Macro-Modelling

with a focus on the role of financial markets

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Microfoundations

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Financing Decisions

- A firm can finance its needs by issuing equity, by issuing debt or by using its retained profits.
- Firms face the following financing questions.
  - How much should they borrow?
  - How much retained earning should they use?
  - Does the financial structure affect the cost of financing?
Modigliani Miller - Irrelevant Questions

  
  "...the market value of the firm - debt plus equity - depends only on the income stream generated by its assets. It follows, in particular, that the value of the firm should not be affected by the share of debt in its financial structure or by what will be done with the returns paid out as dividends or reinvested (profitably)."

- It is irrelevant how the firm finance itself
Modigliani Miller - Irrelevant Questions

- Modigliani-Miller Theorem is composed by three propositions.
  - MM I: The firm’s market value is independent of its capital structure (debt-equity ratio).
  - MM II: The firm’s market value is independent of its dividend policy.
  - MM III: The firm’s weighted average cost of capital (WACC) is independent of its capital structure.

- Firms are indifferent between going to the capital market themselves, issuing bonds or ask for a loan to intermediaries.

- Financial intermediaries do not play any role.
Modigliani-Miller Timing

Borrower and lender write financial contract

Observable shock $S$ determines output

Contract enforced. Payment to B and L contingent on $S$
Definitions

- Assume a firm’s cash flow next period is a random variable $x$.
  - Unlevered firm: Only issue stocks $S_U$
    - Value $V_U = S_U$.
    - Costs of stocks: $r_0 = \frac{E(x)}{\text{Assets}} = \frac{E(x)}{S_U}$
  - Levered firm: Issue stocks $S_L$ and bonds $B_L$
    - Value $V_L = S_L + B_L$.
    - Cost of debt: $r_b$.
    - Repayment of Debt: $R = r_b B_L$
    - Costs of stocks: $r_s = \frac{E(x) - R}{S_L}$. 
Modigliani-Miller I

- MMI: Independence of capital structure, $V_U = V_L$.
- Assume two identical firms with different capital structures and an investor deciding between
  - Buy a fraction $k$ of stocks in the unlevered firm.
    - Gains: $kE(x)$
    - Costs: $kS_U$
  - Buy a fraction $k$ of stocks in the levered firm and $k$ of bonds.
    - Gains: $k(E(x) - R) + kR$
    - Costs: $k(S_L + B_L)$
- Since gains are the same, costs should be the same, then $V_U = V_L$. 
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    Costs: \( k(S_L + B_L) \)

- Since gains are the same, costs should be the same, then \( V_U = V_L \).

- **No arbitrage, or the ’law of one price’ argument**

- **If you cut up a pizza, you have more slices but not more pizza!**
Definitions

- Assume a firm’s cash flow next period is $x$, which can be reinvested to generate a random variable $y$.
  - Firm pays dividends: Value $V_D = S_D$.
  - Firm reinvest profits in best option: Value $V_R = S_R$. 
Modigliani-Miller II

- MMII: Independence of dividend policy, $V_D = V_R$.
- Assume two identical firms with different dividend policies and an investor deciding between
  - Buy a fraction $k$ of stocks in the firm that reinvest in the best option.
    Gains: $k[x + E(y) - x]$  
    Costs: $kS_R$
  - Buy a fraction $k$ of stocks in the firm that pays dividends and reinvest those dividends in the best option (at a cost $P$).
    Gains: $k[x + E(y) - P]$  
    Costs: $kS_D$
- With competitive markets, $P = x$. Since gains are the same, costs should be the same, then $V_D = V_R$. 
Modigliani-Miller II

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    Costs: $kS_D$
- With competitive markets, $P = x$. Since gains are the same, costs should be the same, then $V_D = V_R$.
- The gains from buying a stock include future profits from the best investment opportunity.
Modigliani-Miller III

- MMIII: Independence of WACC on capital structure.
- Developing the equation for $r_s$

\[
 r_s = \frac{E(x) - R}{S_L} \\
    = \frac{E(x)}{S_L + B_L} \frac{S_L + B_L}{S_L} - \frac{r_b B_L}{S_L} \\
    = r_0 + (r_0 - r_b) \frac{B_L}{S_L}
\]
**Modigliani-Miller III**

- **MMIII**: Independence of WACC on capital structure.

- Defining

  \[
  \text{WACC} = r_s \frac{S_L}{V_L} + r_b \frac{B_L}{V_L}
  \]

- WACC is constant, independent of \( \frac{B_L}{S_L} \)

  \[
  \text{WACC} = [r_0 + (r_0 - r_b) \frac{B_L}{S_L}] \frac{S_L}{V_L} + r_b \frac{B_L}{V_L}
  \]

  \[
  = r_0 \frac{S_L}{V_L} + r_0 \frac{B_L}{V_L}
  \]

  \[
  = r_0
  \]
Modigliani-Miller III

Cost of Capital

Debt/Equity

\[ r_0 \]

\[ r_b \]

\[ r_s \]
Modigliani-Miller - Main Assumptions

- Implicit Assumptions
  - No transaction costs (In the US, for firms it is easier to borrow).
  - No differential taxation of debt and equity. (In the US, for individuals taxes on equity (dividends) are higher than taxes on debt (interests)).
  - No bankruptcy costs (this affects risky debt).
  - No Moral hazard: Managers maximize the value of the firm.
  - No Adverse selection: Information is symmetric.
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- Then, the study of financial intermediaries should deal with these frictions.
Why Do Financial Intermediaries Exist?

