Bank Information Sharing and Liquidity Risk

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Bank Credit Information Sharing

- What is bank credit information sharing?
- Banks disclose the credit history of their borrowers, and exchange such information with other banks.
  - private credit bureau
  - e.g., Experian, Equifax, and TransUnion in the U.S.
  - public credit register
  - e.g., Central Credit Register in Spain
- DoingBusiness.com: about 150 out of 200 economies have some sorts of credit info sharing systems.
- Banks make profit on private information about borrowers' credit worthiness. Why share such info with other banks?

Our Exposition

- A new rationale for credit info sharing
- Info sharing driven by banks' fragile liability structure
    - banks need protection against bank runs
    - precautionary cash holding is costly
    - alternatives: asset sale, securitization, collateralized borrowing
    - asset sale and borrowing both rely on asset liquidity
- Incentives to disclose credit history for asset liquidity
- Info sharing $\Rightarrow$ transparency on asset quality $\Rightarrow$ liquidity
- Main trade-off: asset market liquidity vs. rent extraction
- Info sharing can endogenously emerge.

Literature Survey

- Earlier theories focus on how info sharing improves banks' credit risk management and loan pricing.
  - Pagano & Jappelli (JF 1993): reducing adverse selection
  - Padilla & Pagano (RFS 1997, EER 2000): mitigating borrowers' moral hazard
  - Bouckaert & Degryse (JIE 2004, EJ 2006): softening ex-ante and ex-post competition for high quality borrowers
- Empirical studies
  - Brown et al. (JFI 2009): access to bank loans
  - Houston et al. (JFE 2010), and Jappelli & Pagano, (JBF 2002): credit risk of bank borrowers and that of banks
- Our contributions
  - Theoretical argument: Incentives to share information may also come from banks' liability side.
  - Empirical support: (work-in-progress, Beck, Gong, and Ma): Info sharing affects banks' liquidity management.

Model Setup: Market Participants

- ▶ Insider: a relationship bank
    - ▶ inheriting a lending relationship from history
    - ▶ privately observes borrower's type and credit history
- ▶ Outsider: a distant bank
    - ▶ has no ongoing lending relationship with the borrower
    - ▶ cannot observe borrower's type or credit history
    - ▶ can compete for the borrower by offering loan rates
    - ▶ bears an entry cost c when initiating a lending relationship
- ▶ Other outsiders: bank depositors and asset buyers
    - ▶ have no better information on borrower type/credit history than the distant bank
    - ▶ only require to break even in competitive markets
- ▶ All agents in the model are risk-neutral.

Bank Asset and Loan Qualities

- One borrower, two types, safe (H)or risky (L)
  - priori: $Pr(H) = \alpha$, and $Pr(L) = 1 - \alpha$
  - need 1 unit of funding
  - safe borrower (H): always generates income $R > r_0$
  - risky borrower (L): income depends on state s
    - $R > r_0$ in good state G, zero income in bad state B
    - $Pr(s = G) = \pi$, $Pr(s = B) = 1 - \pi$
  - e.g., prime vs. subprime mortgage borrowers
- Positive NPV projects for both types of borrowers
  - $\pi R > r_0$
  - we assume no credit rationing throughout the paper

Credit Information Sharing

- Information sharing: a choice by the relationship bank
- Relationship bank serves the same borrower for two periods
- Borrower credit information in two categories
  - types cannot be communicated
  - credit history can be communicated
    - credit history: default (D), or no default ($\bar{D}$)
    - H type's credit history: $Prob(\bar{D}|H) = 1$
    - L type's credit history: $Prob(\bar{D}|L) = \pi$ and $Prob(D|L) = 1 - \pi$
- Alternative assumptions on the nature of credit history
  - strong assumption: credit history, once shared, is verifiable
  - weak assumption: credit history is nonverifiable
- We start with the strong assumption, and then relax it.
- Denote equilibrium loan rates as: R_N w/o info sharing and $\{R_S(\bar{D}), R_S(D)\}$ w/ info sharing

