Strategic Opaqueness: A Cautionary Tale on Securitization

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Motivation

- Enormous rise in securitization in the banking sector
- Increase in banks' interconnectedness
  - Overlapping portfolios
  - Interbank exposures
- Run on banks
  - Information asymmetry

Research Questions

- *Why* do banks securitize their assets?

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- *How much* do they choose to securitize?

This Paper

Our framework:

- Banks
  - Issue debt to invest in risky projects
  - Can securitize their assets
- Investors
  - Have access only to local information about the state of the project
  - Decide whether to liquidate prematurely or continue

This Paper

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  - Optimal portfolio: *optimal* opaqueness
  - Securitization is welfare reducing and leads to banking crisis

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  - Traditionally: information asymmetry leads to securitization
- *How much* do they choose to securitize?
  - Optimal portfolio: *optimal* opaqueness
  - Securitization is welfare reducing and leads to banking crisis
- Bailouts further increase probability of banking crisis

Outline

Model

Equilibrium

Welfare, optimal securitization and financial crises

Conclusion

The Model

The environment

- Three dates $t = 0, 1, 2$
- Two banks $i = 1, 2$
- Two investors $I = 1, 2$

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- Two banks $i = 1, 2$
- Two investors $I = 1, 2$
- Bank i raises one unit of funds from investor I:
  - Issues debt contracts at face value D with maturity at date $t = 2$
  - Invests in a risky project that returns $\tilde{R}_i$ per unit of investment at date $t = 2$

State	Probability	Return $t = 2$
$\theta_i = L$	p_L	0
$\theta_i = M$	p_M	R_M
$\theta_i = H$	p_H	$F_H(.) = R_H$

$$R_H > R_M > 0$$

The Model

Securitization

At date 0, banks choose whether to securitize a fraction of their project

- Bank i, chosen at random, proposes to exchange a fraction $(1-\phi)$ of her project for a fraction $(1-\phi)$ of bank j's project

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- Bank i, chosen at random, proposes to exchange a fraction $(1-\phi)$ of her project for a fraction $(1-\phi)$ of bank j's project
- Bank j can accept or reject
  - If she reject, no exchange takes place
  - If she accepts, bank i's portfolio is

$$V_i(\phi) = \phi\tilde{R}_i + (1-\phi)\tilde{R}_j$$

while bank j's portfolio is

$$V_j(\phi) = \phi\tilde{R}_j + (1-\phi)\tilde{R}_i$$

The Model

Information

At date 1, perfectly revealing signal $\theta_i \in \{L, M, H\}$ is realized about **state** of project i

- Investor I observes signal θ_i
- Bank i observes both signals θ_i and θ_j if $\phi \in (0, 1)$

The Model

Actions and payoffs

At date 1, after observing θ_i, investor I chooses to liquidate or continue

$$s_I(\theta_i) = \begin{cases} 1 & \text{if investor } I \text{ continues bank } i \\ 0 & \text{if investor } I \text{ liquidates bank } i \end{cases}$$

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  - Investor receives an early liquidation value, $r < R_M$.
  - Bank receives 0

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- Liquidate
  - Investor receives an early liquidation value, $r < R_M$.
  - Bank receives 0
- Continue
  - Investor receives D at date 2, if $V_i \geq D$ and zero otherwise
  - Bank is the residual claimant and receives at date 2

$$\max\{V_i - D, 0\}.$$

  - Note: if $V_i < D$, bankruptcy wipes out V_i and both the bank and the investor receive 0.

The Model

Timing

- Date 0:
  - Banks borrow from investors and invest in projects
  - Banks choose their portfolio $(\phi, 1 - \phi)$
  - Face value of debt D set **to maximize expected lender surplus**

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- Date 1
  - Signals are realized
  - Investors decide whether to continue or liquidate
- Date 2, for the bank(s) continued
  - The project(s) matures
  - The debt is paid back, or the bank is destroyed

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Equilibrium

A symmetric equilibrium is given by

- A portfolio allocation $(\phi^*, 1 - \phi^*)$ and a face value of debt D^*
- A continuation decision $s_I^*(\theta_i)$ of each investor I given signal θ_i

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- Investor I's decision is optimal:
  - Each investor I's expected payoff is maximized at date 1

$$\max_{s_I} \{s_I(\theta_i) \cdot D^* \cdot \Pr(D^* \leq V_i(\phi^*)|\theta_i) + (1 - s_I(\theta_i)) \cdot r\}$$

  - Face value of debt maximizes investors expected surplus at date 0

$$\max_{D} \mathbb{E}_{\theta_i} \{s_I^*(\theta_i) \cdot D \cdot \Pr(D \leq V_i(\phi^*)|\theta_i) + (1 - s_I^*(\theta_i)) \cdot r\}$$