- Households with savings can lend to nonfinancial firms directly in stock or bond markets.
- Still the direct contact between households and firms are dominated by intermediaries (securities are traded via intermediaries).
- An organizational structure (bank) should then beat the market in some respect!
Borrower and lender write financial contract

Observable shock $S$ determines output

Contract enforced. Payment to B and L contingent on $S$
Liquidity Provision

Borrower and lender write financial contract

Observable shock $S$ determines output

Contract enforced.
Payment to B and L contingent on $S$

Liquidity shock to L and/or B.
Costly State Verification

Borrower and lender write financial contract

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Liquidity shock to L and/or B.

Unobservable shock and costly state verification
Incomplete Contracts and Commitment

Borrower and lender write financial contract

Observable shock S determines output

Contract enforced. Payment to B and L contingent on S

Incomplete contracts

Liquidity shock to L and/or B.

Unobservable shock and costly state verification

Limited contract enforcement
Information Asymmetries

Borrower and lender write financial contract

Incomplete contracts

Adverse Selection:
Asymmetric Information about the quality of the project

Observable shock S determines output

Liquidity shock to L and/or B.

Moral Hazard:
B may take hidden actions

Contract enforced.
Payment to B and L contingent on S

Unobservable shock and Costly state verification

Limited contract enforcement

Liquidity shock to L and/or B.
Open Questions

- How important are these frictions?
- Which friction is more important?
- Are frictions relevant for economic development and fluctuations?
- Is there something governments can do to mitigate the macro effects of financial frictions?
Why Do Financial Intermediaries Exist?

- Liquidity Provision.
- Delegation of Information and Monitoring Processing.
  - Incompleteness.
  - Limited Enforcement.
- Commitment Mechanism.
  - Moral Hazard.
  - Adverse Selection.
What is liquidity?

- Option to turn your investment into cash right now if you need.
What is liquidity?

- Option to turn your investment into cash right now if you need.
- **Condition:** The price at which you can turn the asset into cash is known in advance and does not vary much with how many other people are trying to do the same at the same time.
Main ideas

- Banks transform illiquid assets into liquid liabilities.
- Banks can improve on a competitive market by providing better risk sharing among people with different liquidity needs.
- Key: Asymmetric information about those needs.
- Bank runs: Undesirable equilibrium with real economic consequences (termination of productive investments).
- Contracts that may prevent bank runs:
  - Suspension of convertibility.
  - Deposit insurance.
  - Lender of last resort.
Model

- Single homogeneous good. Endowments and technology

<table>
<thead>
<tr>
<th></th>
<th>T=0</th>
<th>T=1</th>
<th>T=2</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>−1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>−1</td>
<td>0</td>
<td>$R &gt; 1$</td>
</tr>
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- The agent may want to consume at $T = 1$ or $T = 2$, not both.

- $Pr(type \ T = 1) = t$ at $T = 0$.

Assumptions

- The type is unknown at $T = 0$ (idiosyncratic risk).
- At $T = 1$ the agent privately observes his type (uninsurable risk).
- $t$ is known (NO aggregate risk).
Competitive markets

- \( U(c_1, c_2; \Theta) = tl\ln(c_1) + (1-t)\rho l\ln(c_2) \) where \( R \geq \rho R > 1 \) (discounting does not overturn the gains from technology maturity)

- Economy-wide resource constraint for unit mass of agents:

\[
1 = tc_1 + (1 - t)\frac{c_2}{R}
\]

- In competitive markets, the solution is autarky:

\[
c_1^1 = 1, \; c_2^1 = 0 \text{ and } c_1^2 = 0, \; c_2^2 = R
\]

- This is because no agent store goods from period 1 to 2.
Social optimum

• The society can do it better since there is the risk of becoming an early consumer and not taking advantage of production.

• The planner maximizes $U(c_1, c_2; \Theta)$ s.t. resource constraint.

• Then

$$c_1^* = \frac{1}{t + (1 - t)\rho} > 1$$

$$c_2^* = \frac{R}{(1 - t) + \frac{t}{\rho}} < R$$

Assume $r_1 = c_1^*$ and $r_2 = c_2^*$

$$R > r_2 > r_1 > 1$$
Sequential Withdrawing

Assume a sequential withdrawal rule:

\[ V_1(f_j, r_1) = \begin{cases} r_1 & \text{if } f_j < \frac{1}{r_1} \\ 0 & \text{if } f_j \geq \frac{1}{r_1} \end{cases} \]

\[ V_2(f, r_1) = \begin{cases} \frac{(1-nf)R}{(1-f)} & \text{if } f < \frac{1}{r_1} \\ 0 & \text{if } f \geq \frac{1}{r_1} \end{cases} \]

The optimal situation is feasible and an equilibrium

- If \( f = t \) and \( r_1 = c_1^{1*} \), then \( tr_1 < 1 \) (feasible)
- If \( f = t \), \( V_2(t, c_1^{1*}) = c_2^{2*} > c_1^{1*} \) (types 2 withdraw at \( T = 2 \))
Multiple Equilibria

- Problem for two type 2 depositors, A and B.
- Two equilibria
  - Good Equilibrium: Social optimum. better than autarky.
  - Bad Equilibrium: Bank run. worst than autarky.

