

MACROECONOMICS OF FINANCIAL MARKETS

Microfoundations of Financial Markets

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January 12, 2020

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?
 - How their financing choices affect the cost of borrowing?

MODIGLIANI MILLER - IRRELEVANT QUESTIONS

- Modigliani-Miller Theorem (1958): Irrelevance Proposition.

"...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 finances itself**

MODIGLIANI MILLER - IRRELEVANT QUESTIONS

- Modigliani-Miller Theorem is composed by three propositions.
 - MM I: The firm's market value is independent of its debt-equity ratio.

No arbitrage, or the "law of one price" argument
If you cut up a pizza, you have more slices but not more pizza!
 - MM II: The firm's market value is independent of its dividend policy.

Dividends will be reinvested in the best opportunity.
 - 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 III

- MMIII: Independence of WACC on capital structure.
- Define B_L and S_L the bonds and stocks issued.
- Define the return of the project by $r_0 = \frac{E(x)}{S_L + B_L}$
- Define $R = r_b B_L$ the debt. Then r_s is

$$\begin{aligned}r_s &= \frac{E(x) - R}{S_L} \\&= \frac{E(x)}{S_L + B_L} \frac{S_L + B_L}{S_L} - \frac{r_b B_L}{S_L} \\&= r_0 + (r_0 - r_b) \frac{B_L}{S_L}\end{aligned}$$

MODIGLIANI-MILLER III

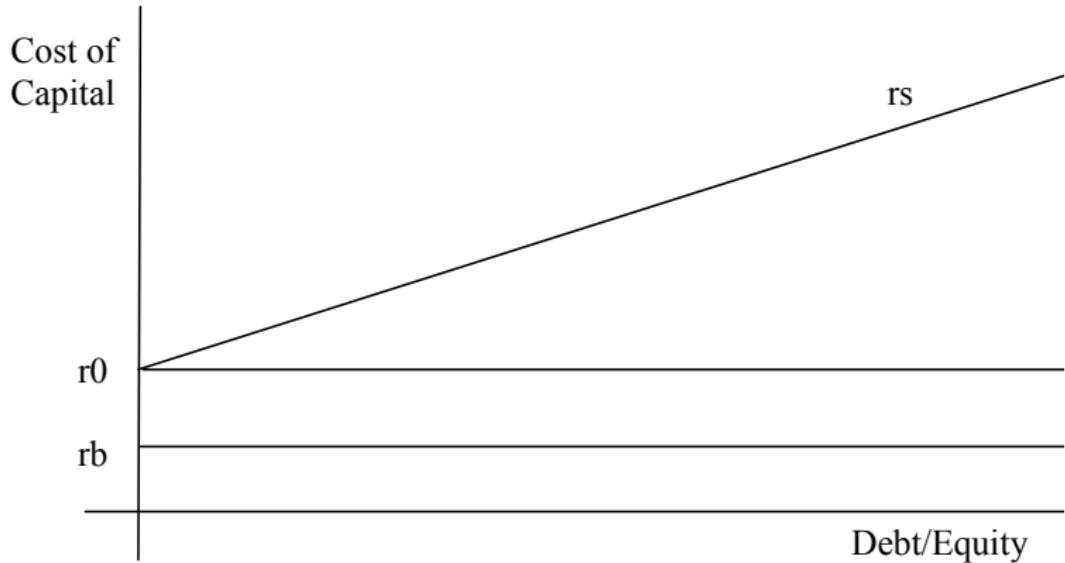
- MMIII: Independence of WACC on capital structure.
- Defining

$$WACC = r_s \frac{S_L}{V_L} + r_b \frac{B_L}{V_L}$$

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

$$\begin{aligned} WACC &= [r_0 + (r_0 - r_b) \frac{B_L}{S_L}] \frac{S_L}{V_L} + r_b \frac{B_L}{V_L} \\ &= r_0 \frac{S_L}{V_L} + r_0 \frac{B_L}{V_L} \\ &= r_0 \end{aligned}$$

MODIGLIANI-MILLER III



MODIGLIANI-MILLER TIMING



Borrower and
lender write
financial
contract

Observable
shock S
determines
output

Contract enforced.
Payment to B and L
contingent on 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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 - No Moral hazard: Managers maximize the value of the firm.
 - No Adverse selection: Information is symmetric.
- **Then, the study of financial intermediaries should deal with these frictions.**

WHY DO FINANCIAL INTERMEDIARIES EXIST?

- Households with savings can lend to nonfinancial firms with funding needs 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!

Let's see first how they look like!!!

FINANCIAL MARKETS

- **Trade** of financial instruments by individuals and institutions.

FINANCIAL MARKETS

- Trade of financial instruments by **individuals and institutions**.
- Who trade?
 - Debtors are individuals or institutions who want to spend more than their current income.
 - Creditors are individuals or institutions who want to spend less than their current income.
 - Financial markets provide a way for the first group to borrow from the second group.

FINANCIAL MARKETS

- Trade of **financial instruments** by individuals and institutions.
- What do they trade?
- Cash instruments:
 - Value determined by the market.
 - Generated by debtors' needs to purchase an asset today (investment) and creditors' needs to accumulate resources for the future (savings).
 - Cash: Borrower and lender agree to a transfer (Loans and Deposits).
 - Securities: Readily transferrable instruments (Stocks, Bonds, Commercial Paper, T-Bills).

FINANCIAL MARKETS

- Trade of **financial instruments** by individuals and institutions.
- What do they trade?
- Derivatives.
 - Value determined by the underlying assets.
 - Generated by institutional needs to insure against future bad shocks.
 - OTC (over the counter): Contracts traded directly between two parties (Stock Options, Bond Futures, Interest Rate Futures, Forward Rate).
 - Exchange-traded: Standardized contracts traded via specialized future exchanges (Stock Options, Credit Swaps, Exotic Instruments).

FINANCIAL INTERMEDIATION

- **MOST** of this trade is done by financial intermediaries.
- Financial intermediaries channel funds from creditors to debtors.
- Types
 - **Commercial Banks. (depository institutions)**
 - Institutions whose current operations consist in granting loans and receiving deposits from the public.
 - Mutual funds.
 - Pension funds.
 - Insurance companies.
 - Finance companies.
 - Asset backed security issuers.

FINANCIAL INTERMEDIATION

- Financial intermediaries channel funds from creditors to debtors.
- Types
 - Commercial Banks. (depository institutions)
 - **Mutual funds.**
 - Pools money from many investors and a manager invests, typically in securities.
 - After deducting managers fees, the gains from investments are distributed to the investors, at least annually.
 - **Hedge funds** invest in riskier alternatives (short selling, derivatives,...)
 - Pension funds.
 - Insurance companies.
 - Finance companies.

FINANCIAL INTERMEDIATION

- Financial intermediaries channel funds from creditors to debtors.
- Types
 - Commercial Banks. (depository institutions)
 - Mutual funds.
 - **Pension funds.**
 - Common asset pool meant to generate stable growth, and provide pensions for retirees.
 - Managed by large intermediaries. Largest investors in most countries.
 - Insurance companies.
 - Finance companies.
 - Asset backed security issuers.

FINANCIAL INTERMEDIATION

- Financial intermediaries channel funds from creditors to debtors.
- Types
 - Commercial Banks. (depository institutions)
 - Mutual funds.
 - Pension funds.
 - **Insurance companies.**
 - Provide insurance policy to individuals and companies to avoid possible bad shocks.
 - Finance companies.
 - Asset backed security issuers.

FINANCIAL INTERMEDIATION

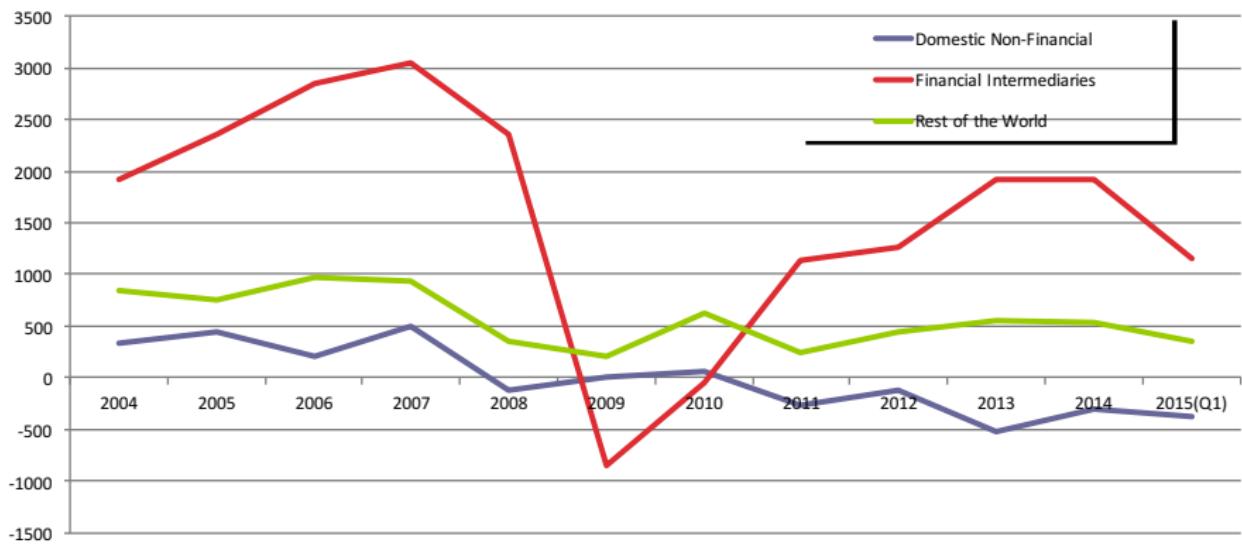
- Financial intermediaries channel funds from creditors to debtors.
- Types
 - Commercial Banks. (depository institutions)
 - Mutual funds.
 - Pension funds.
 - Insurance companies.
 - **Finance companies.**
 - Make loans to individuals or businesses, obtains its financing from banks and other money market sources, not deposits.
 - Asset backed security issuers.

FINANCIAL INTERMEDIATION

- Financial intermediaries channel funds from creditors to debtors.
- Types
 - Commercial Banks. (depository institutions)
 - Mutual funds.
 - Pension funds.
 - Insurance companies.
 - Finance companies.
 - **Asset backed security issuers.**
 - An asset-backed security is a security whose value and income payments are "backed" by a specified pool of underlying assets.
 - Special purpose vehicles are remote companies (with a sponsor) that create and sell these ABSs (like CDOs, CLOs, etc).

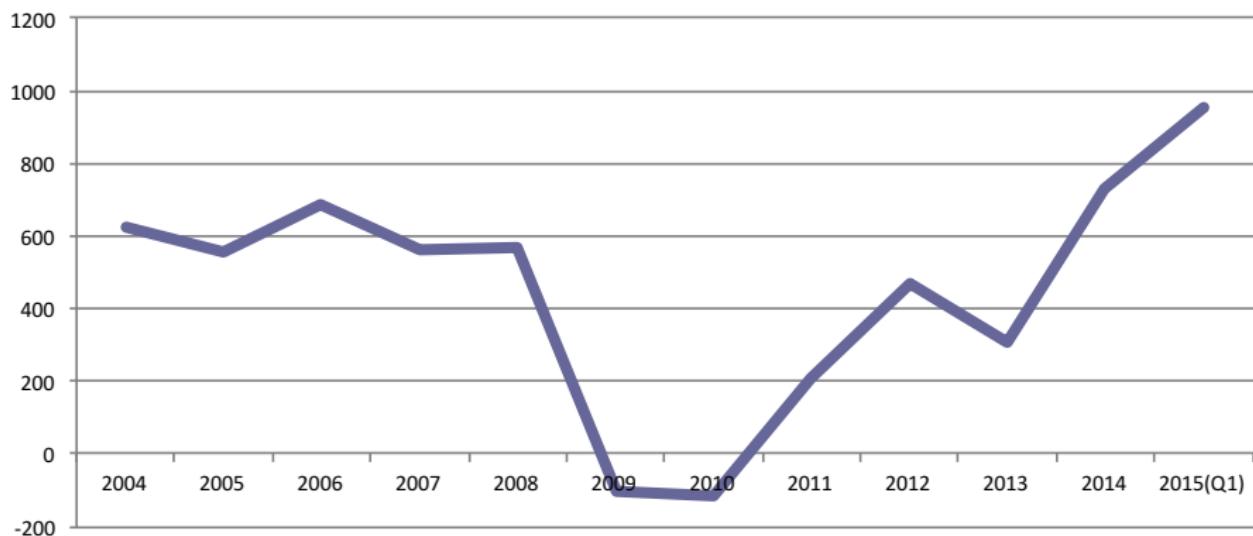
FINANCIAL INTERMEDIARIES ARE KEY

- Net Lending in Billions of Dollars (Fed Flow of Funds. Table F1)