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- Bank i's decision is optimal:
  - Portfolio allocation maximizes bank' expected surplus at date 0

$$\max_{\phi} \mathbb{E}_{\theta_i,\theta_j} \{\max[(V_i(\phi) - D^*), 0]\,|\, s_I^*(\theta_i)\}$$

Equilibrium

2 Steps

1. Solve for investors' optimal decisions, given ϕ.

2. Solve for banks' optimal decisions.

Investors' Decisions

Face value of debt

Given a continuation decision $s_I(\theta_i)$, the face value of debt is

$$D^*_{s_I} = \arg\max \mathbb{E}_{\theta_i} \left\{ s_I^*(\theta_i) \cdot D \cdot \Pr(D \leq V_i(\phi^*) \,|\theta_i) + (1 - s_I^*(\theta_i)) \cdot r \right\}$$

Investors' Decisions

Face value of debt

Example 1: $\phi = 1$.

- $s_I(H) = 1$, and $s_I(M) = s_I(L) = 0$

$$\begin{aligned} D_H^* &= \arg\max \left[p_H \cdot D \cdot \Pr(D \leq \tilde{R}_i | \theta_i = H) \right] \\ &= R_H, \end{aligned}$$

- $s_I(H) = s_I(M) = 1$, and $s_I(L) = 0$

$$\begin{aligned} D_{HM}^* &= \arg\max \left[p_H \cdot D \cdot \Pr(D \leq \tilde{R}_i | \theta_i = H) + p_M \cdot D \cdot \Pr(D \leq \tilde{R}_i | \theta_i = M) \right] \\ &= R_M. \end{aligned}$$

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Example 2: $\hat{\phi} = \frac{R_M}{\frac{R_H}{p_H + p_M} - (R_H - R_M)}$.

- $s_I(H) = 1$, and $s_I(M) = s_I(L) = 0$

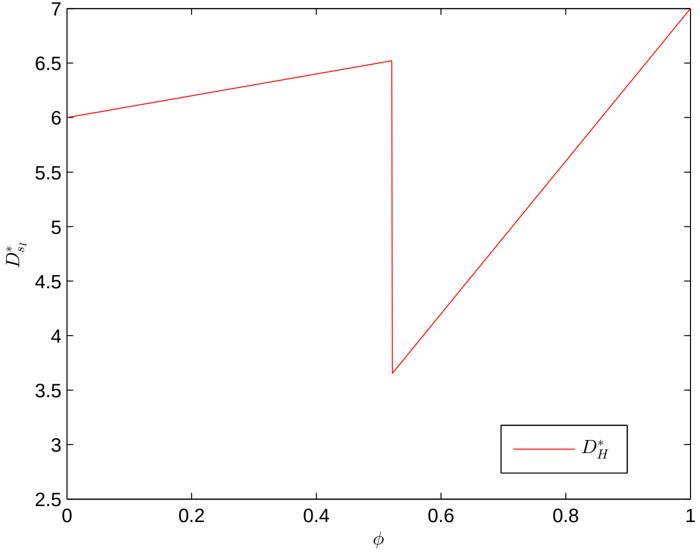
$$\begin{aligned} D_H^* &= \arg\max\left[p_H \cdot D \cdot \Pr\left(D \leq \left(\phi \tilde{R}_i + (1-\phi)\tilde{R}_j\right) | \theta_i = H\right)\right] \\ &= \phi R_H, \end{aligned}$$

- $s_I(H) = s_I(M) = 1$, and $s_I(L) = 0$

$$D_{HM}^* = R_M.$$

Investors' Decisions

Face value of debt



Investors' Decisions

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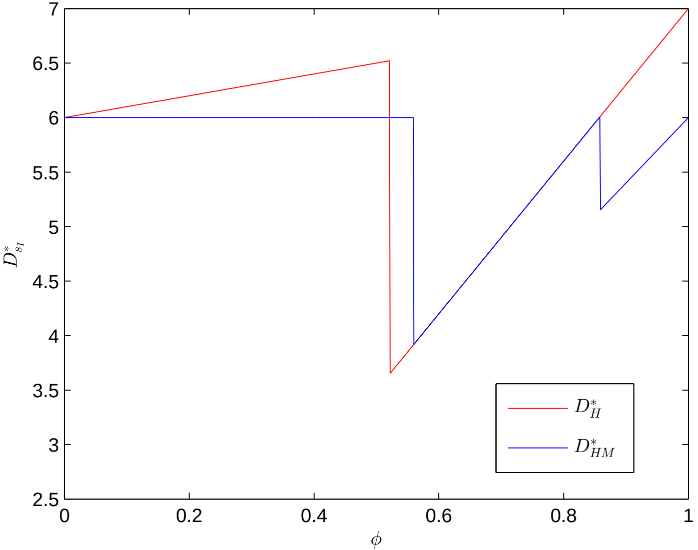

