c_2^u < c_2$
- We need an asset in this model: a land with fixed supply ($a_0^s = a_1^s = 1$), with price p_1 at t=1 and dividend D at t=2
- How is this asset priced in equilibrium?

Financial Accelerator

$$\max_{c_1, c_2, a_1} u(c_1) + \beta u(c_2) \ s.t.$$

$$c_1 + p_1 a_1 = y_1 + p_1 a_0, \quad c_2 = y_2 + D a_1$$

- a_0 is given at t=0
- In equilibrium, we have

$$p_1 u'(c_1) = \beta D u'(c_2) \Rightarrow p_1 = \frac{\beta u'(c_2^e)}{u'(c_1^e)} D = \frac{\beta u'(y_2 + D)}{u'(y_1)} D$$

- $u(c) = log(c) \Rightarrow p_1 = \frac{\beta c_1^e}{c_2^e} D$
- Let's combine this asset with borrowing

Financial Accelerator

- Consumer solves

$$\max_{c_1, c_2, a_1, d_1} u(c_1) + \beta u(c_2) \; s.t.$$

$$c_1 + p_1 a_1 = y_1 + p_1 a_0 + d_1,$$

$$c_2 + d_1(1 + r^*) = y_2 + D a_1$$

$$d_1 \leq \kappa p_1 a_0$$

- When $\kappa = \infty$
  we have $u'(c_1) = \beta(1 + r^*)u'(c_2)$ and $p_1 = \frac{\beta u'(c_2)}{u'(c_1)} D$
  and if $\beta(1 + r^*) = 1$, we have $c_1 = c_2$ and $p_1 = \beta D$

Financial Accelerator

- When $d_1 > \kappa p_1$, we have binding borrowing constraint (assume $a_0 = 1$)
- $p_1 = \frac{\beta u'(y_2 + D - \kappa p_1(1+r^*))}{u'(y_1 + \kappa p_1)} D$, p_1 appears everywhere!
- Let's make simplifying assumptions
  $\rightarrow u_1(c_1) = log c_1,\ u_2(c_2) = c_2,\ \kappa \beta D < 1$
- Skipping several steps, we have
  $\rightarrow p_1 = \beta D c_1 = \frac{\beta D y_1}{(1-\beta) D \kappa}$, and $c_1 = \frac{y_1}{1 - \beta D \kappa}$
- Where is the financial accelerator effect?
  $\rightarrow \frac{\partial c_1}{\partial y_1} = \frac{1}{1 - \beta D \kappa} > 1$
- $\rightarrow c_1 = y_1 + \kappa p_1$
  $\rightarrow p_1 = \beta D c_1$
  $\rightarrow$ A decrease in y_1 lowers c_1, which lowers p_1. This is the effect of negative income shock on asset prices. But, since borrowing depends on p_1, consumption drops further