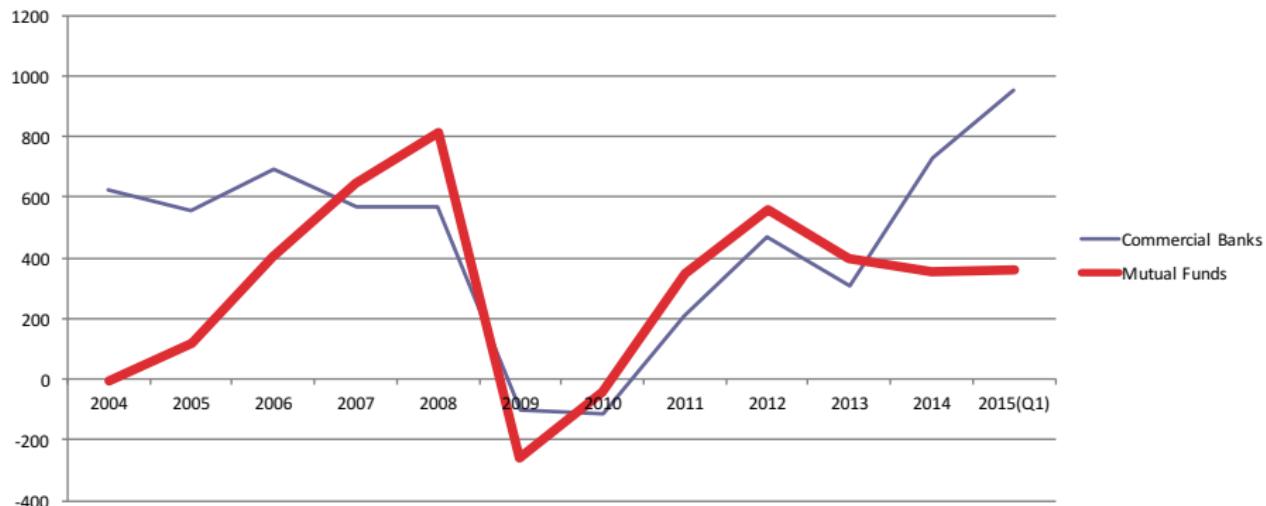


COMMERCIAL BANKS ARE THE MOST IMPORTANT

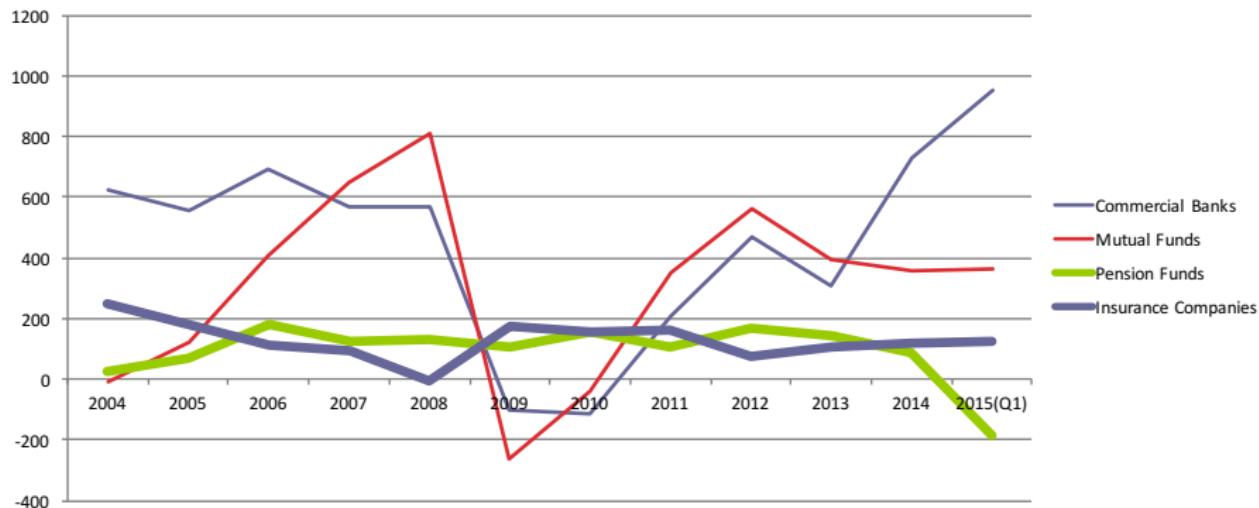
Commercial Banks



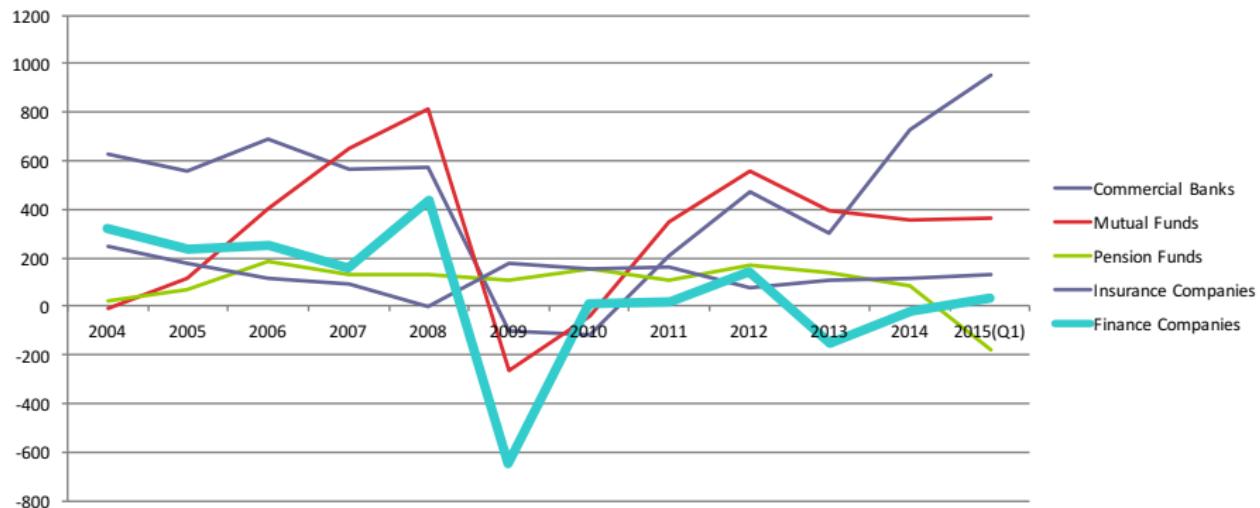
MUTUAL FUNDS HAVE INCREASED IN IMPORTANCE



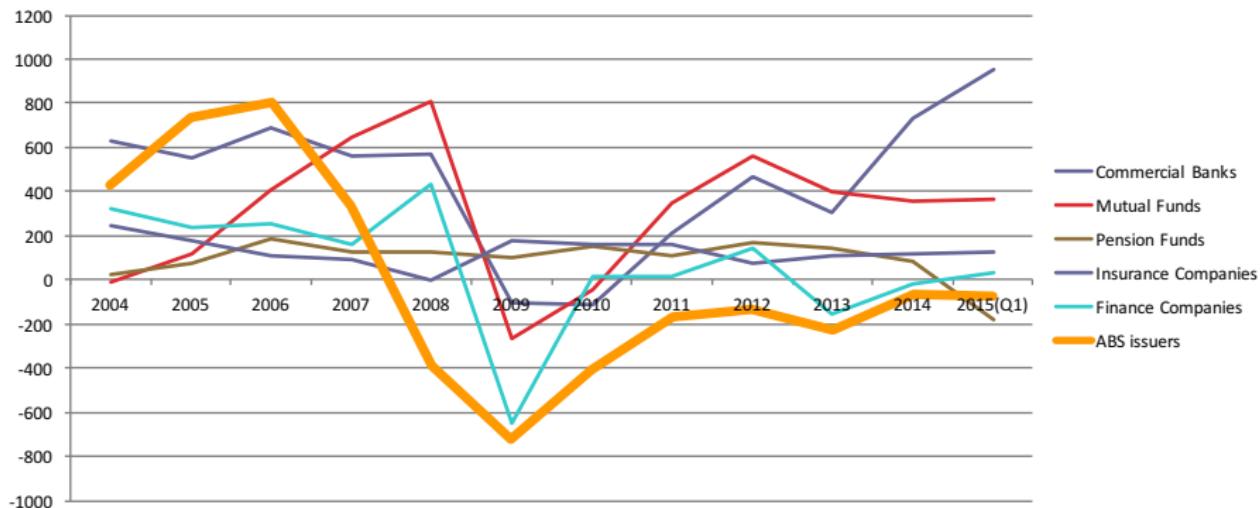
PENSION FUNDS AND INSURANCE COMPANIES ARE STABLE



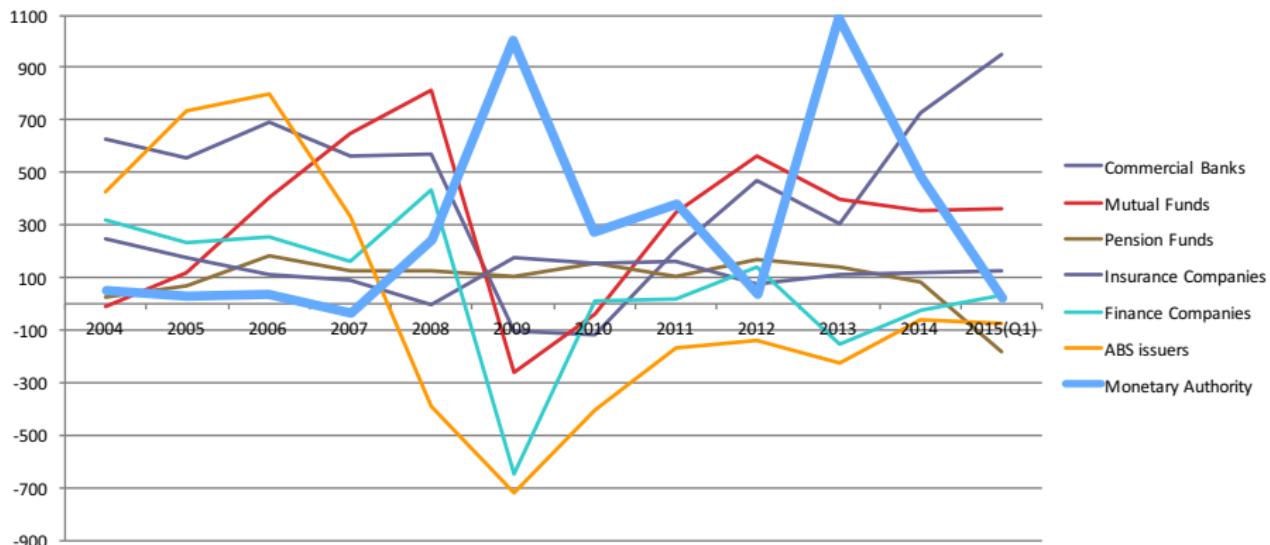
FINANCE COMPANIES ALSO COLLAPSED



ABS ISSUES COLLAPSED BEFORE THE REST



INTERVENTION OF THE FEDERAL RESERVE BANK



BANKS ARE THE LARGEST SOURCE OF FINANCE

- A lot of external finance comes from banks (25%).
- What are banks unique characteristics?
 - Banks borrow from a group of agents that save (households) and lend to another group of agents that invest (firms).
 - Banks' borrowing and lending groups are large. **Diversification**.
 - Banks borrow short-term and lend long-term. **Maturity mismatch**.

BANKS' BALANCE SHEET

- **Total Assets = Total Liabilities**
- Composition is from the Fed (July 2015)
- Assets.
 - Cash. (10%)
 - Securities. (20%)
 - Loans. (57%)
 - Other Assets. (13%)
- Liabilities.
 - Deposits. (75%)
 - Borrowings. (20%)
 - Equity (Bank capital or Net Worth). (5%)

MODIGLIANI-MILLER

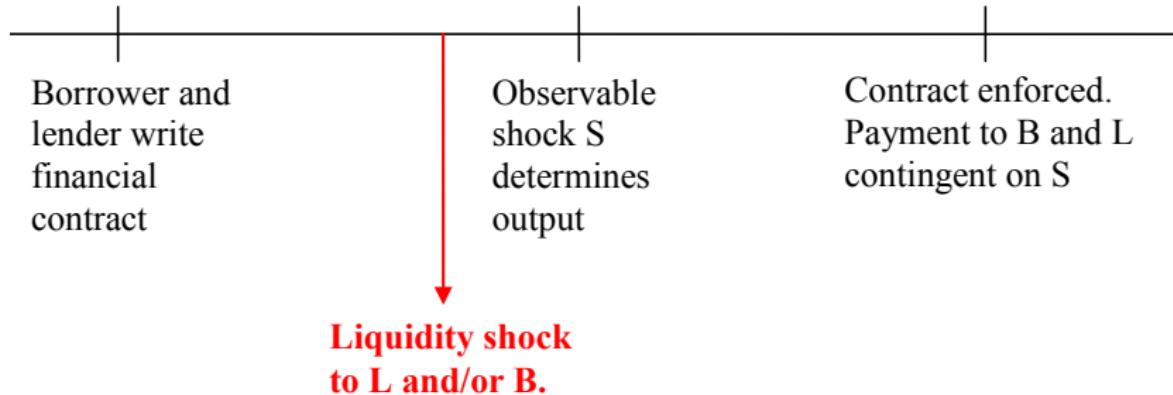


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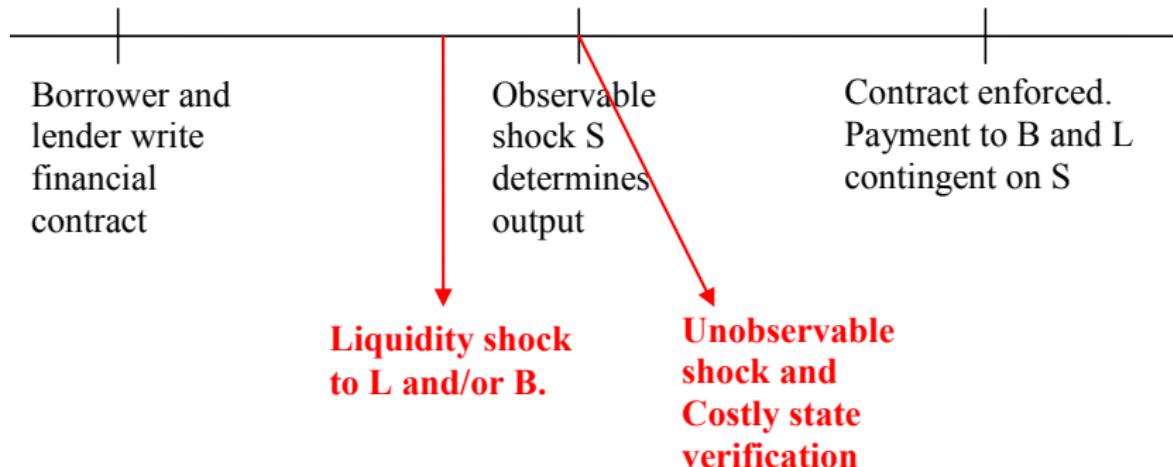
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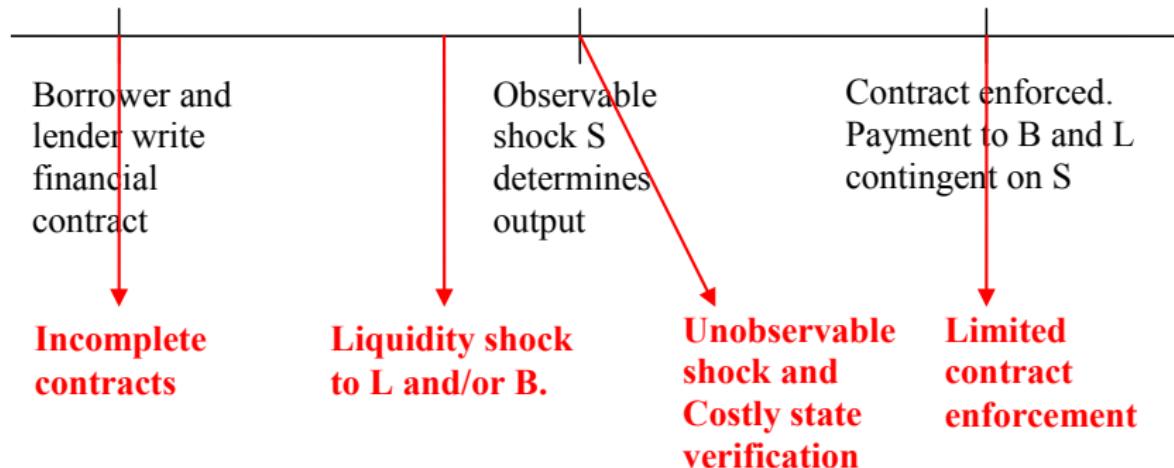
LIQUIDITY PROVISION