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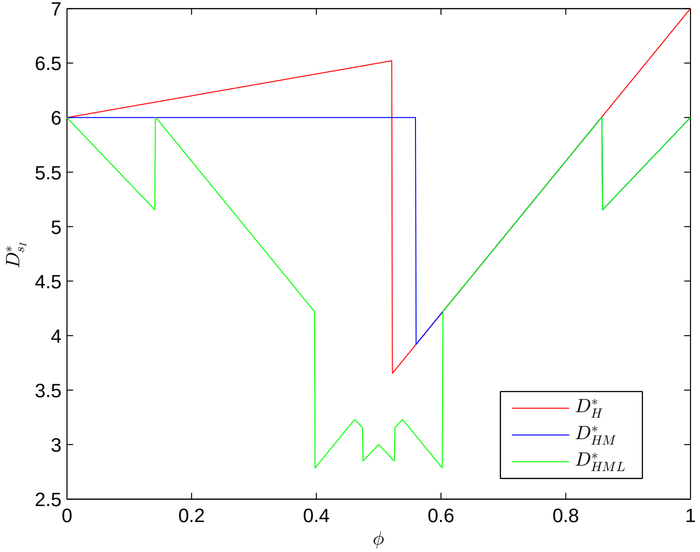

Given a continuation decision $s_I(\theta_i)$ and $D^*_{s_I}$, then investor I's surplus is

$$\begin{cases} D^*_{s_I} \cdot \Pr(D^*_{s_I} \leq V_i(\phi) | \theta_i = H) \cdot s_I(H) + r \cdot (1 - s_I(H)) & \text{with prob } p_H \\ D^*_{s_I} \cdot \Pr(D^*_{s_I} \leq V_i(\phi) | \theta_i = M) \cdot s_I(M) + r \cdot (1 - s_I(M)) & \text{with prob } p_M \\ D^*_{s_I} \cdot \Pr(D^*_{s_I} \leq V_i(\phi) | \theta_i = L) \cdot s_I(L) + r \cdot (1 - s_I(L)) & \text{with prob } p_L \end{cases}$$

Example 1 (cont): $\phi = 1$.

- $s_I(H) = 1$, and $s_I(M) = s_I(L) = 0$

$$p_H \cdot R_H + (p_M + p_L)\, r$$

- $s_I(H) = s_I(M) = 1$, and $s_I(L) = 0$

$$(p_H + p_M) \cdot R_M + p_L r$$

Example 2 (cont): $\hat{\phi} = \frac{R_M}{\frac{R_H}{p_H + p_M} - (R_H - R_M)}$.

- $s_I(H) = 1$, and $s_I(M) = s_I(L) = 0$

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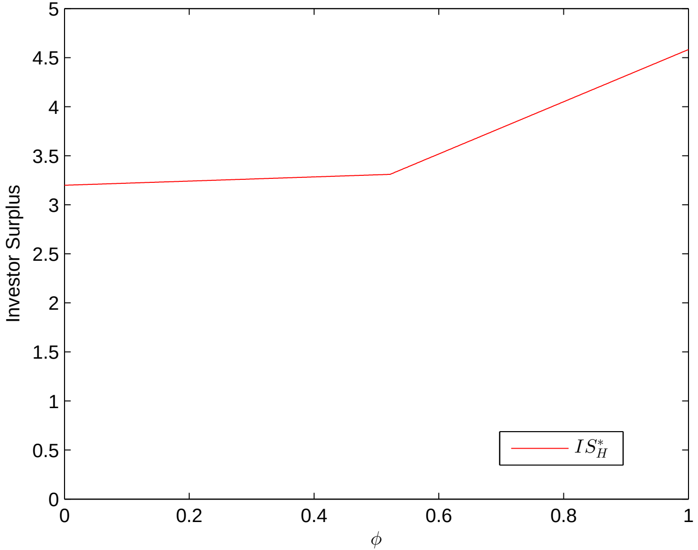
$$p_H \cdot (p_H + p_M)\, R_M + p_M \cdot (p_H + p_M)\, R_M + p_L r$$