Bank Liability and Funding Liquidity Risk

- ▶ Both banks are financed by 100% deposits.
- ▶ Perfectly competitive deposit market: depositors earn r_0
- ▶ Perfect market discipline
  - ▶ deposit rates based on bank risk
  - ▶ no risk-shifting induced by limited liability
  - ▶ different deposit rates based on shared information
    - ▶ w/o info sharing: r_N for relationship bank
    - ▶ w/ info sharing:
    - ▶ $r_S(\bar{D})$ for relationship bank with $\bar{D}$ loan
    - ▶ $r_S(D)$ for relationship bank with D loan
- ▶ Only the relationship bank faces funding liquidity risk
  - ▶ $Pr(run) = \rho$, all depositors withdraw fund before loan matures
  - ▶ $Pr(r\bar{u}n) = 1 - \rho$, no funding liquidity risk arises
- ▶ Zero salvage value in case of bankruptcy

Loan Sales and Adverse Selection

- In order to raise cash to meet the liquidity need
  - financial liquidation: loan sale to uninformed asset buyers
  - loan indivisible
- Asset can be on sale for two reasons
  - H-type loan, forced sale due to funding liquidity risk
  - L-type loan, strategic sale for arbitrage
- Strategic asset sale leads to adverse selection.
- Asset sold to outside asset buyers who
  - observe the realization of state s
  - require to break even
- An H-type loan will be under-priced in an asset sale.
- A bank with high quality asset can fail due to illiquidity.

Timeline

- Sequence of events
    - The relationship bank decides whether to share info or not [endogenous info sharing].
    - Borrower type and credit history realize.
    - Credit history is disclosed if the relationship bank chooses to share such information.
    - The relationship bank and the distant bank compete for the borrower by offering loan rates [endogenous loan rates]
    - The winner financed by depositors [endogenous deposit rates].
    - State s realizes and is publicly observed.
    - The relationship bank's liquidity risk is realized, and only privately observed.
    - A secondary loan market opens; and the relationship bank can sell its loan to asset buyers [endogenous asset prices].
    - Bank loan pays off.

Endogenous Asset Prices

- Secondary market price
    - depends on disclosed credit history *and* realized states
    - without info sharing: $\{P_N^G, P_N^B\}$
    - with info sharing: $\{P_S^G(\bar{D}), P_S^B(\bar{D}), P_S^G(D), P_S^B(D)\}$
- Without info sharing
    - in state G: $P_N^G = R_N$
    - in state B: $P_N^B = \frac{\alpha\rho}{(1-\alpha)+\alpha\rho} R_N$
    - $\frac{\alpha\rho}{(1-\alpha)+\alpha\rho}$ a measure of secondary market adverse selection
- With info sharing
    - in state G: $P_S^G(\bar{D}) = R_S(\bar{D})$ and $P_S^G(D) = R_S(D)$
    - in state B
        - for a loan with D history: $P_S^B(D) = 0$
        - for a loan with $\bar{D}$ history: $P_S^B(\bar{D}) = \frac{\alpha\rho}{(1-\alpha)\pi+\alpha\rho} R_S(\bar{D})$
- The benefit of info sharing: reduced adverse selection
   - $\frac{\alpha\rho}{(1-\alpha)+\alpha\rho} < \frac{\alpha\rho}{(1-\alpha)\pi+\alpha\rho}$

Endogenous Deposit Rates

- Deposit rates depend on disclosed credit history.
- Equilibrium deposit rate can be risky or risk-free.
- Candidate equilibrium rate must result in zero profit.
- Without info sharing
  - candidate risk-free rate r_0
  - candidate risky rate $\frac{r_0}{\alpha+(1-\alpha)\pi-\alpha(1-\pi)\rho} \equiv \widehat{r_N}$
  - $P_N^B \geq r_0 \Rightarrow r_N = r_0$; $P_N^B < r_0 \Rightarrow r_N = \widehat{r_N}$
- With info sharing
  - for a loan with D history
    - deposits always risky and $r_S(D) = \frac{r_0}{\pi}$
  - for a loan with $\bar{D}$ history
    - candidate risk-free deposit rate r_0
    - candidate risky deposit rate $\frac{\alpha+(1-\alpha)\pi}{\alpha+(1-\alpha)\pi^2-\alpha(1-\pi)\rho}r_0 \equiv \widehat{r_S(\bar{D})}$
    - $P_S^B(\bar{D}) \geq r_0 \Rightarrow r_S(\bar{D}) = r_0$; $P_S^B(\bar{D}) < r_0 \Rightarrow r_S(\bar{D}) = \widehat{r_S(\bar{D})}$