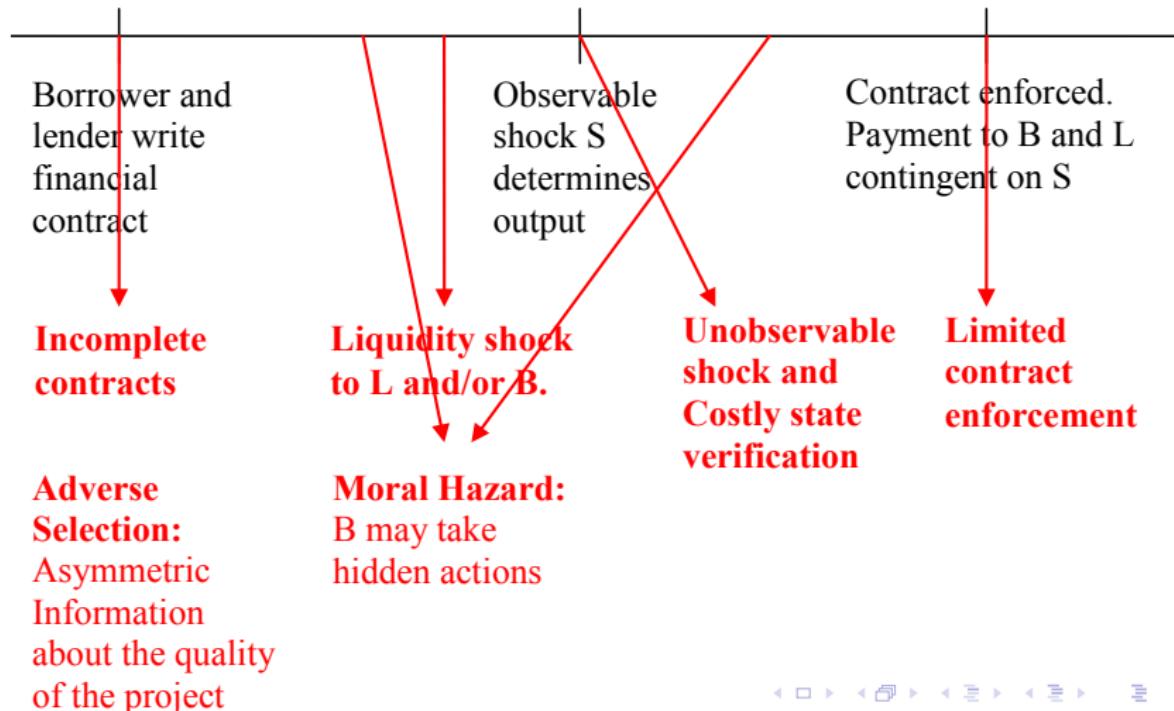
COSTLY STATE VERIFICATION



INCOMPLETE CONTRACTS AND COMMITMENT



INFORMATION ASYMMETRIES



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?

- Delegation of Information and Monitoring Processing.
 - Costly State Verification.
 - Adverse Selection.
 - Moral Hazard.
- Liquidity Provision.
- Commitment Mechanism.
 - Incomplete Contracts.
 - Limited Enforcement.

INFORMATION AT DIFFERENT STAGES

- **Screening** of projects to relax adverse selection (**before**).
- **Monitoring** behavior to relax moral hazard (**during**).
- **Auditing** borrowers who fail to repay (**after**).

QUESTIONS

- Let's start with the problem of auditing ex-post!
- Main papers: Townsend (79), Gale and Hellwig (85)
- Why standard debt contracts are the primary source of external finance? Is it for simplicity?
- They show standard debt contracts are optimal when there is ex-post hidden information and costly state verification.

ENVIRONMENT

- E and L are risk neutral. E has all bargaining power.
- E has zero wealth. L has deep pockets. Risk free rate 0.
- E has monopoly access to a project that costs I .
- The project generates a random profit $y \in [y_L, y_H]$, with cdf F and pdf f , smooth.
- The project has a positive NPV.

$$\int_{y_L}^{y_H} yf(y)dy > I$$

INFORMATION STRUCTURE

- Hidden Information: Cash flow privately observed by E.
- Costly State Verification: L observes the realized y only by paying an auditing cost C .

CONTRACTING PROBLEM

- E maximizes expected payoffs subject to L breaking even.
- Assumption: **Deterministic audits** $a(y) = \{0, 1\}$ (not WLOG)
- WLOG, confine attention to direct mechanism design.
- Contract: $\{P(y), a(y)\}$ enforced by a court - **no renegotiation**.
 - $P : Y \rightarrow \mathbb{R}$ (payment for each report \hat{y})
 - $a : Y \rightarrow \{0, 1\}$ (audit decision at each report \hat{y})

CONTRACTING PROBLEM

- E maximizes

$$\int_{y_L}^{y_H} [y - P(y)] f(y) dy$$

subject to

LL: (limited liability)

$$P(y) \leq y, \quad \text{for all } y$$

PC: (participation constraint)

$$\int_{y_L}^{y_H} [P(y) - a(y)C] f(y) dy = I$$

CONTRACTING PROBLEM

- also subject to

IC: When $a(y) = 0$, $P(y) = R$ (constant since no info about y).

- $P(y) = (1 - a(y))R + a(y)S(y) = R - a(y)[R - S(y)]$
- $a(y)S(y) \leq R$

where we defined R the payment when no auditing and $S(y)$ the payment when auditing.

CONTRACTING PROBLEM

- E decides $a(y)$ and $S(y)$, (pinning down R uniquely from PC).
- We can rewrite the problem as an optimal control problem, deciding the \hat{y} to stop auditing and the payments when auditing $S(y)$.

CONTRACTING PROBLEM AS OPTIMAL CONTROL

$$\begin{aligned}
 \mathcal{L} = & \int_{y_L}^{y_H} [y - R + a(y)(R - S(y))] f(y) dy \\
 & + \pi \left[\int_{y_L}^{y_H} [R - a(y)(R - S(y) + C)] f(y) dy - I \right] \\
 & + \int_{y_L}^{y_H} [\lambda(y)[y - R + a(y)(R - S(y))] + \mu(y)[R - a(y)S(y)]] dy
 \end{aligned}$$

Take derivatives

$$\frac{\partial \mathcal{L}}{\partial a(y)} = (f(y) + \lambda(y))[R - S(y)] - \pi f(y)[R - S(y) + C] - \mu(y)S(y)$$

SOLUTION FOR CASES $a(y) = 1$

- If $a(y) = 1$, $\frac{\partial \mathcal{L}}{\partial a(y)} > 0$, (recall $a(y) \in \{0, 1\}$)

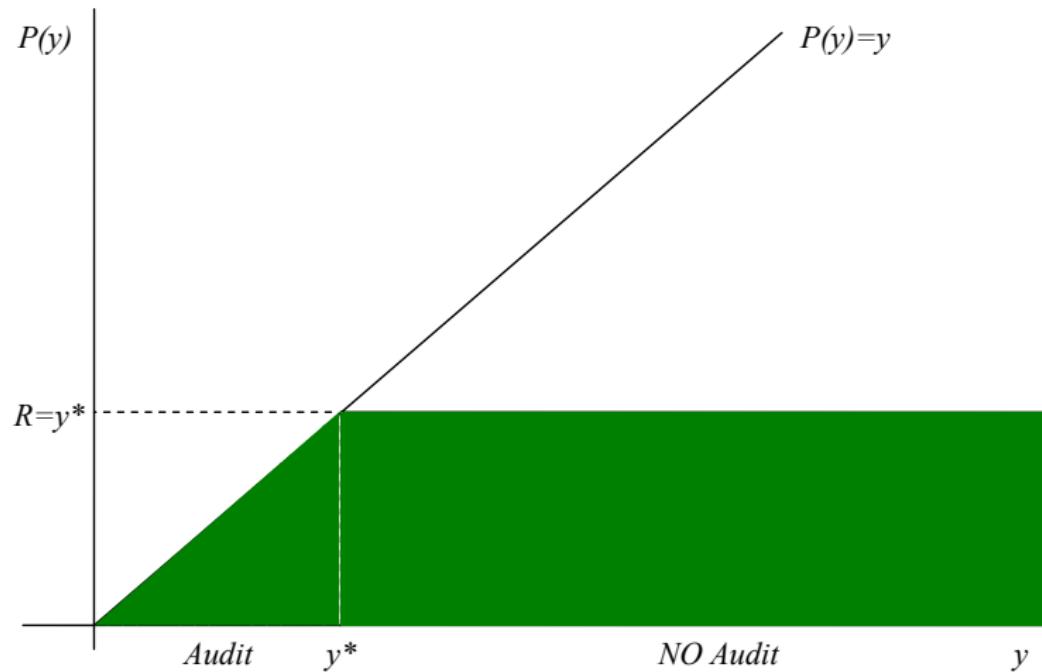
$$[R - S(y)][\lambda(y) + f(y)(1 - \pi)] > \pi f(y)C + \mu(y)S(y) \geq 0$$

- Hence $R - S(y) > 0$ and $\mu(y)^* = 0$.
- From $\frac{\partial \mathcal{L}}{\partial S(y)} \geq 0$, $\pi^* \geq 1$ (in fact, strict).
- From the expression above, not only $R - S(y) > 0$, but also $\lambda(y)^* > f(y)(\pi^* - 1) \geq 0$, then $S(y) = y$.

STANDARD DEBT IS OPTIMAL

- For all y s.t. $a^*(y) = 1, P^*(y) = y$
- For all y s.t. $a^*(y) = 0, P^*(y) = R$
- Hence, audit whenever $y < R$ and get $P(y) = y$. For $y \geq R$, no auditing and payment is $P(y) = R$.
- **Standard Debt Contract is Optimal.**

STANDARD DEBT CONTRACT



ISSUES

- Why restrict to $a \in \{0, 1\}$? It is more efficient to introduce public randomization. (Mookherjee and Png, QJE, 89).
- Not renegotiation proof.
- Krasa and Villamil (Ecta, 00) show the standard debt contract is still optimal when ex-post renegotiation is allowed.

DELEGATED MONITORING

- We have discussed why there is debt, but why there are banks?
- Main paper: Diamond (84)
- Without intermediaries there is a duplication of monitoring efforts.
- Monitors can also lie. Who monitor the monitor?
- Diversification is key despite risk neutrality for all the agents.

MODEL

- N risk neutral E 's with 0 initial wealth. They have a project that costs \$1 and generates $y \in [0, \infty)$, such that $E(y) > 1$.
- ∞ risk neutral L 's with initial wealth $\$ \frac{1}{m} < 1$. They have access to a risk-free investment opportunity with 0 return.
- Costly state verification: Only E can freely observe the realization of y . L should pay C to observe y .

OPTIMAL CONTRACT IS STANDARD DEBT CONTRACT

- Each L get $\rho(y) = \min\{y/m, R\}$
- E gets

$$Pr(y \geq R)E_y(y - R|y \geq R) - Pr(y < R)mC$$

- For mC big enough, there is no loan (underinvestment).

DELEGATION TO A BANK FOR A UNIQUE LOAN

- Standard debt contract is optimal between the bank and E.
- C is paid only once in case of monitoring.
- Standard debt contract is also optimal between L and the bank (since depositors cannot observe the payment from E to the bank).
- Hence, if the bank only intervenes for one loan we have the same costs as without intermediary, plus one C .

DELEGATION TO A BANK FOR MANY LOANS

- Return to the bank when $\rho(y, R) = \min\{y, R\}$

$$\bar{Y} = \sum_{n=1}^N [R\mathbb{I}_{(y_n \geq R)} + (y_n - C)\mathbb{I}_{(y_n < R)}]$$

- Return to depositors $\rho(\tilde{y}) = \min\{\tilde{y}, R_N\}$, where

$$\tilde{y} = \frac{\bar{Y}}{mN} \quad \text{and} \quad R_N = R/N$$

Then

$$\int \min\{\tilde{y}, R_N\} g_N(\tilde{y}) d\tilde{y} - CG_N(R_N)$$

where $G_N(R_N)$ is the probability of bank default.

DELEGATION TO A BANK FOR MANY LOANS

- Assumption: $E(\tilde{y}) > \frac{1}{m}$ (or $\bar{Y} > 1$).
- As $N \rightarrow \infty$, there is no need to monitor the bank as $G_N(R_N) \rightarrow 0$.
- In other words, depositors do not need to monitor an infinitely large intermediary, as it can repay with probability 1.

DELEGATION TO A BANK FOR MANY LOANS

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- In other words, depositors do not need to monitor an infinitely large intermediary, as it can repay with probability 1.
- **Diversification relaxes "who monitors the monitor?"**

EXTENSIONS

- 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.
- Yet another theory of optimal bank size..... trade off between bank capital and diversification (Winton (95) showed that more capital reduces the needs for diversification to maintain monitoring low).
- With risk aversion the result is naturally stronger.

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 new investment opportunities is costly, then lenders can duplicate efforts in generating such information.
- A smaller number of agents could produce the information, becoming informed, and then sell the information to the uninformed!
- Not so easy
 - 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 own wealth in assets about which it claims to have produced valuable positive 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

- Main paper: Boyd and Prescott (86)
- Financial intermediaries are coalitions of agents that evaluate projects, invest in those determined to be high-value, and share the returns from the portfolio of projects.
- Efficient mandates investment only in good projects...but....
- 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 coalitions portfolio returns, not on the returns of a single project, the coalition can offer higher returns to bad-type agents, so they will participate in the coalition.

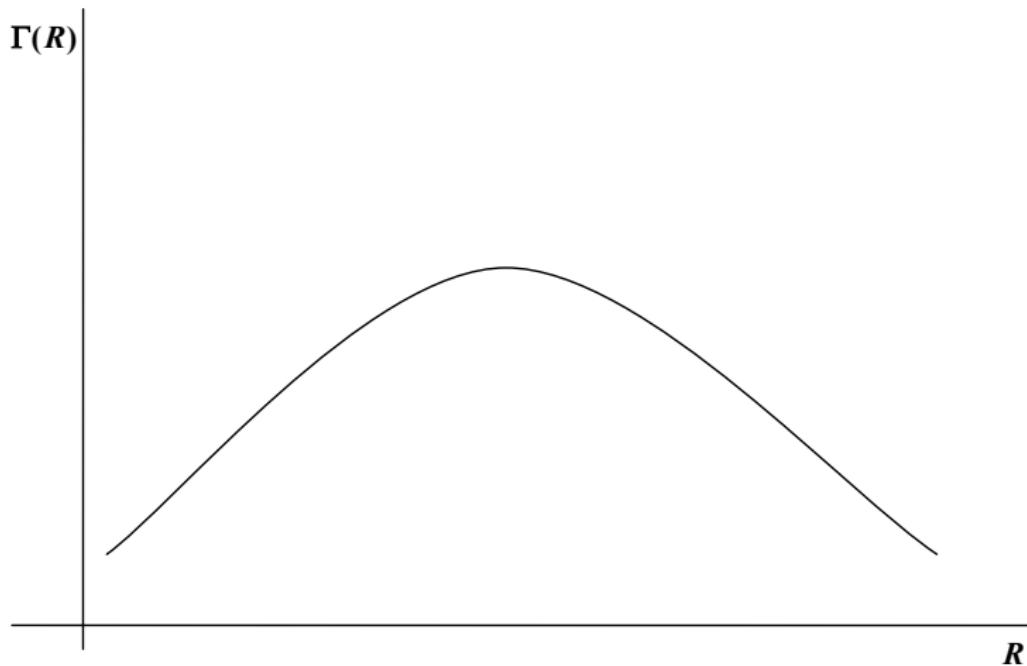
BANKS AS INFORMATION PRODUCERS

- 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.
 - Mutual funds' managers do not hold equity claims in the portfolio.