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<td>$\frac{r_1}{2}, \frac{r_1}{2}$</td>
<td>$r_1, 0$</td>
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<td>$0, r_1$</td>
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Old Bank Runs
Not So Old Bank Runs
Suspension of convertibility

- Eliminates bank runs **ONLY when $t$ is known**.
- It eliminates incentives to type 2 agents to withdraw at $T = 1$

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Suspension of convertibility

- **When** $t$ **is unknown** (for example, following a stochastic process), the unconstrained optimum is not achievable.

- With sequential withdrawing, there is a distortion of the consumption of type 2 agents that comes from market clearing.

- Even when first best is not achievable, the result is better than without suspension.
Deposit Insurance

- **This works even when** $t$ **is unknown.**

- Key: The government tax after $T = 1$, when observing the fraction $(f)$, such that they get $c_1^* = r_1 - \tau(f)$.

- Taxes are plowed back into banks, to pay withdraws at $T = 2$.

- Then unique dominant strategy equilibrium is $f = t$

- Only a government can make the credible promise of providing insurance. In equilibrium the promise does not need to be fulfilled.

- Same result with lender of last result.
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- Only a government can make the credible promise of providing insurance. In equilibrium the promise does not need to be fulfilled.
- Same result with lender of last result.
- **CHICKEN MODEL!!!**
Final remarks - Not an aggregate story!

- Financial crises occur when depositors at many or all of the banks in a region or country attempt to withdraw their funds simultaneously.
- However this is not a story of contagion!
Final remarks - What fuels bank runs?

- Bank runs are self-fulfilling in nature.
- Are they random events or natural results of business cycles?
- Calomiris and Gorton (91) and Lindgren et al. (96) found there is no support for the "sunspots" view of bank runs.
- They also found evidence deposit insurance and lender of last resort are in fact effective in avoiding bank runs.
Final remarks - What fuels bank runs?

<table>
<thead>
<tr>
<th>NBER Cycle Peak-Trough</th>
<th>Panic Date</th>
<th>Percentage Δ (Currency/Deposit)</th>
<th>Percentage Δ Pig Iron</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 1873-Mar. 1879</td>
<td>Sep. 1873</td>
<td>14.53</td>
<td>-51.0</td>
</tr>
<tr>
<td>Mar. 1882-May 1885</td>
<td>Jun. 1884</td>
<td>8.80</td>
<td>-14.0</td>
</tr>
<tr>
<td>Mar. 1887-Apr. 1888</td>
<td>No panic</td>
<td>3.00</td>
<td>-9.0</td>
</tr>
<tr>
<td>Jul. 1890-May 1891</td>
<td>Nov. 1890</td>
<td>9.00</td>
<td>-34.0</td>
</tr>
<tr>
<td>Jan. 1893-Jun. 1894</td>
<td>May 1893</td>
<td>16.00</td>
<td>-29.0</td>
</tr>
<tr>
<td>Jun. 1899-Dec. 1900</td>
<td>No panic</td>
<td>2.78</td>
<td>-6.7</td>
</tr>
<tr>
<td>Sep. 1902-Aug. 1904</td>
<td>No panic</td>
<td>-4.13</td>
<td>-8.7</td>
</tr>
<tr>
<td>May 1907-Jun. 1908</td>
<td>Oct. 1907</td>
<td>11.45</td>
<td>-46.5</td>
</tr>
<tr>
<td>Jan. 1910-Jan. 1912</td>
<td>No panic</td>
<td>-2.64</td>
<td>-21.7</td>
</tr>
</tbody>
</table>
Final remarks - Bank’s Moral Hazard!

- In the presence of portfolio choices, both deposit insurance and bailouts may introduce distortions through moral hazard.
- Question: Combination of tools to prevent bank runs and maintain potential punishments to bank managers.
Final remarks - Extensions and Critics

- This paper has been extended to currency crises and firms liquidity crises and has also been applied in designing bankruptcy laws.

- Why capital markets cannot smooth consumption? (Jacklin, 87)
  - Banks can only exist if trading restrictions limit consumers to the type of demand deposits in Diamond and Dybvig model. This highlights the importance of the sequential service constraint.
  - Haubrich and King (90) also find securities market is as good as banks in providing liquidity, unless we restrict trade.
Final remarks - Some questions

Why do people deposit in the first place?

- In fact, they only deposit if the "bank run" probability is low.

Why does an intermediary appear in the first place?

- A monopolist could profit while achieving the first best.
Liquidity vs. Solvency

- **Liquidity Problems:**
  - In the absence of bank runs, banks would be able to pay as promised.
  - Banks should be rescued.