Endogenous Loan Rates

- Loan rate conditional on available credit history
- The distant bank demands the following rates to break even.
- Without info sharing
  - $R_N^E = \frac{c+r_0}{\alpha+(1-\alpha)\pi}$
- With info sharing
  - for a loan with D history: $R_S^E(D) = \frac{c+r_0}{\pi}$
  - for a loan with $\bar{D}$ history: $R_S^E(\bar{D}) = \frac{\alpha+(1-\alpha)\pi}{\alpha+(1-\alpha)\pi^2}(c+r_0)$
- Rank the break-even rates: $R_S^E(\bar{D}) < R_N^E < R_S^E(D)$
- Depending on the level of R (a measure of contestability), we have four cases
  - Case 0: $R \in [c+r_0, R_S^E(\bar{D})]$,
    - $R_S(\bar{D}) = R_N = R_S(D) = R$
  - Case 1: $R \in (R_S^E(\bar{D}), R_N^E]$
    - $R_S(\bar{D}) = R_S^E(\bar{D})$, and $R_N = R_S(D) = R$
  - Case 2: $R \in (R_N^E, R_S^E(D)]$,
    - $R_S(\bar{D}) = R_S^E(\bar{D})$, $R_N = R_N^E$, and $R_S(D) = R$
  - Case 3: $R \in (R_S^E(D), +\infty)$
    - $R_S(\bar{D}) = R_S^E(\bar{D})$, $R_N = R_N^E$, and $R_S(D) = R_S^E(D)$

Endogenous Loan Rates
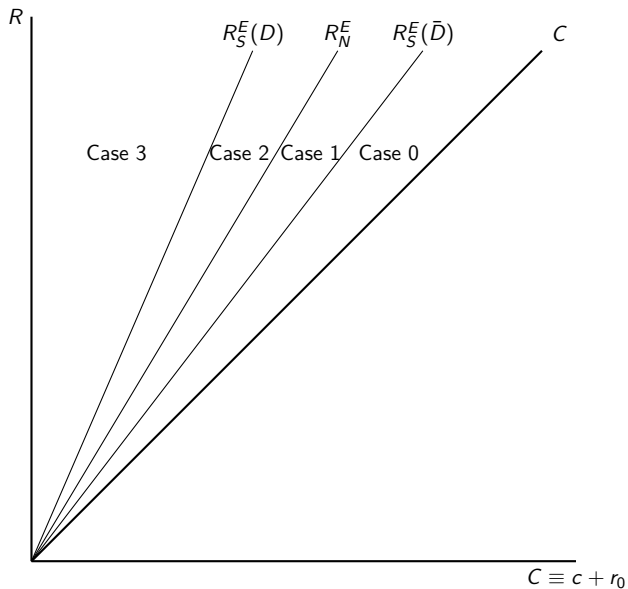
The Impacts of Info Sharing

- Info sharing increases asset price: $P_N^B < P_S^B(\bar{D})$
  - $P_N^B = \frac{\alpha\rho}{(1-\alpha)+\alpha\rho} R_N$
  - $P_S^B(\bar{D}) = \frac{\alpha\rho}{(1-\alpha)\pi+\alpha\rho} R_S(\bar{D})$
  - two countervailing effects on asset prices
    - increasing average asset quality
    - decreasing loan face value
  - $P_N^B/P_S^B(\bar{D}) \leq 1$
  - equality only if no adverse selection
- Information sharing *can* save the relationship bank from illiquidity
  - parameter values such that $P_N^B < r_0 < P_S^B(\bar{D})$
  - w/o info sharing, the bank fails in a run
  - w/ info sharing, the bank survives with a $\bar{D}$
- This provides the potential benefit of info sharing
- but does not necessarily mean info sharing will be chosen.