MAIN IDEAS

- Main paper: Stiglitz and Weiss (81)
- Credit rationing: Banks deny loans to borrowers who are observationally indistinguishable than those who receive loans.
- Credit rationing (and unemployment) may not be a disequilibrium.
- Higher interest rates
 - Attract borrowers less likely to pay (adverse selection).
 - Induce borrowers to take more risks (moral hazard).
- Hence, the expected return by the bank may increase less rapidly than the interest rate.

GRAPHICAL IDEA



MODEL

- Here I will focus on the main idea without moral hazard and without collateral.
- E need \$1 from L to start a project.
- Projects pay $y \sim F(., \theta)$
- Two types of projects $\theta = \{\theta_G, \theta_B\}$, only known by E.
- Standard Debt Contract:
 - Profits to L: $\gamma(y, R) = \min\{y, R\}$
 - Profits to E: $\pi(y, R) = \max\{0, y - R\}$

TWO CASES IN TERMS OF PROFITS DISTRIBUTIONS

- Define $\Gamma(R|\theta) = E_y [\gamma(y, R)|\theta]$
- Define $\Pi(R|\theta) = E_y [\pi(y, R)|\theta]$
- All projects need to generate a minimum (reservation value) $\bar{\Pi}$.
- Define $\bar{R}(\theta)$ such that $\Pi(\bar{R}|\theta) = \bar{\Pi}$
- We will consider two cases with opposite results (Bester, 85)

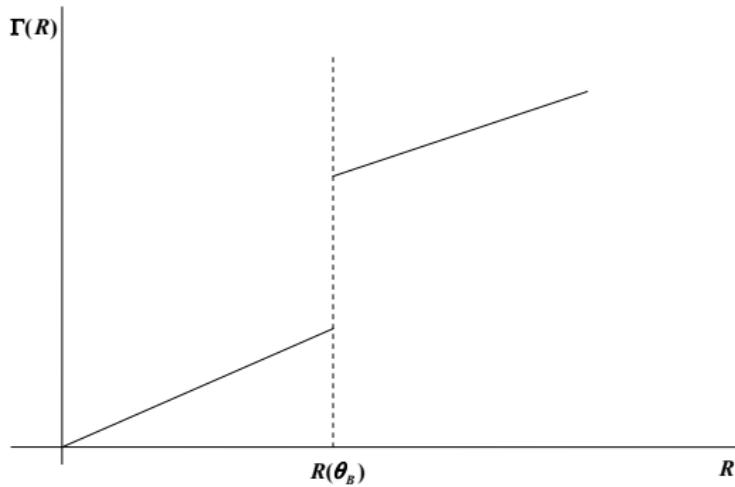
FIRST ORDER STOCHASTIC DOMINANCE (FOSD)

$$F(y|\theta_G) \leq F(y|\theta_B) \quad \text{for all } y$$

- For L: $\Gamma(R|\theta_G) \geq \Gamma(R|\theta_B)$
- For E: $\Pi(R|\theta_G) \geq \Pi(R|\theta_B)$
- Hence, $\overline{R}(\theta_G) \geq \overline{R}(\theta_B)$

FIRST ORDER STOCHASTIC DOMINANCE (FOSD)

$$\Gamma(R) = \Pr(\theta_G)\Gamma(R|\theta_G) + \Pr(\theta_B)\Gamma(R|\theta_B)$$



SECOND ORDER STOCHASTIC DOMINANCE (SOSD)

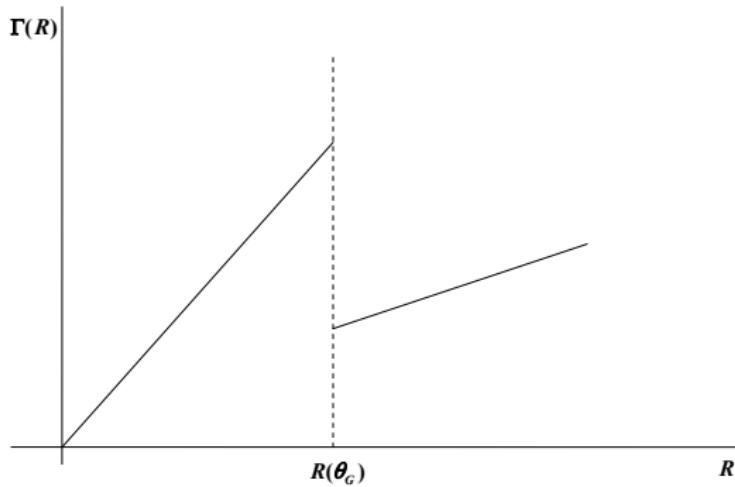
$$E(y|\theta_G) = E(y|\theta_B)$$

$$\int_l^a F(y|\theta_G)dy \leq \int_l^a F(y|\theta_B)dy \quad \text{for all } a$$

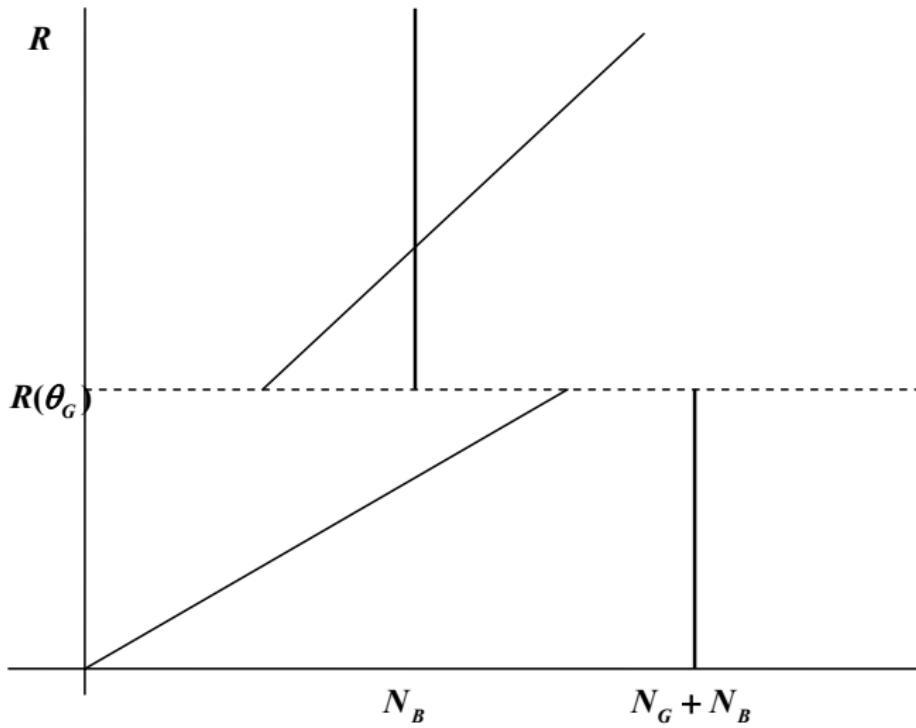
- For L: $\Gamma(R|\theta_G) \geq \Gamma(R|\theta_B)$
- Property: If X SOSD Y, then $E(h(X)) \leq E(h(Y))$ for all convex function h .
- For E: Since $\pi(y, R)$ is convex, $\Pi(R|\theta_G) \leq \Pi(R|\theta_B)$
- Hence, $\bar{R}(\theta_G) \leq \bar{R}(\theta_B)$

SECOND ORDER STOCHASTIC DOMINANCE (SOSD)

$$\Gamma(R) = \Pr(\theta_G)\Gamma(R|\theta_G) + \Pr(\theta_B)\Gamma(R|\theta_B)$$



CREDIT RATIONING



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.
- In Dang, Gorton, Holmstrom and Ordonez (17) we introduce a difference we will discuss later
 - Risky liquidity (stocks)
 - Safe liquidity (debt)

MAIN IDEAS

- Main Paper: Diamond and Dybvig (83).
- 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

T=0	T=1	T=2
-1	1	0
-1	0	$R > 1$

- The agent may want to consume at $T = 1$ or $T = 2$, not both.
- $\Pr(\text{type } T = 1) = t$ 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

- $U(c_1, c_2; \Theta) = t \ln(c_1) + (1-t)\rho \ln(c_2)$ 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:
 $c_1^1 = 1$, $c_2^1 = 0$ 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

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

$$c_2^{2*} = \frac{R}{(1-t) + \frac{t}{\rho}} < R$$

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

$$R > r_2 > r_1 > 1$$

SEQUENTIAL WITHDRAWING

- Assume a sequential withdrawal rule:

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

$$V_2(f, r_1) = \begin{cases} \frac{(1-r_1f)R}{(1-f)} & \text{if } f < \frac{1}{r_1} \\ 0 & \text{if } f \geq \frac{1}{r_1} \end{cases}$$

- 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. **worse than autarky.**

A/B	Withdraw in 1	Withdraw in 2
Withdraw in 1	$\frac{r_1}{2}, \frac{r_1}{2}$	$r_1, 0$
Withdraw in 2	$0, r_1$	r_2, r_2

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Withdraw in 2	$0, r_1$	r_2, r_2

SUSPENSION OF CONVERTIBILITY

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

$$V_1(f_j, r_1) = \begin{cases} r_1 & \text{if } f_j < \hat{f} \\ 0 & \text{if } f_j \geq \hat{f} \end{cases}$$

$$V_2(f, r_1) = \begin{cases} \frac{(1-r_1 f)R}{(1-f)} & \text{if } f < \hat{f} \\ \frac{(1-r_1 \hat{f})R}{(1-\hat{f})} & \text{if } f \geq \hat{f} \end{cases}$$

such that $\hat{f} \in [t, \frac{R-r_1}{r_1(R-1)}]$

- Optimal risk sharing is a unique NE in dominant strategies.

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 should tax at the end of $T = 1$, after observing f . If f withdraws at $T = 1$, set taxes such that,

$$\hat{V}_1(f) = \begin{cases} c_1^{1*}(f) & \text{if } f \leq \bar{t} \\ 1 & \text{if } f > \bar{t} \end{cases}$$

- Implemented by the following proportional taxes

$$\tau(f) = \begin{cases} 1 - \frac{c_1^{1*}(f)}{r_1} & \text{if } f \leq \bar{t} \\ 1 - \frac{1}{r_1} & \text{if } f > \bar{t} \end{cases}$$

DEPOSIT INSURANCE

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

$$\hat{V}_2(f) = \begin{cases} c_2^{2*}(f) = \frac{(1-c_1^{1*}(f)f)R}{(1-f)} > c_1^{1*}(f) & \text{if } f \leq \bar{t} \\ \frac{(1-f)R}{(1-f)} = R > 1 & \text{if } f > \bar{t} \end{cases}$$

- Then unique dominant strategy equilibrium is $f = t$ (the realization of t), which delivers the unconstrained social optimum.

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- **Many other tax schedules can make it!!!**
- Only a government can make the credible promise of providing insurance. In equilibrium the promise need not be fulfilled.

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- Many other tax schedules can make it!!!
- Only a government can make the credible promise of providing insurance. In equilibrium the promise need not be fulfilled.
- **CHICKEN MODEL!!!**

SOME 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!**

SOME 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 support for the "fundamental" view of bank runs.
- They also found evidence that deposit insurance and lender of last resort are in fact effective in avoiding bank runs.

SOME REMARKS - WHAT FUELS BANK RUNS?

NBER Cycle Peak-Trough	Panic Date	Percentage Δ (Currency/Deposit)	Percentage Δ Pig Iron
Oct. 1873-Mar. 1879	Sep. 1873	14.53	-51.0
Mar. 1882-May 1885	Jun. 1884	8.80	-14.0
Mar. 1887-Apr. 1888	No panic	3.00	-9.0
Jul. 1890-May 1891	Nov. 1890	9.00	-34.0
Jan. 1893-Jun. 1894	May 1893	16.00	-29.0
Dec. 1895-Jun. 1897	Oct. 1896	14.30	-4.0
Jun. 1899-Dec. 1900	No panic	2.78	-6.7
Sep. 1902-Aug. 1904	No panic	-4.13	-8.7
May 1907-Jun. 1908	Oct. 1907	11.45	-46.5
Jan. 1910-Jan. 1912	No panic	-2.64	-21.7

SOME 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.

SOME 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.

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

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

- Main Paper: Holmstrom and Tirole (98).
- Demand for liquidity comes from borrowers (firms), not lenders (depositors).
- Moral hazard restricts firms' ability to borrow under unexpected investment needs.
- In contrast to DD(83) there is no private information but there are private actions.

WHY MORAL HAZARD LEADS TO UNDERINVESTMENT

- Before going to H&T, let me show the effects of Moral Hazard.
 - Entrepreneur (E) and lender (L) are risk neutral.
 - E has no wealth, L is deep pocket.
 - E are scarce (they have all the bargaining power).
 - E has a project that costs I and pays RI with probability p and 0 otherwise.
 - $p \in \{p_L, p_H\}$ depending on E's unobservable efforts.
 - Assume $p_H RI \geq I \geq (p_L R + B)I$. **E should work!!!**
 - Contract specifies: Loan and Investment (I) and repayment (P).

MORAL HAZARD LEADS TO UNDERINVESTMENT

- E maximizes $E(\pi) = p_H(RI - P)$ subject to,
IC: $p_H(RI - P) \geq p_L(RI - P) + BI$
PC: $p_H P \geq I$
- IC binds: Given I, for the manager to work, **the payment to L cannot be higher than**

$$P \leq \left[R - \frac{B}{p_H - p_L} \right] I$$

MORAL HAZARD LEADS TO UNDERINVESTMENT

- Since the maximum pledgable return that guarantees no cheating is $p_H \left[R - \frac{B}{p_H - p_L} \right] I$, lenders lend only if the following condition is fulfilled

$$p_H \left[R - \frac{B}{p_H - p_L} \right] \geq 1$$

- A project can be financed if

$$R > \hat{R} = \frac{1}{p_H} + \frac{p_H}{p_H - p_L} B$$

- A project should be financed (positive NPV) if

$$R > R^* = \frac{1}{p_H}$$

MORAL HAZARD LEADS TO UNDERINVESTMENT

- There is a range of projects with returns $R \in [R^*, \hat{R})$ that would be optimal to finance, but are not. This is because moral hazard creates a wedge that translates into underinvestment.
- This creates firms' demand for liquidity (risk-sharing among firms to guarantee investments to continue).
- Four ways a firm can satisfy its liquidity needs.
 - Holding claims on other firms.
 - Holding government-issued claims.
 - Using a credit line.