- **Solvency Problems:**
  - Even in the absence of bank runs, banks cannot pay as promised (for example a shock in assets’ values).
  - Banks should NOT be rescued.
Liquidity vs. Solvency

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- **Solvency Problems:**
  - Even in the absence of bank runs, banks cannot pay as promised (for example a shock in assets’ values).
  - Banks should NOT be rescued.

- In the presence of bank runs:
  - Very difficult to identify between the problems.
  - However, whether the problem is solvency or liquidity calls out very different policy reactions.
Liquidity Shocks to Borrowers

- Moral hazard restricts firms’ ability to borrow under unexpected investment needs.

- Holmstrom and Tirole (98). Demand for liquidity comes from firms, not depositors. We’ll come back to this when analyzing commitment (Diamond and Rajan, 01).

- Unlike claims in the financial market, which cannot be made contingent on a firm's liquidity shock, firms only draw on the credit line at date 1 to the extent that they need resources.
Liquidity as Medium of Exchange

- **Liquidity 2**: Bank liabilities are medium of exchange.
- A medium of exchange is a set of claims or securities that can be offered to other agents in exchange for goods.
- Such claims can dominate barter (which requires needs coincidence).
- What are the advantages of privately-produced trading claims to be a medium of exchange?
Liquidity as Medium of Exchange

- Banks issue private money to facilitate clearing transactions. (a clearinghouse accepts money in payment of promises and pays off promises).
- Banks actually did issue their own private money during the American Free Banking Era, 1838-1863. This era was thought as a failure, arguing that it was marked by wildcat banking. Recent studies show this was not the case (Rolnick and Weber, 84).
Liquidity as Medium of Exchange

- When offered a bank liability in exchange for goods, the seller of goods must recognize the risk that the bank can fail before the liability is honored.

- For these claims to be medium of exchange, the value of liabilities should be riskless or free of such considerations.
Liquidity as Medium of Exchange

- Gorton and Pennacchi (90): Uninformed traders, or those with liquidity needs lose money when selling securities to informed traders.

- If securities could be valued independently of information known only to the informed traders, then these securities would be highly desirable for trading purposes.

- They argue banks can create this security (debt) by splitting its portfolio in equity and debt. The key is their portfolio is diversified.
Liquidity as Medium of Exchange

- Dan, Gorton, Holmstrom and Ordonez (2012): Banks exist to generate information when making loans... and hide the information when providing liquidity!
- It is not coincidence banks perform both activities.
- Banks can hide information successfully by lending to small firms, households or not very risky investments.
Possible Monitoring

- **Auditing** borrowers who fail to repay.
- **Screening** of projects to relax adverse selection.
- **Preventing** opportunistic behavior to relax moral hazard.
Why Intermediaries Should Monitor?

- Scale economies in monitoring.
- Small investors (free riding).
- Low costs of delegation.
Standard Debt Contract

- Bank "borrowing" and "lending" typically follow debt type contracts.
- Standard Debt Contract:
  - Specifies a fixed repayment (principal plus interest).
  - If this is not repaid, bankruptcy proceedings are initiated, and all resources are transferred to the holders of claims on the debtor.
- Is this optimal? ... or just exists out of simplicity?
Standard Debt Contract

- Townsend (79) and Gale and Hellwig (85) show in fact debt is optimal
  - Asymmetric information: Only borrowers know the result of the project.
  - Costly state verification.
Why is Debt Optimal?

- Assume
  - A firm wants to finance a project that costs $1, pays $X$ with probability $p$ and 0 otherwise.
  - The project is efficient $pX > 1$
  - Infinite many lenders with risk-free rate 0.
  - Costly state verification: Firms observe the result for free and lenders have to pay $C$ if they want to see the result.
- If information is symmetric, only defaults in case of failure
- Interest rates are

$$pR_{SI} = 1$$
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$$R_{SI} = \frac{1}{p}$$
Why is Debt Optimal?

- If information is asymmetric, the firm never wants to repay.
- If lenders cannot verify the result, then there is no financing of the project (inefficient).
- If lenders can verify the result at a cost $C$, they can commit verify when there is no payment and seize remaining assets.
- What the firm does in this case?
  - If success: Firms gets $X - R > 0$ if paying and 0 if not.
  - If failure: Firms gets $-R < 0$ if paying and 0 if not.
- Interest rates are
  
$$ pR_{AI} - (1 - p)C = 1 $$
Why is Debt Optimal?

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- If lenders cannot verify the result, then there is no financing of the project (inefficient).
- If lenders can verify the result at a cost $C$, they can commit to verify whenever there is no payment.
- **What the firm does in this case?**
  - If success: Firms gets $X - R > 0$ if paying and 0 if not.
  - If failure: Firms gets $-R < 0$ if paying and 0 if not.
- **Interest rates are**
  $$R_{AI} = \frac{1 + (1 - p)C}{p}$$
Why is Debt Optimal?

- Since

\[ R_{AI} = \frac{1 + (1 - p)C}{p} \]

- For the cases in which \( \frac{1}{p} < X < \frac{1 + (1 - p)C}{p} \) no loans would be taken (inefficient).