Bank's Incentive to Share Credit History

- Benefits overcome losses $\rightarrow$ info sharing emerges
- Bank profits from an ex-ante perspective
  - without info sharing:
    $V_N = [\alpha + (1-\alpha)\pi^2]R_N + (1-\alpha)(1-\pi)\pi R_N - \alpha(1-\pi)\rho R_N - r_0$
 - with info sharing:
    $V_S = [\alpha + (1-\alpha)\pi^2]R_S(\overline{D}) + (1-\alpha)(1-\pi)\pi R_S(D) - r_0$
- Decompose $V_S - V_N$
  - liquidity effect: $\alpha(1-\pi)\rho R_N \geq 0$
  - capturing effect: $(1-\alpha)(1-\pi)\pi(R_S(D) - R_N) \geq 0$
  - competition effect: $[\alpha + (1-\alpha)\pi^2](R_S(\overline{D}) - R_N) \leq 0$
- If $V_S - V_N > 0$, info sharing arises endogenously.
- Main trade-off: asset liquidity v.s. rent extraction

An Example: Incentives for Information Sharing: Case 2

- Two interior solutions: $R_S(\bar{D}) = R_S^E(\bar{D}) < R_N = R_N^E < R$
- One corner solution: $R_S(D) = R$
- There exist a range of parameters Ψ_2 such that
  - $P_N^B < r_0 < P_S^B(\bar{D})$ in Case 2.
  - a bank with $\bar{D}$ loan saved from illiquidity
- All three forces are at play.
  - competition effect: $(\alpha + (1-\alpha)\pi^2)(R_S^E(\bar{D}) - R_N^E) < 0$
  - capturing effect: $(1-\alpha)(1-\pi)\pi(R - R_N^E) > 0$
  - liquidity effect: $\alpha(1-\pi)\rho R_N^E > 0$
- The relationship bank prefers info sharing when the sum of capturing effect and liquidity effect dominates.
  - info sharing arises endogenously on $\varphi_2 \subseteq \Psi_2$
  - when $0 < \rho < (1-\alpha)(1-\pi)$, $\varphi_2 \subset \Psi_2$
  - when $\rho > (1-\alpha)(1-\pi)$, $\varphi_2 = \Psi_2$

Graphic Representation: Case 2
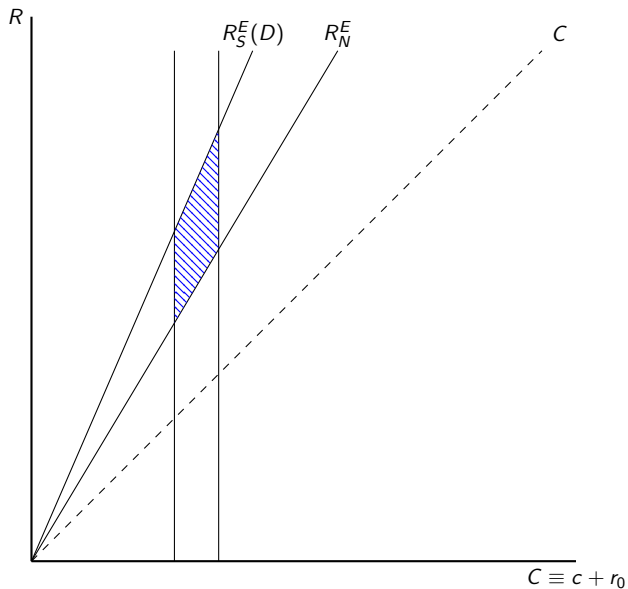
Graphic Representation: Case 2 (Cont'd)
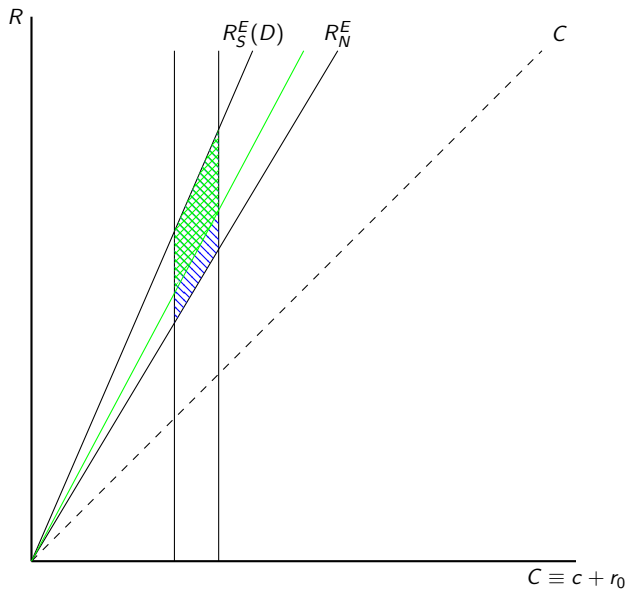
Potentially Manipulatable Credit History

- Banks have incentives to withhold bad credit history in hope to raise secondary market asset price.
- Empirical evidence
  - Giannetti et al. (2015): banks manipulate the credit ratings of their borrowers in the Argentinean credit register
- When credit history is not perfectly verifiable, will the relationship bank share the truth?
- We allow credit history to be partially unverifiable.
  - bank can conceal default history (mis-report D as $\bar{D}$)
  - but cannot do it the other way around
  - borrowers have incentives and means to correct the inaccuracy in credit reporting
  - e.g., empowered by Fair Credit Act in the U.S.