A FINANCIAL MARKET FOR INDIVIDUAL CLAIMS

- Can a firm cover potential shortfalls of liquidity issuing claims and buying claims issued by other firms?
- Not in general.
 - Lucky firms hold shares they do not need.
 - Unlucky firms cannot continue because the average share of the market portfolio offers insufficient liquidity.
- When the market fails, the second best can be implemented by an intermediary that pool liquidity needs (a mutual fund)

PREVIEW

- **NO aggregate uncertainty:** Financial intermediaries achieve efficiency and the private sector is enough to finance own needs.
- **Aggregate uncertainty:** The government should issue securities to achieve efficiency since the private sector is not enough (in certain circumstances) to finance own needs. Inter-temporal insurance by state contingent bonds.

Trick: Taxation Power to create storage opportunities!

PREVIEW

- **NO aggregate uncertainty:** Financial intermediaries achieve efficiency and the private sector is enough to finance own needs.
- **Aggregate uncertainty:** The government should issue securities to achieve efficiency since the private sector is not enough (in certain circumstances) to finance own needs. Inter-temporal insurance by state contingent bonds.
Trick: Taxation Power to create storage opportunities!
- **CHICKEN MODEL!!!**

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 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 (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.

Rolnick and Weber, (84) showed this was not the case.

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

- Sanches and Jesus FV (2016): What is the effect of competition and free entry in the production of fiat money?
(Bitcoin, Ethereum, Ripple, Litecoin, etc).

LIQUIDITY, EXCHANGE AND INFORMATION

- Main paper: Dang, Gorton, Holmstrom and Ordonez (17)
- 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.

LIQUIDITY, EXCHANGE AND INFORMATION

“Every banker knows that if he has to prove he is worthy of credit, in fact his credit is gone.”

Walter Bagehot, *Lombard Street: A Description of the Money Market*, 1873.

- We are interested in understanding why banks are purposefully opaque
- ...and what the implications are for the types of investments that banks undertake.

BANKS AND MARKETS

- Securities markets are **information revealing** institutions, creating price-contingent claims – *risky liquidity*.
- Banks are **information concealing** institutions, creating non-contingent claims – *safe liquidity*.
- Depending on the risk of the underlying asset, banks can only issue limited amounts of safe liquidity to avoid information acquisition.
- **Conclusion:** The trade-off between less safe liquidity and more risky liquidity determines which firms fund projects through banks and which ones through capital markets.

PREFERENCES AND ENDOWMENTS

- One storable good. Three periods. Three risk-neutral agents.

$$U_F = \sum_{t=0}^2 C_{Ft} \quad \omega_F = (0, 0, 0)$$

$$U_E = \sum_{t=0}^2 C_{Et} + \alpha \min\{C_{E1}, k\} \quad \omega_E = (\textcolor{red}{e}, 0, 0)$$

$$U_L = \sum_{t=1}^2 C_{Lt} + \alpha \min\{C_{L2}, k\} \quad \omega_L = (0, \textcolor{red}{e}, 0)$$

TECHNOLOGY

- The firm has two investment opportunities in period 0.
 - One is always a lemon (does not generate any payoff)
 - The other (“the project”) is not a lemon
 - In **period 0** it costs w
 - In **period 2** it pays $\begin{cases} x > w & \text{prob. } \lambda \\ 0 & \text{prob. } (1 - \lambda) \end{cases}$ (**state *g***) (**state *b***)
 - The project is ex-ante efficient, $\lambda x > w$.
- A file contains information that identifies the project and its state.
- Only L can interpret the state of the project from the file.

ASSUMPTIONS

- Early consumers can cover their liquidity and investment needs,
but not both.

$e > k$ and $e > w$

but

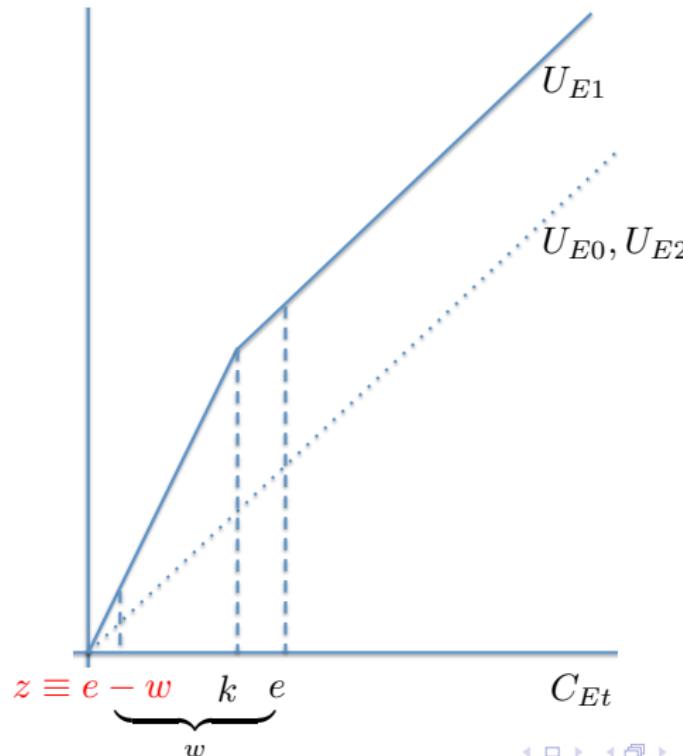
$e < k + w$

Useful notation: $k > z \equiv e - w$

- Both consumers can cover all liquidity and investment needs.

$$2e > 2k + w$$

ASSUMPTIONS



BENCHMARKS

Autarky

- Consumers store endowments. Firm cannot invest.

First Best (unconstrained)

- Period 0:

- Use w from E to finance the project.

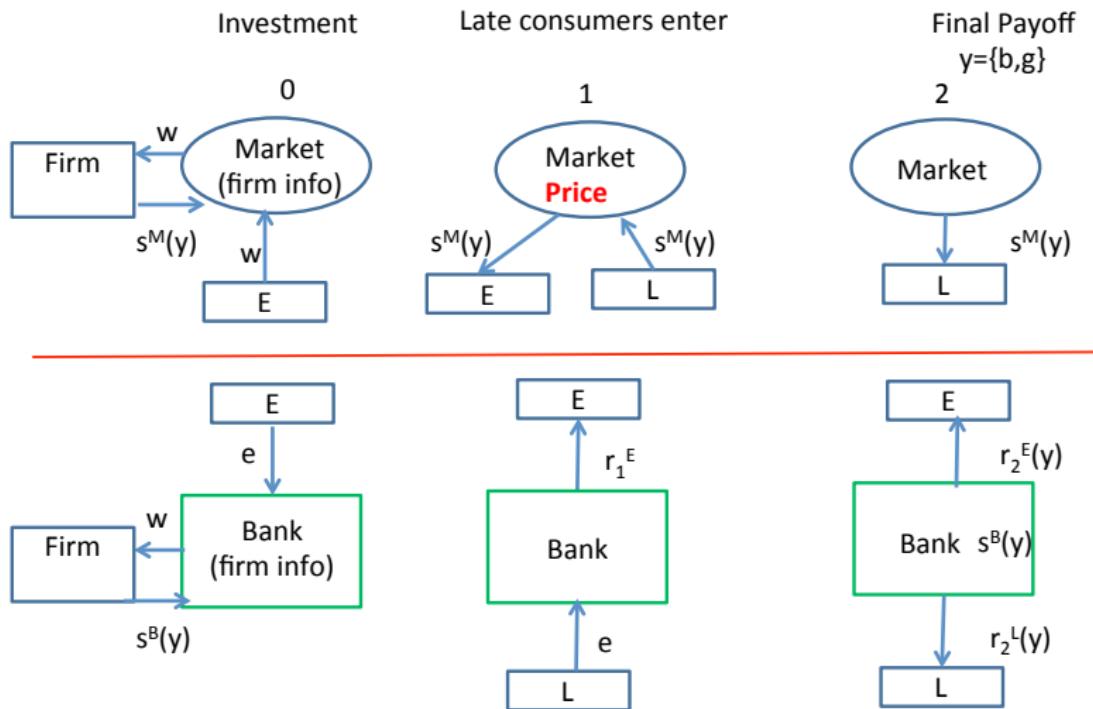
Feasible since $e > w$

- Period 1:

- Transfer $k - z$ from L to E .

Feasible since $e > k - z$

MARKETS VS. BANKS



CAPITAL MARKETS

- **Period 0:**

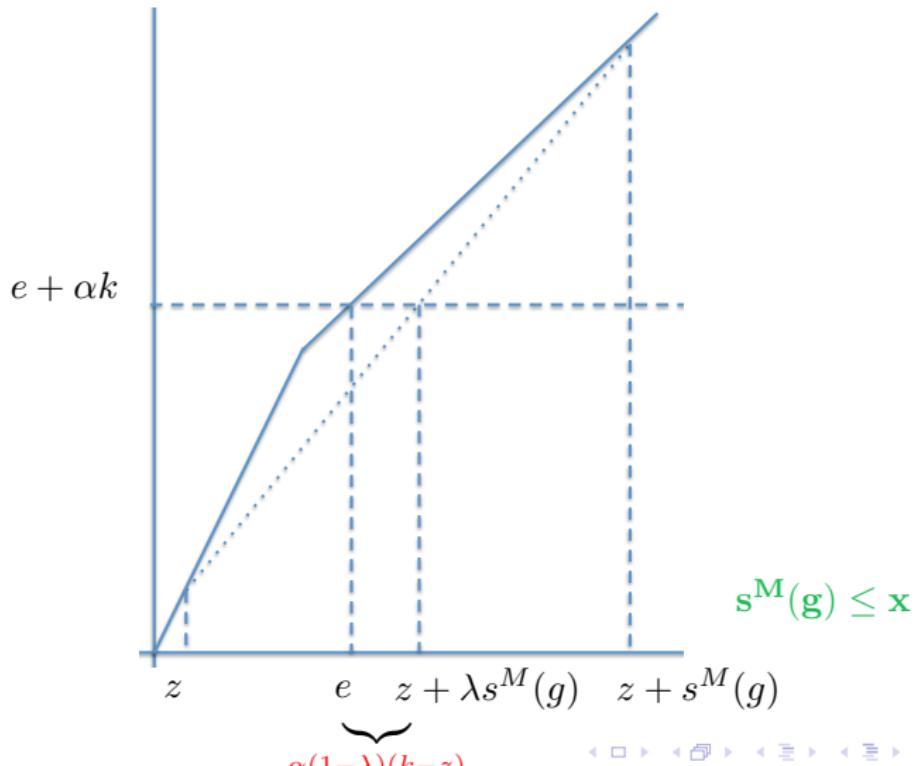
- F shows the file to a “market agent,” who verifies it.
- A “market agent” makes the file public and issues a security that pays $s^M(b)$ or $s^M(g)$ in $t = 2$ to raise w from E .

- **Period 1:** Many L s enter.

- E offers its shares for sale.
- L s bid for these shares (having seen the file), resulting in a fair market price (either $s^M(b)$ or $s^M(g)$).

- **Period 2:** Project’s payoff realized. Security holders paid.

RISKY CONSUMPTION FOR E



COMPARISON OF EXPECTED UTILITIES

If $s^M(g) \leq x$, risky consumption for E .

First Best

$$E(U_F) = \lambda x - w$$

$$E(U_E) = e + \alpha k$$

$$E(U_L) = e + \alpha k$$

Capital Markets

$$E(U_F) = \lambda x - \overbrace{\lambda s^M(g)}^{w+\alpha(1-\lambda)(k-z)}$$

$$E(U_E) = e + \alpha k$$

$$E(U_L) = e + \alpha k$$

Assumption: F gets all the surplus

Capital markets implement $\alpha(1 - \lambda)(k - z)$ less welfare.

If risk premium so high that $s^M(g) > x$, then no investment.

BANKS

- **Period 0:**

F shows the file to B , who verifies it.

F issues a security that pays $s^B(b)$ or $s^B(g)$ in $t = 2$ to B .

E deposits e in B , who promises r_1^E in $t = 1$ and $r_2^E(b)$ and $r_2^E(g)$ in $t = 2$

- B commits to keep the file secret.

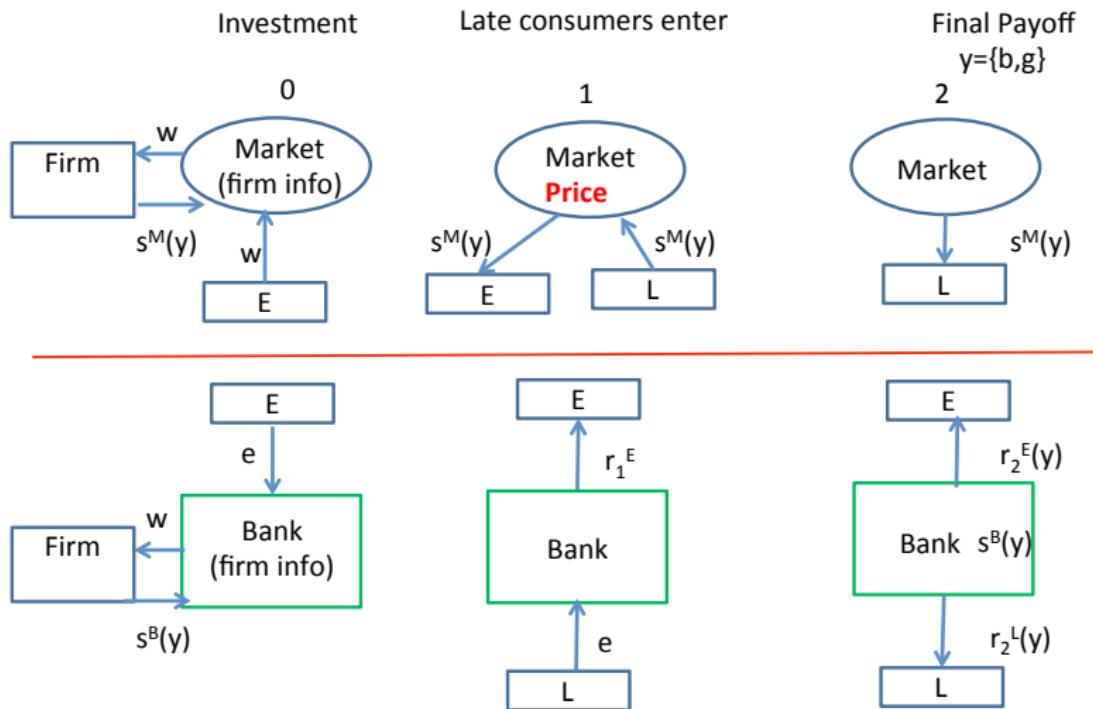
- **Period 1:** A single L enters.