- Then, it is key to reduce \( C \) or the need for monitoring.
Banks as Delegated Monitors

- Diamond (84) explain how banks can reduce the need for monitoring.
- Because of economies of scale, intermediaries have an advantage in "monitoring" borrowers.
- But, "...who monitors the monitor?"
- The solution is given by diversification of the banks assets.
- If the bank only gives one loan, there are no monitoring gains from intermediation.
Direct Lending

- Assume the same framework as above. Only difference is investors are small and can only contribute $\frac{1}{m}$.

- Then, under direct lending, the optimal contract is debt and each investor would lend at a rate,

\[ r = \frac{\frac{1}{m} + (1 - p)C}{p} \]

- This means the firm should pay, in case of success

\[ R = mr = \frac{1 + (1 - p)mC}{p} \]
Delegation and Diversification

- Assume there is an intermediary. Can it make profits?
- The optimal contract between the bank and the firm is still debt.
- With just one project the intermediary can only lose money. This is because investors still have to monitor the monitor!
- Depositor will charge in total to the bank \( R_B^1 = mr = \frac{1+(1-p)mc}{p} \)
- What if the bank charges \( R^L = R = \frac{1+(1-p)mc}{p} \) for the loan?
- Profits for the bank, with one project, are

\[
\pi_1 = p(R^L - R^B_1) - (1-p)C = -(1-p)C < 0
\]

- This is because there is just another player monitoring.
Delegation and Diversification

- Now assume the bank finances two projects. Can it make profits?
- Assume the bank still charge each lender $R^L = R = \frac{1+(1-p)mC}{p}$
- The bank’s probability of default is just $(1 - p_2^B) = (1 - p)^2$. Then,

$$R_2^B = \frac{1 + (1 - p_2^B)mC}{p_2^B} < R^L$$

- Profits for the bank, with two projects, are

$$\Pi_2 = p^2(2R^L - 2R_2^B) + 2p(1 - p)(R^L - C - 2R_2^B) - (1 - p)^22C$$
Delegation and Diversification

Now assume the bank finance two projects. Can it make profits?

Assume the bank still charge each lender $R_L = R = \frac{1 + (1 - p)mC}{p}$

The bank’s probability of default is just $(1 - p^B_2) = (1 - p)^2$. Then,

\[ R^B_2 = \frac{1 + (1 - p^B_2)mC}{p^B_2} < R^L \]

Profits for the bank, for each project, are

\[ \pi_2 = \frac{\Pi_2}{2} = p^2 (R^L - R^B_2) + p(1 - p)(R^L - C - 2R^B_2) - (1 - p)^2 C \]
Delegation and Diversification

- Now assume the bank finance two projects. Can it make profits?
- Assume the bank still charge each lender $R^L = R = \frac{1 + (1 - p) mC}{p}$
- The bank’s probability of default is just $(1 - p^B_2) = (1 - p)^2$. Then,

  $R^B_2 = \frac{1 + (1 - p^B_2) mC}{p^B_2} < R^L$

- Profits for the bank, for each project, are

  $\pi_2 = \frac{\Pi_2}{2} = \left( \frac{p^2 + p(1 - p)}{p} \right) R^L - \left( \frac{p^2 + 2p(1 - p)}{1 + (1 - p)^2 mC} \right) R^B_2 - \left[ \frac{p(1 - p) + (1 - p)^2}{(1 - p)} \right] C$
Delegation and Diversification

- Now assume the bank finance two projects. Can it make profits?
- Assume the bank still charge each lender $R^L = R = \frac{1+(1-p)mC}{p}$
- The bank’s probability of default is just $(1 - p_2^B) = (1 - p)^2$. Then,

$$R_2^B = \frac{1 + (1 - p_2^B)mC}{p_2^B} < R^L$$

- Profits for the bank, for each project, are

$$\pi_2 = \frac{\Pi_2}{2} = 1 + (1 - p)mC - 1 - (1 - p)^2 mC - (1 - p)C$$
Delegation and Diversification

- Now assume the bank finance two projects. Can it make profits?
- Assume the bank still charge each lender $R^L = R = \frac{1+(1-p)mC}{p}$
- The bank’s probability of default is just $(1 - p_B^2) = (1 - p)^2$. Then,

$$R_B^2 = \frac{1 + (1 - p_B^2)mC}{p_B^2} < R^L$$

- Profits for the bank, for each project, are

$$\pi_2 = \frac{\Pi_2}{2} = (1 - p)(pm - 1)C$$

**POSITIVE UNDER OUR ASSUMPTION THAT $R^L > 2R_B^2$**
Delegation and Diversification

- As $N \rightarrow \infty$, $p_N^B \rightarrow 0$ and $R_N^B \rightarrow 1$.
- In this case, profits per project are,

$$\pi_N \rightarrow pR^L - 1 - (1 - p)C = (1 - p)(m - 1)C > 0$$

- In this extreme case, diversification is very effective and the "monitor the monitor" problem disappears.
- Hence, the no duplication of monitoring efforts is very effective.
Relevance for Efficiency