Investors' Decisions

Investors' surplus



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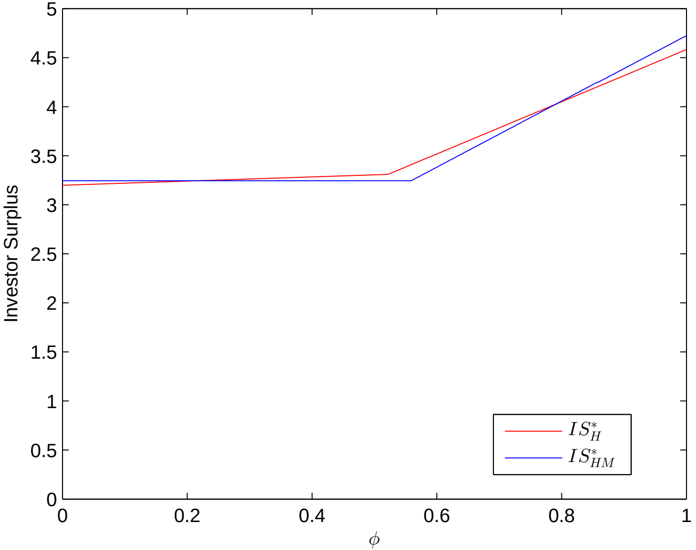

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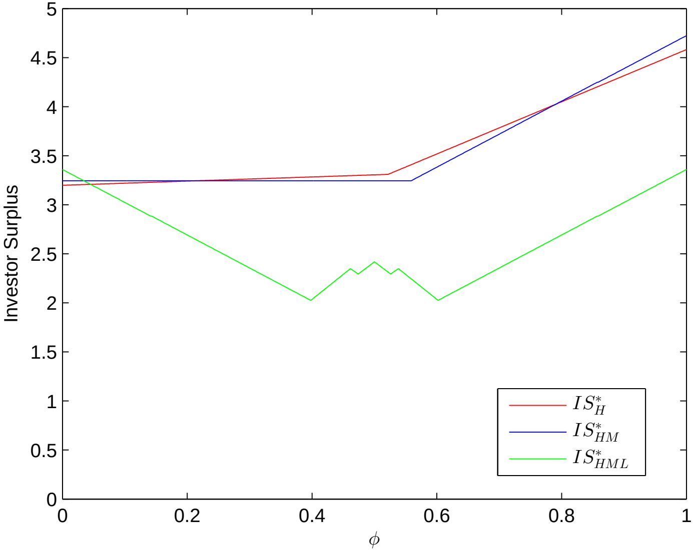
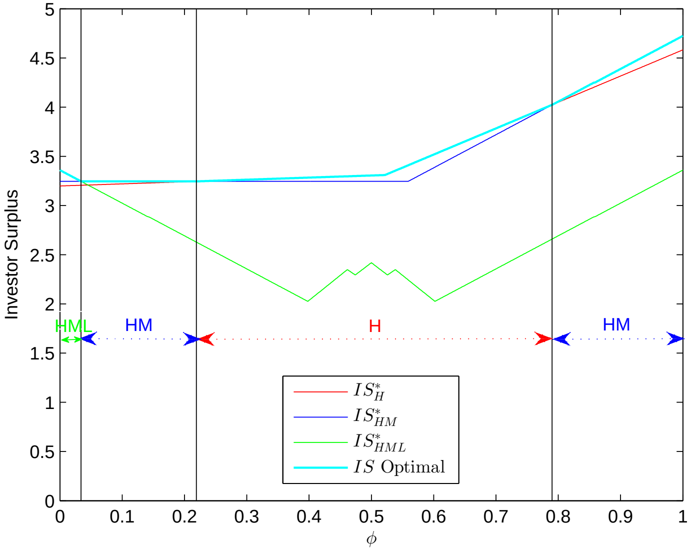


Investors' Decisions

Continuation decision



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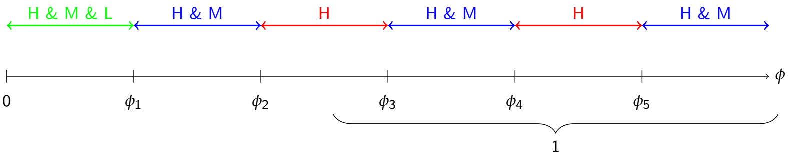
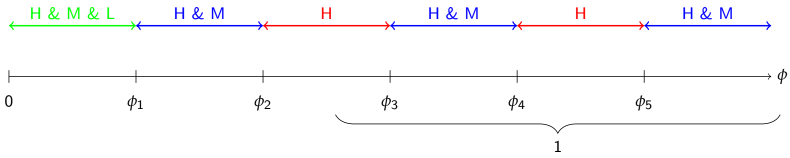


Intuition: for each ϕ, the investor chooses over compound lotteries

- The inner lotteries: the choice of D for each continuation decision
  - Small D is a safe lottery;
  - High D is a risky lottery.