L deposits e in B , who promises $r_2^L(b)$ and $r_2^L(g)$ in $t = 2$. E withdraws r_1^E .

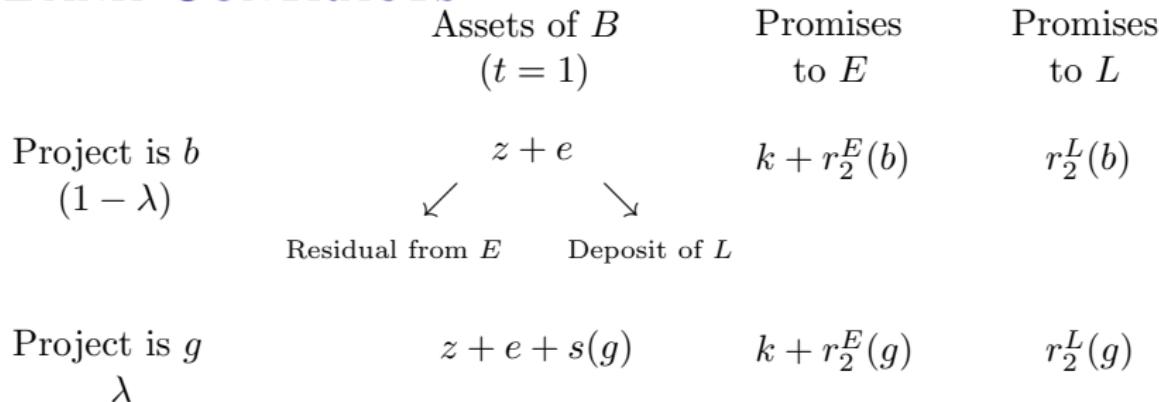
- **Period 2:** Projects payoff observed. Securities' holders paid.

Can B implement a contract such that $r_1^E = k$?

MARKETS VS. BANKS



BANK CONTRACTS



BANK CONTRACTS

	Assets of B $(t = 1)$	Promises to E	Promises to L
Project is b $(1 - \lambda)$	$z + e$	$k + 0$	\Rightarrow $e - (k - z)$ $>k$
Project is g λ	$z + e + s(g)$	$k + r_2^E(g)$	$r_2^L(g)$

BANK CONTRACTS

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Project is b $(1 - \lambda)$	$z + e$	$k + 0$	$e - (k - z)$ \Downarrow $>k$
Project is g λ	$z + e + s(g)$	$k + \frac{e-k}{\lambda}$	$r_2^L(g)$

E breaks even

$$(1 + \alpha)k + \lambda r_2^E(g) = e + \alpha k$$

BANK CONTRACTS

	Assets of B ($t = 1$)	Promises to E	Promises to L
Project is b $(1 - \lambda)$	$z + e$	$k + 0$	$e - (k - z)$ $\underbrace{}_{>k}$
Project is g λ	$z + e + s(g)$	$k + \frac{e-k}{\lambda}$	$e + \frac{(1-\lambda)}{\lambda}(k-z)$ $\underbrace{\phantom{e + \frac{(1-\lambda)}{\lambda}(k-z)}}_{>k}$

L breaks even

$$(1 + \alpha)k + \lambda(r_2^L(g) - k) + (1 - \lambda)(e - (k - z) - k) = e + \alpha k$$

BANK CONTRACTS

	Assets of B ($t = 1$)	Promises to E	Promises to L
Project is b $(1 - \lambda)$	$z + e$	$k + 0$	$e - \underbrace{(k - z)}_{>k}$
Project is g λ	$z + e + s(g)$	$k + \frac{e-k}{\lambda}$	$e + \underbrace{\frac{(1-\lambda)}{\lambda}(k-z)}_{>k}$

Are these promises feasible?

$$k + r_2^E(g) + r_2^L(g) = e + z + s(g) \Rightarrow E(s) = w$$

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Are these promises feasible?

$$k + r_2^E(g) + r_2^L(g) = e + z + s(g) \Rightarrow E(s) = w$$

By keeping information secret, B transfers the risk from E to L .

F keeps the insurance premium, B breaks even.

COMPARISON OF EXPECTED UTILITIES

First Best

$$E(U_F) = \lambda x - w$$

$$E(U_E) = e + \alpha k$$

$$E(U_L) = e + \alpha k$$

Banks

=

$$E(U_F) = \lambda x - \overbrace{\lambda s^B(g)}^w$$

$$E(U_E) = e + \alpha k$$

$$E(U_L) = e + \alpha k$$

Banks implement the First Best allocation.

L'S INCENTIVES TO FIND OUT SECRETS

- So far we have assumed a secret is impossible to be discovered.
- There may be incentives for *L* to acquire information privately.
- Assume the cost of information is γ in units of consumption.
- *L* has incentives to acquire information if and only if

$$(1 - \lambda)(e - r_2^L(b)) > \gamma$$

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- Assume the cost of information is γ in units of consumption.
- *L* has incentives to acquire information if and only if

$$(1 - \lambda)(k - z) > \gamma$$

Banks are feasible when: γ , λ and z are high or k is low.

DISTORTIONARY CONTRACTS

- How can banks prevent information and still improve welfare?
- Banks can increase $r_2^L(b)$ to reduce the benefits of information.
- Two options:
 - **Distort Investment:** B maintains in cash **more than z** at $t = 0$.
 - Less investment.
 - **Distort Money Provision:** B promises **less than k** to E at $t = 1$.
 - Less safe liquidity.

BANKS DISTORT INVESTMENT

	Assets of B ($t = 1$)	Promises to E	Promises to L
Project is b	η $(1 - \lambda)$ $+ (1 - \eta)$	$z + e$ $\underbrace{z + w}_{e} + e$	k \Rightarrow $e - (k - z)$ $+ (1 - \eta)w$

Save more than z

Information can be avoided if and only if $r_2^L(b) \geq e - \frac{\gamma}{1-\lambda}$, or

$$(1 - \eta) = \frac{1}{w} \underbrace{\left[k - z - \frac{\gamma}{(1 - \lambda)} \right]}_{\text{Net benefit of info}} \geq 0$$

Cost of distortion: $(1 - \eta)(\lambda x - w) = \frac{\lambda x - w}{w} \left[k - z - \frac{\gamma}{(1 - \lambda)} \right]$

BANKS DISTORT MONEY PROVISION

	Assets of B $(t = 1)$	Promises to E	Promises to L
Project X is b $(1 - \lambda)$	$e + z$	$r_1^E + 0$	\leftarrow $e - \frac{\gamma}{1 - \lambda}$ Pay less than k $> e - (k - z)$
Project X is g λ	$e + z + s^B(g)$	$r_1^E + r_2^E(g)$	$r_2^L(g)$

BANKS DISTORT MONEY PROVISION

Assets of B
($t = 1$)

Project X is b
 $(1 - \lambda)$

$$e + z$$

Promises
to E

$$\underbrace{z + \frac{\gamma}{1-\lambda}}_{< k} \leftarrow$$

Promises
to L

$$\underbrace{e - \frac{\gamma}{1-\lambda}}_{> e - (k - z)}$$

Project X is g
 λ

$$e + z + s^B(g)$$

$$z + \frac{\gamma}{1-\lambda} + \frac{e-k}{\lambda}$$

$$+ \frac{(1+\alpha)}{\lambda} \left[k - z - \frac{\gamma}{1-\lambda} \right]$$

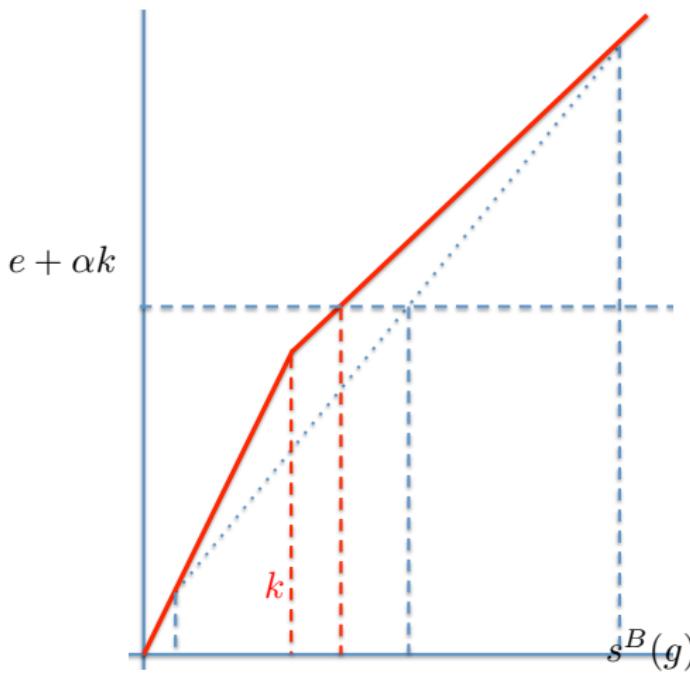
$$e + \frac{\gamma}{\lambda}$$

Are these promises feasible?

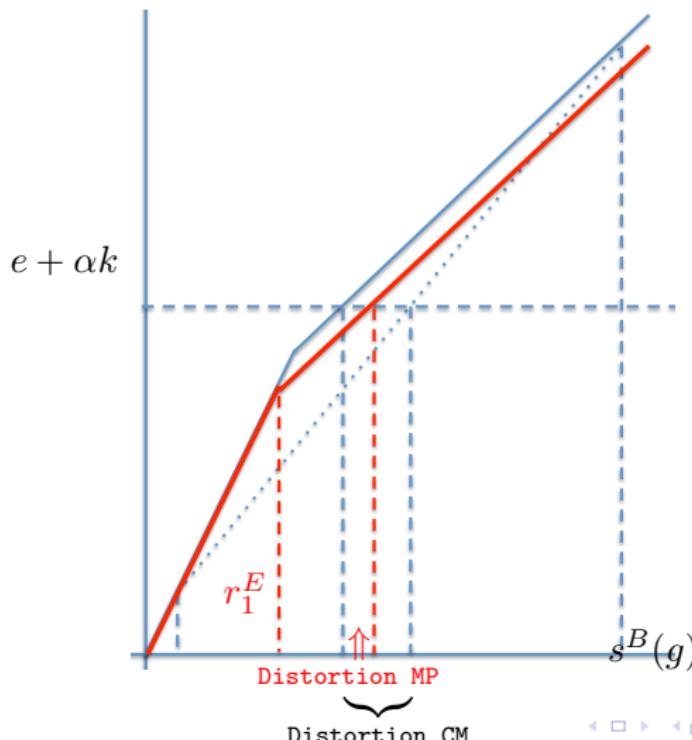
$$r_1^E + r_2^E(g) + r_2^L(g) \leq e + z + s^B(g) \Rightarrow s^B(g) = \frac{w}{\lambda} + \frac{\alpha}{\lambda} \underbrace{\left[k - z - \frac{\gamma}{(1-\lambda)} \right]}_{\text{Net benefit of info}}$$

Cost of banks' distortion: $\lambda s^B(g) - w = \alpha \left[k - z - \frac{\gamma}{(1-\lambda)} \right]$

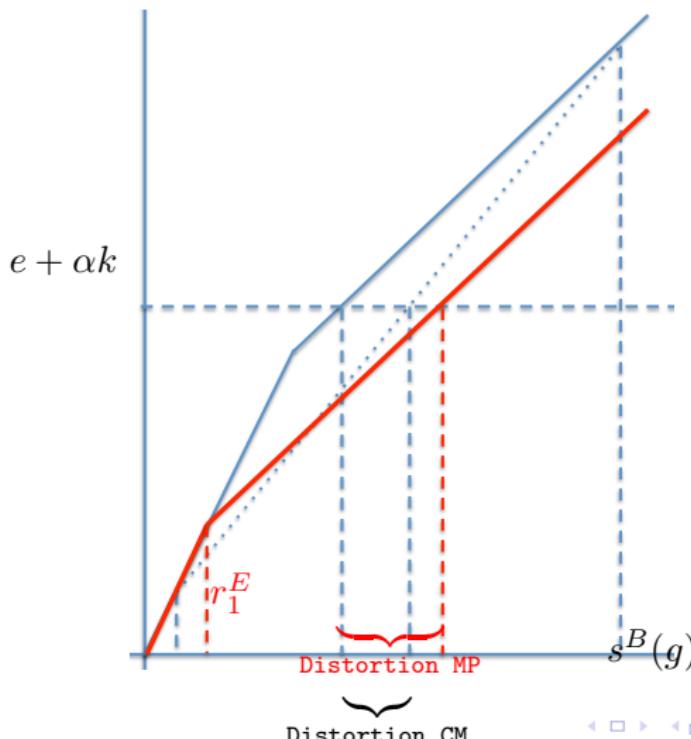
No DISTORTION OF MONEY PROVISION



DISTORTION DOMINATES CAPITAL MARKETS



CAPITAL MARKETS DOMINATE DISTORTION



WHICH DISTORTION IS BETTER?

- Less investment is better than less safe liquidity if and only if

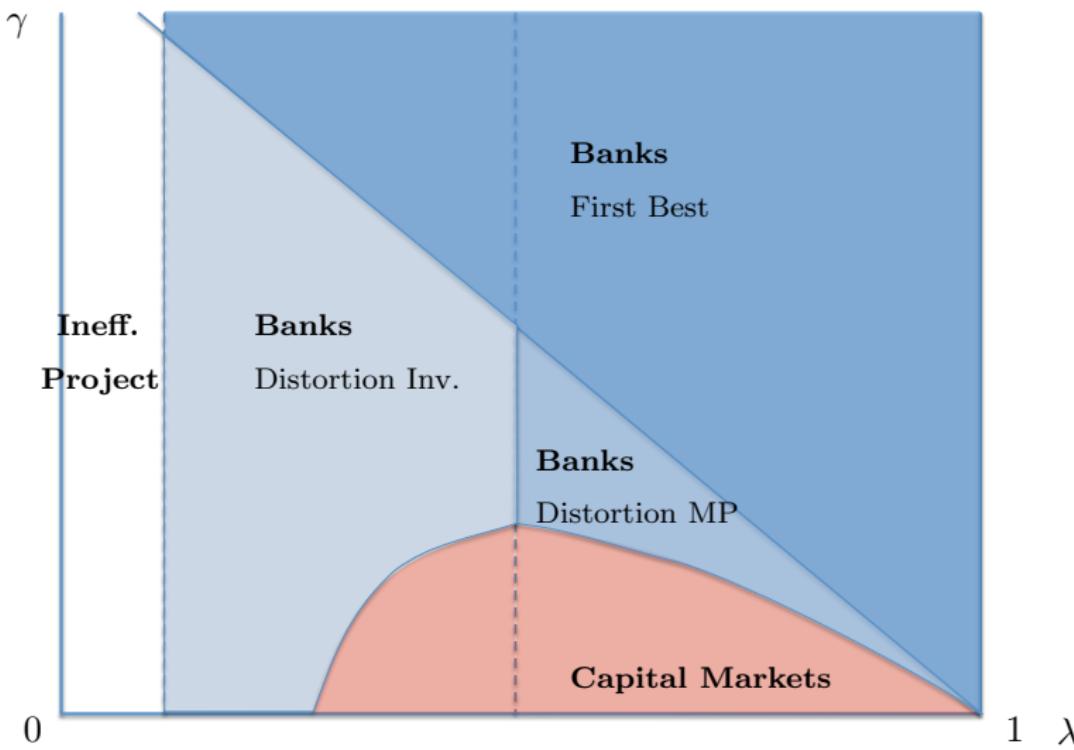
$$\frac{\lambda x - w}{w} \left[k - z - \frac{\gamma}{1 - \lambda} \right] \leq \alpha \left[k - z - \frac{\gamma}{1 - \lambda} \right]$$

WHICH DISTORTION IS BETTER?