- **This is important for efficiency.** We assumed the profits go to lenders (banks), but it can go to borrowers.
- In this case, some projects that cannot be funded with $R^L$ can be funded with a lower rate, closer to 1 (critical when $1 < pX < R^L$).
- In particular underinvestment is a problem for large investments since $m$ tend to be big (and then $R^L$ is also big with direct lending).
Optimal Bank Size

- Results are not that strong when projects’ results are correlated.
- What if the cost of monitoring a larger bank is higher? Optimal Bank Size. Trade off between monitoring and diversification.
- With risk aversion the result is naturally stronger.
Extensions

- Williamson (86) shows that, as the bank size goes to infinity, there is no need for depositors to monitor banks. Law of large numbers.
- Krasa and Villamil (92) show that, if the depositor’s cost of monitoring doesn’t increase exponentially with bank size, the expected cost of monitoring a sufficiently large bank goes to zero.
- If the loan risk is systemic, there is a bank size past which the increase in monitoring costs dominates marginal benefits from additional diversification. This optimal size diminishes as the systemic component of loan risk increases.
Empirical Evidence

- Winton (95) shows that banks that invest their own funds as inside equity capital (since equity absorbs losses first) reduce the probability of bank default and the need of depositors’ monitoring.

- The relative importance of capital versus diversification increases as loan risks are more systemic.

- Intermediaries create a collusion between borrowers and lenders to solve asymmetric information at a lower cost.
Empirical Evidence

- James (87) study 207 announcements of new agreements and renewal of existing agreements.
- He finds a significantly positive announcement effects, in contrast to announcements of other types of securities issued in capital markets.
- Furthermore, the positive effects come from revisions and not new agreements.
- This suggests banks are better at acquiring information.
Empirical Evidence

- Gilson, John and Lang (90) show a firm restructuring is more successful, the higher the firm’s reliance in bank borrowing.

- This suggests renegotiation is easier with a single bank that with multiple bondholders, since free riding problems are reduced.

- This suggests banks are better at dealing with bankruptcies and renegotiations.
Banks as Information Producers

- Monitoring is acquisition of information after the project finishes.
- Banks also try to acquire information before the project starts.
Banks as Information Producers

- If information about investment opportunities is not free, then lenders can produce that information. However that may duplicate efforts.
- A smaller number of agents could produce the information, becoming informed, and then sell the information to the uninformed agents.
- However this generates
  - Reliability problem: How to be sure the information is the right one? (Hirshleifer (71))
  - Appropriability problem: Once the information is sold it can be freely reproducible and transferrable to other agents.
Banks as Information Producers

- Leland and Pyle (77). The intermediary can credibly produce information by investing its wealth in assets about which it claims to have produced valuable information.
- Entrepreneur can also signal his information by investing his own money in the project.
- Again, diversification lowers the intermediary’s signaling costs compared to the entrepreneur’s costs.
Banks as Information Producers

- Boyd and Prescott (86). Financial intermediaries are coalitions of agents that evaluate projects, invest in those determined to be high-value projects, and share the returns from the portfolio of projects.
- An efficient outcome invests in as many good projects as possible.
- Bad-type agents want to mimic good-type agents, claiming they are good, and hoping high returns. In the market equilibrium some bad-type projects are evaluated. This is inefficient.
Banks as Information Producers

- The intermediary dominates the security market because the coalition can induce agents to **truthfully reveal their type**.

- Mechanism Design: Depositors are promised a consumption which is more than a bad-type agent could achieve on his own, but less than the promised amount for projects with a good evaluation and high realized returns.

- Truthful revelation allows the coalition to avoid inefficiently evaluating some bad-type projects.

- Key: By conditioning returns on the coalition's portfolio returns, rather than on the returns of a single project, the coalition can offer higher returns to bad-type agents, so they will participate in the coalition.
Banks as Information Producers

- A strength of Boyd and Prescott (86) is the characterization of the intermediary as as a bank-like institution.
- Why? Because a good theory of intermediation must distinguish bank-like financial intermediaries from firms that sell information, like rating agencies, and firms that just delegate portfolio management, like mutual, pension or hedge funds.
  - Rating agencies do not lend money.
  - In mutual funds, managers do not hold equity claims in the portfolio.
In most papers about expert advice (like Bhattacharya and Pfleiderer (85), Allen (90), and Ramakrishnan and Thakor (84)) intermediaries sell information to investors, but they do not need to actually invest the funds of the investors.
Banks as Commitment Mechanisms

- The existence of banks is explained by their fragility
- Main assumption: Banks are somewhat opaque institutions.
Banks as Commitment Mechanisms

- Calomiris and Kahn (91) argue that demand deposits include the right to withdraw at anytime at par along with a sequential service constraint in order to control the risk taking activities of bankers.

- Information-producing depositors will recover more than other depositors, because of sequential constraints.

**Fragility is a positive attribute of banks!!!**
Banks as Commitment Mechanisms

- Flannery (94): Since depositors cannot control the bank portfolio, but they can estimate a bank's riskiness at any point in time. To control bankers, short-term debt is used because changes in bank risk will be reflected in financing costs.