Info Sharing as a Perfect Bayesian Equilibrium

- Suppose that distant bank, depositors, and asset buyers all hold the same belief that the relationship bank will truthfully disclose the credit history (equilibrium path).
- The only possible manipulation: overstating credit history
- That is, lying is only possible with a (L, D) type loan.
- Payoff from truth-telling
  - $V_S(D, D) = Prob(G)R_S(D) - r_0$
- Payoff from misreporting
  - $V_S(D, \bar{D}) = Prob(G)R_S(\bar{D}) + Prob(B)P_S^B(\bar{D}) - r_0$
- Trade-off from an ex-post perspective (given a D-history loan)
  - capturing effect: $Prob(G)R_S(D) \geq Prob(G)R_S(\bar{D})$
  - liquidity effect: $Prob(B)P_S^B(\bar{D}) > 0$
- Incentives for truth-telling exists *if and only if* capture effect dominates, ρ small

# Ex-post Incentive Compatibility: Case 2
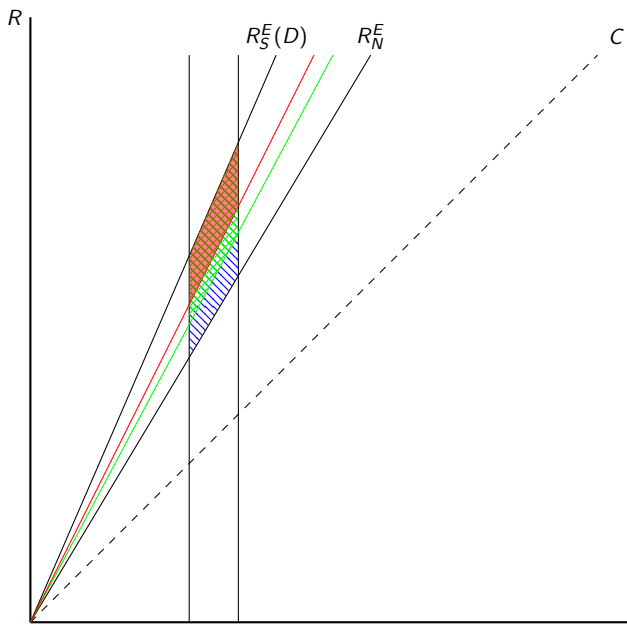
Summary of Results

- Information sharing boosts secondary market asset prices; and there *exists* a set of parameters Ψ where information sharing is beneficial:*can* save banks from funding illiquidity.

- There *exists* a subset of parameters $\varphi \subseteq \Psi$, where the benefit of info sharing dominates its cost. Banks will voluntarily choose the information sharing scheme ex ante.