- Less investment is better than less safe liquidity if and only if

$$\frac{\underbrace{\lambda x - w}_{\text{NPV of project}}}{\underbrace{w}_{\text{Liquidity value}}} \leq \underbrace{\alpha}_{\text{Liquidity value}}$$

BANKS OR CAPITAL MARKETS?



FINAL REMARKS

- Banks are opaque, which indeed induce their regulation.
- Opacity is critical for private money and cheaper loans.
- Be careful with regulation that induces transparency.
- The optimal reaction to less bank equity is more opacity.

BANKS AS COMMITMENT MECHANISMS

- The existence of banks is explained by their fragility
- Main assumption: Banks are somewhat opaque institutions....Now from DGHO (17) we understand why!

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

- **Main paper: Diamond and Rajan (01)**
- If more informed lenders threaten to withdraw from the project, depositors will run to the bank.
- Fragile capital structure allows banks to create liquidity, explaining why bank loans are illiquid.
- 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.

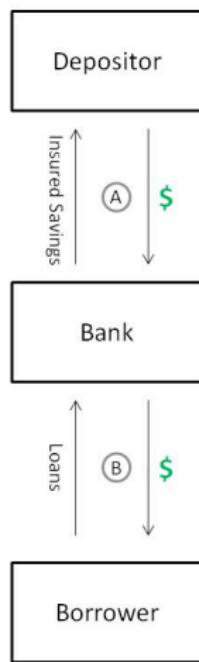
EMPIRICAL EVIDENCE

- 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))

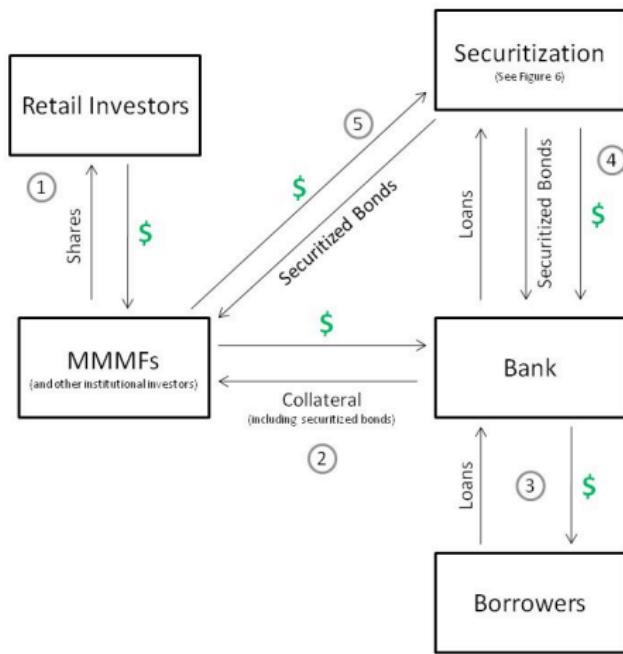
SHADOW BANKING

- **Main paper: Gorton and Metrick (2011).**
- After the Great Depression, the US has no panic during 75 years.
- Deposit insurance was key for this stability,
- The crisis in 2007 was not generated in the traditional banking system, but in a set of lightly regulated institutions.
- Broadly defined, shadow banking includes:
 - Familiar institutions: Investment banks, money-market, mutual funds, and mortgage brokers
 - Some old contracts: Sale and repurchase agreements (repo)
 - Some esoteric instruments: Asset-backed securities (ABS), collateralized-debt obligations (CDOs), and asset-backed commercial paper (ABCP).

TRADITIONAL BANKING OPERATIONS



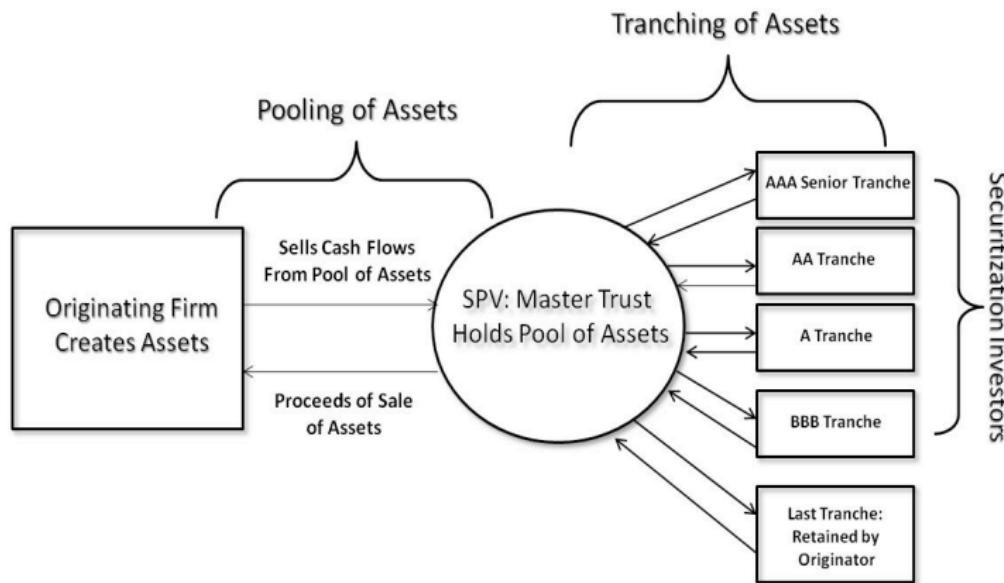
SHADOW BANKING OPERATIONS



SHADOW BANKING

- Step 1: Money market mutual funds (**MMMFs**)
- Step 2: Similar to step A with **repo** agreements.
- Step 3: Same as step B.
- Step 4: **Securitization** used as collateral.
- Step 5: **Securitization** bought by investors.

SECURITIZATION



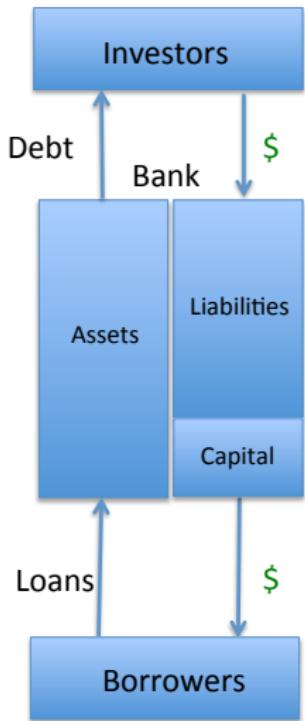
SECURITIZATION

- 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 rewards from those assets.
- Investors' rights to receive cash flows are divided into "tranches".
- **Not subject to bankruptcy** (since assets are off-balance sheet)

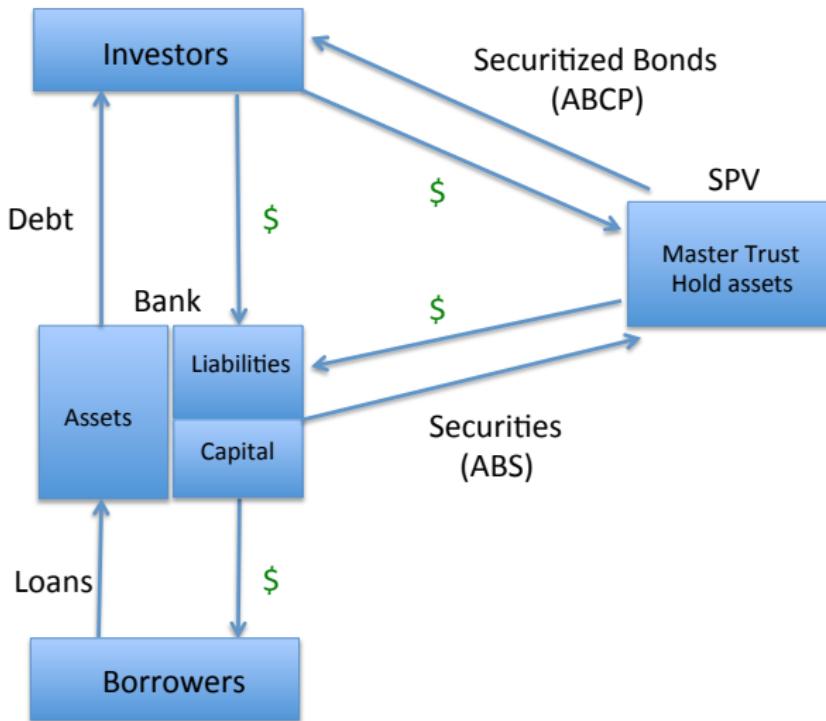
SECURITIZATION

- Dramatic increase in loan sales. A challenge, both theoretically and empirically, to arguments concerning bank existence.
- Borrowers could have issued a security directly!!! **Why banks?**
 - Banks hide information (DGHO, 17)
 - A bank keeps a portion of the cash flows (worst tranche) to maintain incentives, as it would have had the entire loan been kept on its balance sheet. (Gorton and Pennacchi (95), DGHO (17)).
 - Market participants rely on banks' incentives to maintain their reputations for monitoring. (Ordonez, 17)

TRADITIONAL BANKING



SHADOW BANKING



LEADING NARRATIVE

- Shadow banking arises to avoid regulation.
- No regulation leads to excessive risk-taking.
- Excessive risk-taking leads to a collapse.
- Many open questions
 - Why did investors participate? Why at low spreads?
 - No clear evidence of excessive risk-taking!
 - “*17 bps of realized losses on \$1.9 trillion of AAA subprime issued between 2004 and 2007 (as of Feb 2011).*” Park (2012).
 - As of December 2012, the Treasury received over \$405 billion in total cash back on TARP investments. The total disbursed was \$418 billion.

NARRATIVE IN ORDONEZ (17)

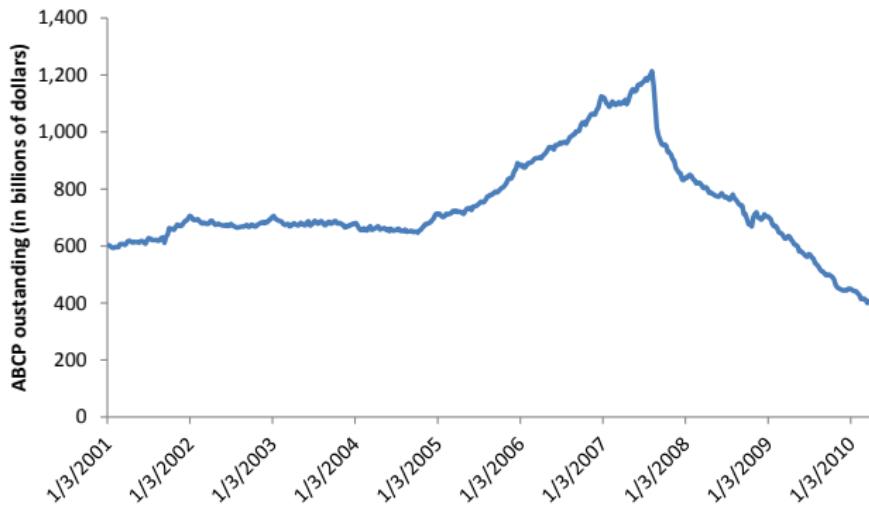
- Shadow banking arises to avoid regulation...**taking advantage of market discipline provided by reputation concerns.**
 - More output (if self-regulation is more efficient).
 - More volatility (if reputation concerns collapse).
- Shadow banking collapsed not because the realization of past risk-taking but because the fear of future risk-taking!

NARRATIVE IN ORDONEZ (17)

- Shadow banking arises to avoid regulation...**taking advantage of market discipline provided by reputation concerns.**
 - More output (if self-regulation is more efficient).
 - More volatility (if reputation concerns collapse).
- Shadow banking collapsed not because the realization of past risk-taking but because the fear of future risk-taking!
- Different message for regulation!
 - *Recently proposed regulation:* Tighten capital requirements
 - **Less volatility** but also **less output**.
 - *My proposed regulation:* Cross-subsidization across reputations.
 - **Less volatility** and also **more output**.

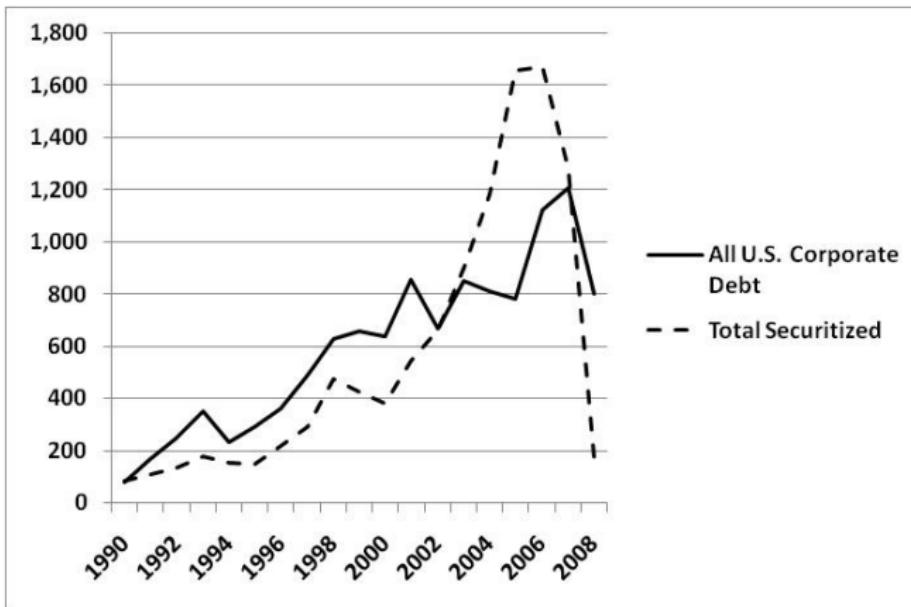
GROWTH AND COLLAPSE

- Securitization (off-balance sheet financing) was key on the growth and sudden collapse of “shadow banking”.



Source: Acharya, Schnabl and Suarez (2013)

GROWTH AND COLLAPSE



WHAT WAS SECURITIZED?