- Empirically, bank debt prices do reflect bank risk.
Banks as Commitment Mechanisms

- Diamond and Rajan (01)
- If the relationship lender threatens to withdraw from the project, depositors will run the bank and the lender will receive no rents.
Main ideas

- Banks are valuable both on the asset side (liquidity to firms) and on the liability side (liquidity to depositors).
- Fragile capital structure allows banks to create liquidity, explaining why bank loans are illiquid.
Simple version of the model

- 3 Dates (0, 1 and 2).
- Players:
  - Entrepreneurs (E) that require $1 at date 0 for a project.
  - Investors with $1 available at date 0 (RL).
  - Investors with $1 available at date 1 (L).
- The project pays $1.5 at date 2 only if E work on it.
- If RL liquidate, they get at most $0.9 at date 1 or $1.1 at date 2.
- If L liquidate, they get at most $0.8 at date 1 or 2.
- RL need money at date 1 and wants to borrow from L.
Limited Commitment

- Loans can be renegotiated. (E all the bargaining power).

- Lenders are afraid to lend
  - E can threaten to quit at dates 1 and 2, unless renegotiation.
  - RL can threaten to not using his better knowledge to liquidate the project, unless renegotiation.
Illiquidity

- **The asset is illiquid**: E, the best user of the assets cannot commit to employing his specialized human capital on behalf of others.

- At date 0, E cannot commit to work on the project and hence to pay more than 1.1 to RL.

- **The loan is also illiquid**: RL, the best user of the loan cannot commit to employing his specialized human capital on behalf of L.

- At date 1, RL cannot commit to use his knowledge and hence to pay more than 0.8 to L.
Illiquidity

- In anticipation of liquidity needs at date 1, **RL will not lend.**
  (They just get at most 0.8 if selling the loan and 0.9 if liquidating the asset at date 1).

- The only chance for a loan is a payment with higher return than storage (**illiquidity premium**)

- Even if illiquidity does not prevent lending, it makes it more expensive.
Fragile banks as a solution

- Everything would be fine if RL could borrow its full value ($1.1) when needing liquidity.
- This is possible only if RL would be able to commit in using their specific skills on behalf of L.
- **Commitment Device:** A fragile structure, subject to a collective action problem, such as a bank.
How does this work?

- At date 1 RL set up a bank by issuing many small demand deposits at face value $1.1.
- Sequential withdraw, as in Diamond and Dybvig.
- If all the depositors run to demand their claims at date 1, the bank lose ownership and the market value is $0.8.
- Any attempt to renegotiate at date 2 will trigger a bank run and a loss of ownership of the loan, driving the banker’s rents to zero.
How does this work?

- The run disciplines the bank, since her skills just make transfers, do not create value.
- The bank gets a benefit from skills just because it owns the loan.
- The run has the potential to disintermediate the bank, transferring ownership to depositors.
Liquidity Provision and Inside Money

- By issuing demand deposits at date 1, RL can raise 1.1 at 1 by credibly committing to pay back 1.1 at 2.

- The bank transforms an illiquid loan with market value of 0.8 into liquid demand deposits that pay 1.1 at date 2.

- Banks also create inside money (checks) since buyers of deposits have no less ability to extract payments than sellers of deposits.
Robustness of banks

- E cannot issue deposits in an attempt to commit to pay more.
- Unlike LR (who just transfer money), E creates value.

- Stability policies (as deposit insurance, lender of last resort or suspension of convertibility) may reduce commitment, impairing the ability of financial institutions to provide liquidity.
Empirical Evidence

- Banks that are more heavily funded through core deposits do provide borrowers with smoother loan rates in response to aggregate shocks. (Berlin and Mester (99))

- Banks make more loan commitments than other types of intermediaries and, within the banking sector, banks with high ratios of transaction deposit to total deposits also have high ratios of loan commitments to total loans. (Kashyap, Rajan, and Stein (01))
Securitization

- Securitization distributes risk by aggregating assets in a pool (often by selling assets to a special purpose entity), then issuing new securities backed by the assets and their cash flows.
- The securities are sold to investors who share the risk and reward from those assets.
- Investors’ rights to receive cash flows are divided into "tranches".
- Not subject to regulation (like capital requirements) or bankruptcy, because assets are off-balance sheet.
Securitization

- At the end of 2005 there were in the United States $2 trillion of total amount outstanding. (10% of bond market debt, 35% of mortgage-related debt and 40% of corporate debt).
- In nominal terms, from 1995 to 2004, ABS amount outstanding has grown about 19 percent annually (with mortgage-related debt and corporate debt each growing at about 10 percent).
- Largest sectors in this market: credit card BS (20%), home-equity BS (25%), automobile BS (10%), and CDOs (17%).
Securitization

- The dramatic increase in loan sales constitutes a challenge, both theoretically and empirically, to arguments concerning bank existence.
- The borrowing firm could have issued a security directly!!!
- Maybe bank keeps a portion of the cash flows that maintain incentives, as it would have had the entire loan been kept on its balance sheet. (Gorton and Pennacchi (95)).
- Market participants seem to rely on banks’ incentives to maintain their reputations for monitoring. (Ordonez (10))
Loans vs. Stocks

- What function do stock markets perform?
- Do they substitute banks?
- Dow and Gorton (97): Stock markets have two roles
  - Monitoring role: Informative stock prices can lead to efficient executive compensation.
  - Screening role: The firm can use information from stock prices in making decisions.
- In their view they are substitutes.
Loans vs. Stocks

- Allen and Gale (99) argue that they are fundamentally different in processing information. Stock markets can aggregate diverse opinions and banks cannot.