- For a even smaller subset of parameters in φ, banks have no incentives to manipulate the disclosed information ex post, and truthful information sharing *can be* sustained as a PBE.
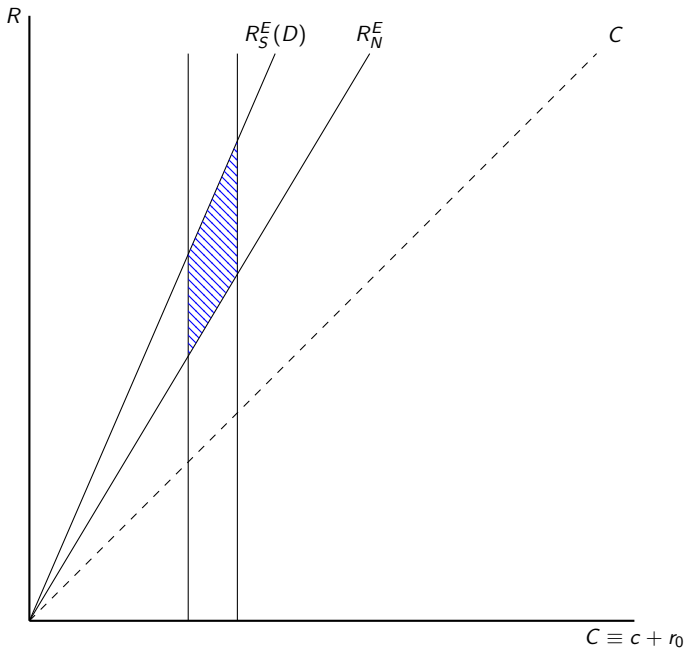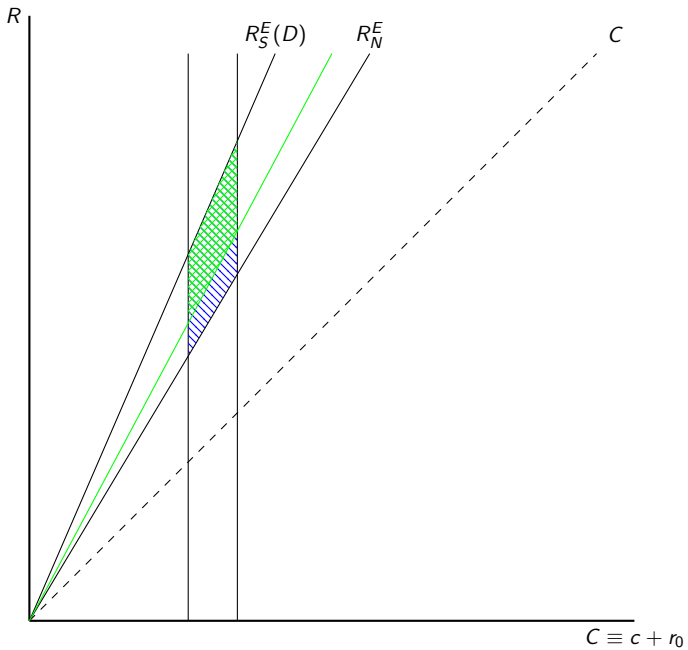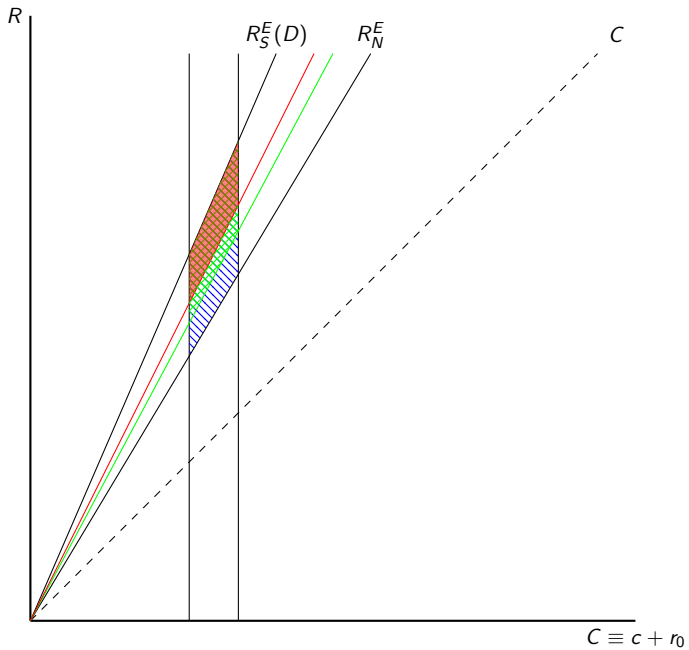
Concluding Remarks

- A new rationale for bank info sharing: info sharing driven by
  - banks' fragile capital structure
  - banks' need for market liquidity
  - a trade-off between rent extraction and liquidity
- A three-step result
  - info sharing increases secondary market asset prices
    - generally true
  - reduced liquidity risk *can* leads to voluntary info sharing
    - when the benefit of market liquidity weights the loss of rent
  - info sharing would be truthful
    - when it helps to capture borrowers with default credit history
- Potential empirical relevance
  - info sharing should facilitate banks liquidity management and loan securitization
  - info sharing can be more easily established and work more effectively in countries with competitive banking sector and in credit market segments where competition is strong (a cross comparison among cases, which not show in the current slides).