- At the end of 2005 there were \$2 trillion outstanding (10 % of total outstanding bond market debt, 35 % of mortgage-related debt and 40 % of corporate debt in the United States).
- 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 %).

WHY A SHADOW BANKING?

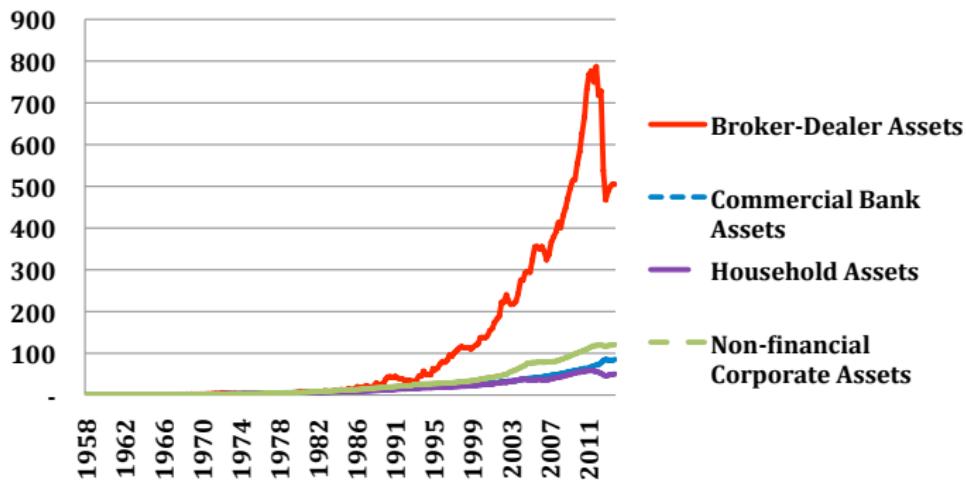
- Changes in the financial system in the last decades led to a decline of traditional banking
 - More competition from commercial paper (asset side).
 - Pressures from MMMFs (liability side).
- Why these changes?
 - Saving glut (Caballero).
 - Corporate savings.
 - Retirement needs (Ordonez and Piguillem).

INSTITUTIONAL INVESTORS (MMMFs)

- MMMFs grew from \$76.36 billion in 1980 to \$1.85 trillion by 2000 and reached a peak of \$3.8 trillion in 2008.
- Highly regulated, but does not have to pay for the implicit insurance that governments provide to the financial system.

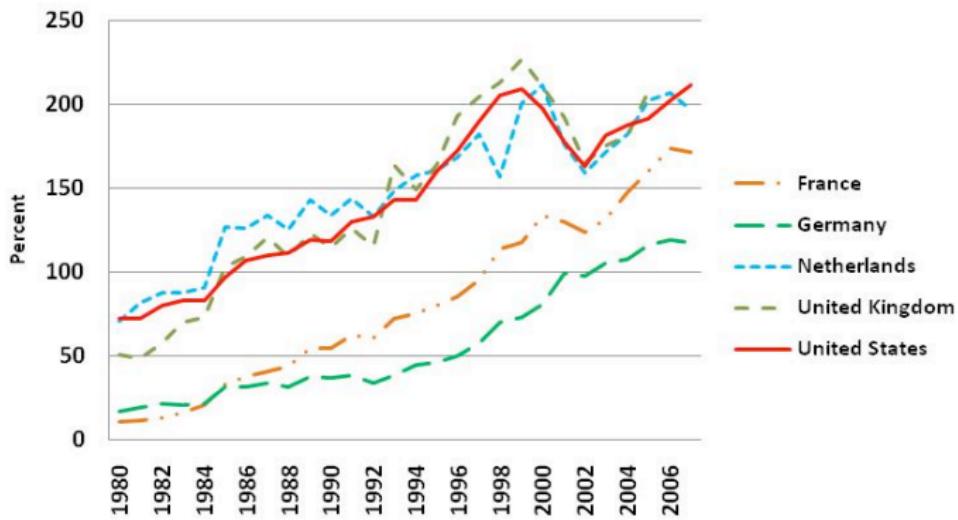
GROWTH OF INSTITUTIONAL INVESTORS

Figure 4: Growth of Assets in Four Financial Sectors (March 1954=1)



GROWTH OF INSTITUTIONAL INVESTORS

Figure 7: Financial Assets of Institutional Investors as a Percent of GDP



REPO

- Growth of money under management by institutional investors.
Want safe, liquid investments that pay interests.
- A repo contract is not a debtor in the bankruptcy proceedings.
- Repo collateral can be rehypothecated. Hence, money velocity associated with the collateral.
- The repo became the blood of the financial system.

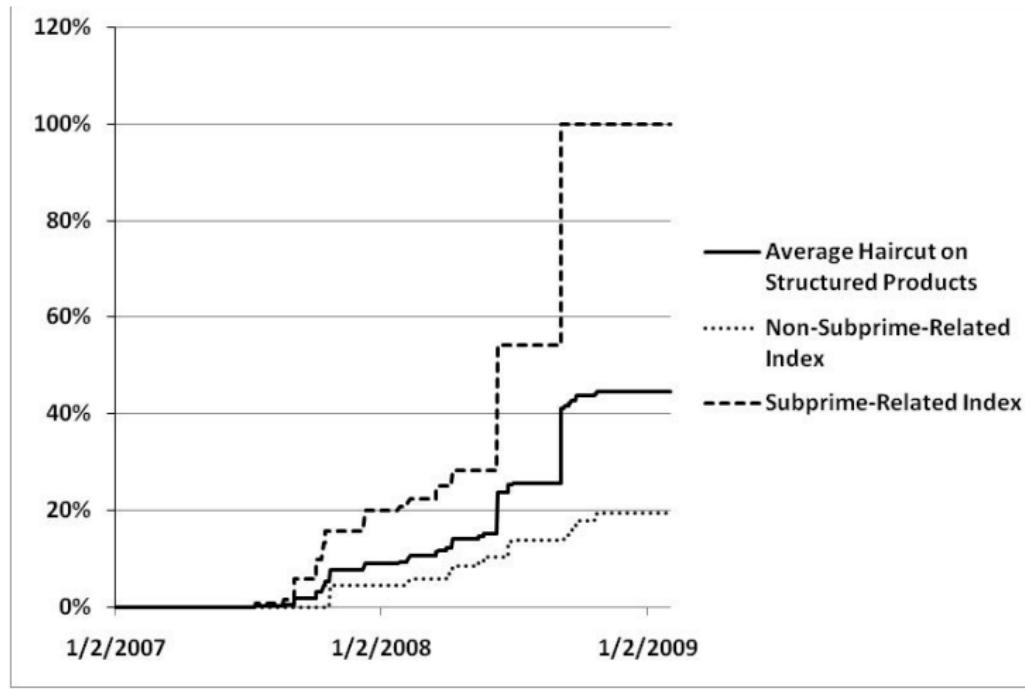
REPO

- By using a repo a market participant can sell a security that he does not own by borrowing it from another party in the repo market. Short positions in securities markets.
- The Federal Reserve counted repo transactions as money in a monetary aggregate called M3. In 2006 discontinued.
- The repo market had an average daily trading volume of about \$2.3 trillion in 2008, compared to the NYSE of around \$80 billion in 2008.

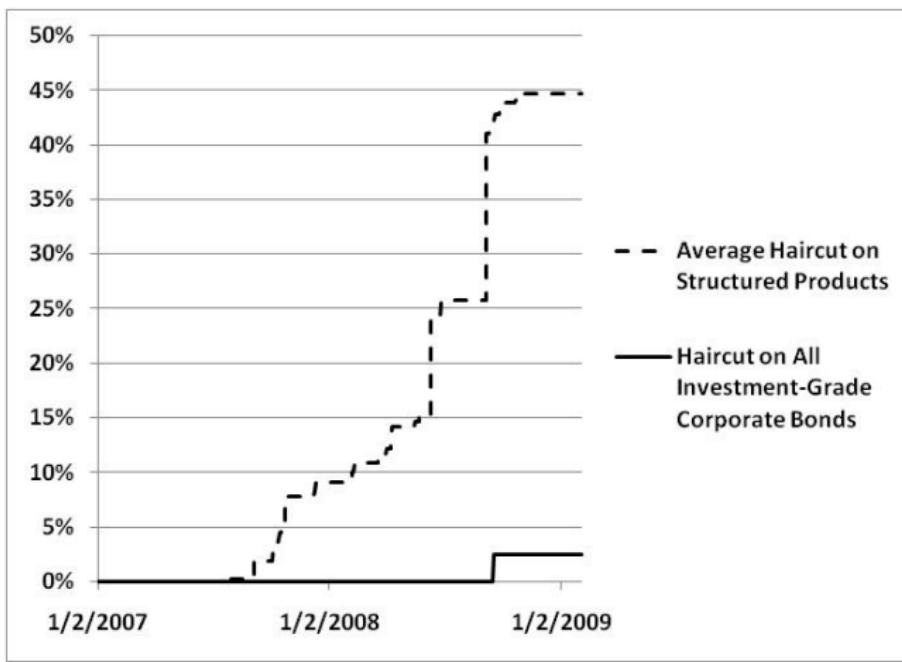
COLLAPSE OF SHADOW BANKING

- Epicenter of the crisis. Run on repo.
- An increase in a repo haircut is like a withdrawal from banks.
- Run on special purpose vehicles (SPVs).
- Run on MMMFs for a flight to quality (MMMFs started investing in treasury bonds).
- **The crisis was just another "Bank Run".**

HAIRCUTS



HAIRCUTS



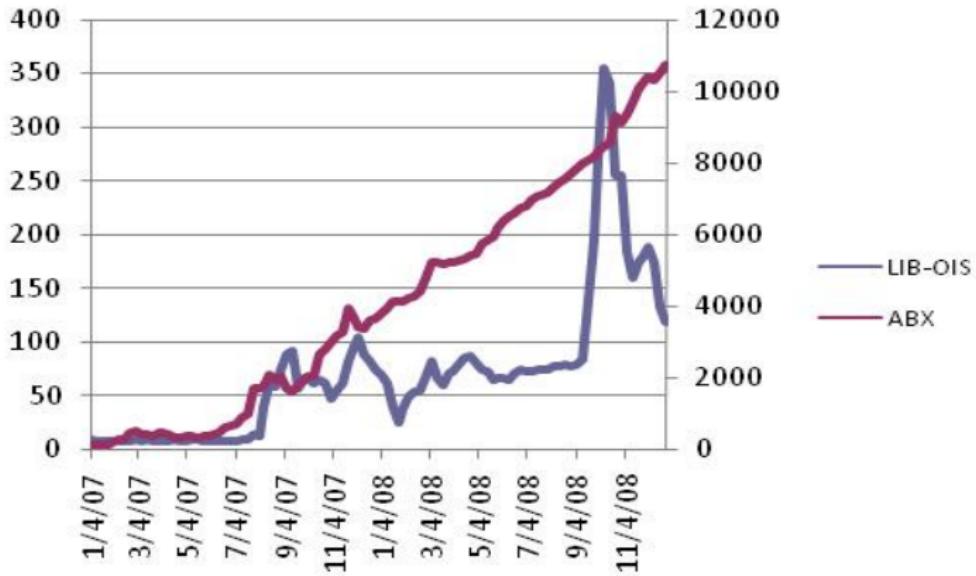
A BACK OF THE ENVELOPE CALCULATION

- Repo Market: \$10 trillion dollars.
- If average haircut grows by 40%, then \$4 trillion has to be raised.
- How? Through assets sales, which reduce prices further.
- This generates a downward spiral such that assets cannot be used much as collateral.
- **This is a large "Bank Run"**

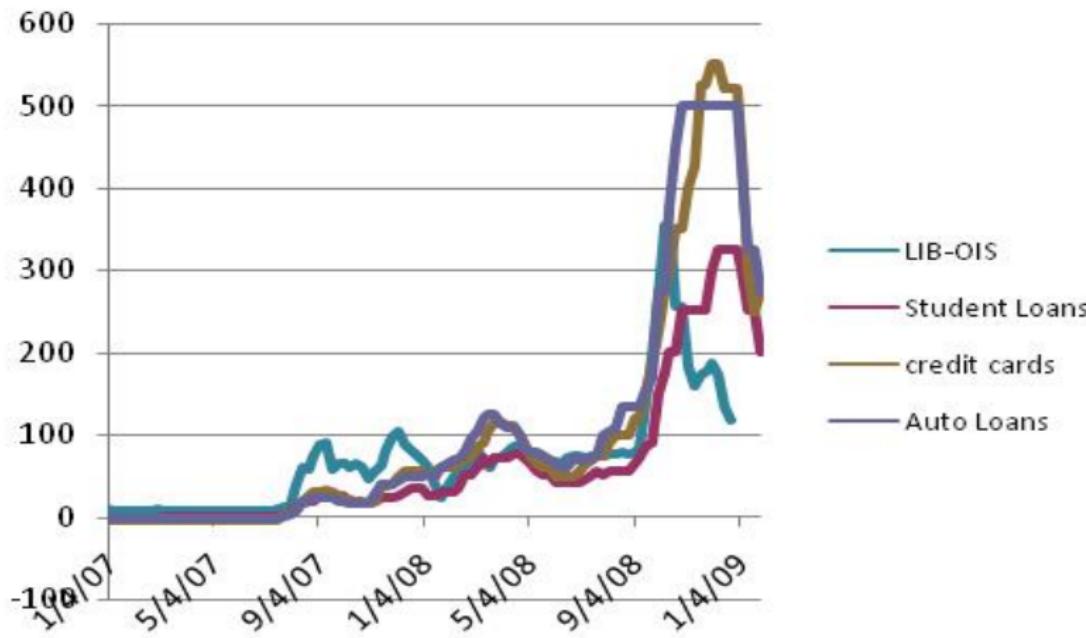
MESSAGE

- What we observed is not different than what we knew.
- Increases in repo haircuts are withdrawals from securitized banks, a standard bank run.
- Banks are forced to fire sell assets, which drive down asset prices.
- Assets become information sensitive. Liquidity dries up and the system becomes insolvent.

THE PROBLEM WAS NOT SUBPRIME



THE PROBLEM WAS IN THE SYSTEM



NEED FOR REGULATION

- The problem of demand deposit panics was only solved in 1934 with the passage of federal deposit insurance.
- MMMFs compete with depository banks, provide an implicit promise to investors that they will never lose money (made explicit by the government in the crisis), and do not have to pay for this promise.
- Repo and securitization should be regulated because they are new forms of banking, but with the same vulnerability as other forms of private bank-created money

DODD-FRANKS

- Many provisions relevant to shadow banking:
 - Hedge funds must now register with the SEC.
 - OTC derivatives trading will be moved to exchanges and clearing-houses.
 - All systemically important institutions will be regulated by the Federal Reserve.
 - Retail finance lenders subject to regulation from the Consumer Financial Protection Bureau.
- Almost silent on regulation for MMMFs, securitization and repo!!!