- Baliga and Polak (01) asks about the differences between the German and Anglo-Saxon financial systems.
  - Bank: The borrower is monitored, the first best outcome can be enforced, but at a cost.
  - Stocks: The borrower is not monitored, only a second best outcome can be achieved, but there is no monitoring cost.
  - The Anglo-Saxon system can only persist if it is efficient, but the economy can get stuck in an inefficient German system.
Loans vs. Bonds

- If loans are preferred to bonds to monitor and create information cheaper, why loans and bonds coexist?
- In Detragiache (94) firms use both bonds and loans. Bonds are public debt that cannot be renegotiated, while loans are private debt costlessly renegotiated. Loans are senior to bonds.
Coexistence of Financial Markets and Intermediaries

- Empirical regularities
  - Large, mature and safe firms that are less likely to need banks as monitors and reorganizers in the event of financial distress issue bonds and equity.
  - Smaller firms, start up and risky ventures rely more heavily on bank loans.
  - These determinants of choice of lender are most important during downturns.
Coexistence of Financial Markets and Intermediaries

- Bolton and Freixas (2000)

- Assume

  - Investors are competitive and risk-neutral. Interest rates are 0.
  - At $T = 1$ and $T = 2$, projects generates $y$ if success and 0 if failure.
    - $T = 0$. The project costs $1$.
    - $T = 1$. Observable probability of success for each firm $p \in [p, 1]$ (Credit rating)
    - $T = 2$. Firms can be Good or Bad. Good firms generate $y$ for sure and Bad firms generate 0 for sure.
    - Each firm knows its own type. Investors only know a fraction $\nu$ of firms is Good.
    - Projects can be liquidated at $L$ at $T = 1$. 
Coexistence of Financial Markets and Intermediaries

- What if good firms decide to finance with bonds?
  - Success at $T = 1$: Repayment $R$ at $T = 1$ and 0 at $T = 2$.
  - Failure at $T = 1$: Bankruptcy and Liquidation.
  - Zero-profit condition for investors

\[ pR + (1 - p)L = 1 \]

- Expected profits for good firms are $\Pi_B = p(y - R) + py$, or

\[ \Pi_B = 2py - 1 + (1 - p)L \]
Coexistence of Financial Markets and Intermediaries

- What if good firms decide to **finance with equity**?
  - A share $\alpha \in [0, 1]$ of cash flows generated by the firm go to investors.
  - Zero-profit condition for shareholders

  \[ \alpha[p y + v y] = 1 \]

- Expected profits for good firms are $\Pi_E = (1 - \alpha)[p y + y]$, or

  \[ \Pi_E = (1 + p) \left( y - \frac{1}{p + v} \right) \]
Coexistence of Financial Markets and Intermediaries

- What if good firms decide to finance with bank loans?
  - Success at $T = 1$: Repayment $\hat{R}$ at $T = 1$ and 0 at $T = 2$.
  - Failure at $T = 1$: Renegotiation. It observes the type. Intermediation costs are $\gamma$.
  - Zero-profit condition for the bank

$$p\hat{R} + (1 - p)[vy + (1 - v)L] = 1 + \gamma$$

- Expected profits for good firms are $\Pi_{BL} = p(y - \hat{R}) + py$, or

$$\Pi_{BL} = 2py - 1 - \gamma + (1 - p)[vy + (1 - v)L]$$
Coexistence of Financial Markets and Intermediaries

- **Equity**
- **Bank Loans**
- **Bonds**

- High fraction of Good firms
- Low fraction of Good firms

- High Credit Risk
- Low Credit Risk

- $v$
- $p$
- $1$

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ECON 244, Spring 2013  Microfoundations  Macro-Modelling
Why is Financial Intermediation Different

- Differently than other economic transactions, financial intermediation critically involves the element of **time and uncertainty**.
- **Time**: Trade of a claim today for a claim in the future.
- **Uncertainty**: Lender’s uncertainty about the borrower’s ability or willingness to pay in the future.
Why is Financial Intermediation Different

- Main manifestations of uncertainty...
  - Imperfect information: Lack of perfect knowledge about the future.
  - Asymmetric information: Borrowers know more than lenders about the risk associated to a loan.
  - Moral hazard: Unknown actions of borrowers determine the repayment probability.
Room for Regulation

- Financial markets are not perfectly competitive. This gives room for beneficial government regulation to solve those information problems.
  - Improve the quality of information available to financial institutions. Particularly to avoid fraud (SEC).
  - Stabilize the financial system by limiting the risk exposure of financial institutions. Deposit insurance, capital requirements (Federal Reserve, FDIC, etc)
  - Arbiter of legal arrangements associated with financial intermediation. Bankruptcy and restructuring procedures.