Investors' Decisions

Continuation decision



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- The inner lotteries: the choice of D for each continuation decision
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- The outer lotteries: the continuation decision
  - Continuation in $H\&M$: smaller expected payoffs in each state;
  - Continuation in H: higher expected payoff in state H, but only r in state M.

Given a continuation decision $s_I(\theta_i)$, then bank i's surplus

$$\begin{cases} \mathbb{E}_{\theta_j}\{\max[(\phi_{s_I} R_H + (1-\phi_{s_I})\tilde{R}_j - D^*_{s_I}), 0]\} \cdot s_I(H) & \text{with prob } p_H \\ \mathbb{E}_{\theta_j}\{\max[(\phi_{s_I} R_M + (1-\phi_{s_I})\tilde{R}_j - D^*_{s_I}), 0]\} \cdot s_I(M) & \text{with prob } p_M \\ \mathbb{E}_{\theta_j}\{\max[(0 + (1-\phi_{s_I})\tilde{R}_j - D^*_{s_I}), 0]\} \cdot s_I(L) & \text{with prob } p_L \end{cases}$$

Example 1 (cont): $\phi = 1$

- If $(p_H + p_M)\, R_M > p_H R_H + p_M r$
  $s_I^*(H) = s_I^*(M) = 1$, $s_I^*(L) = 0$, and $D^* = R_M$.

$$p_H\,(R_H - R_M)\,.$$

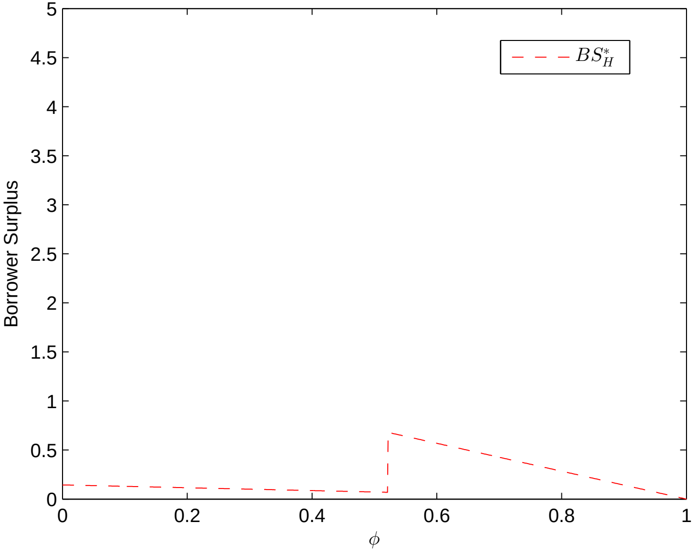
Example 2 (cont): $\hat{\phi} = \frac{R_M}{\frac{R_H}{p_H + p_M} - (R_H - R_M)}$.

- If $\phi p_H R_H + p_M r > (p_H + p_M)^2\, R_M$
  $s_I^*(H) = 1$, $s_I^*(M) = s_I^*(L) = 0$, and $D^* = \phi R_H$

$$p_H \cdot (1 - \phi)\,(p_H R_H + p_M R_M)$$

Banks' Decisions

Banks surplus



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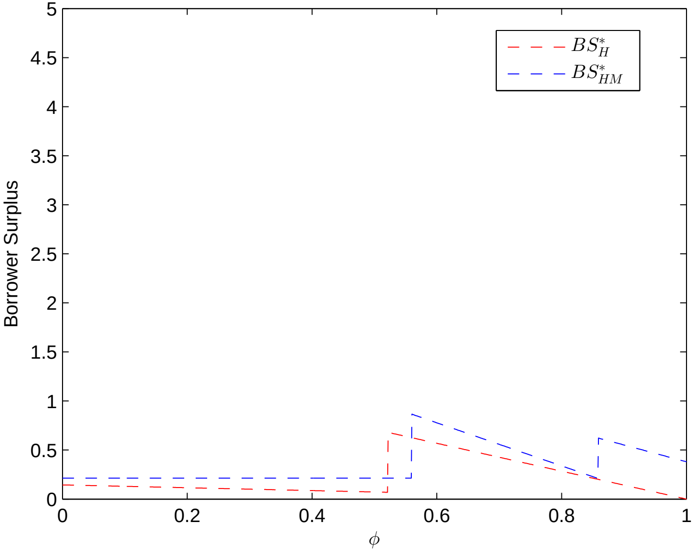

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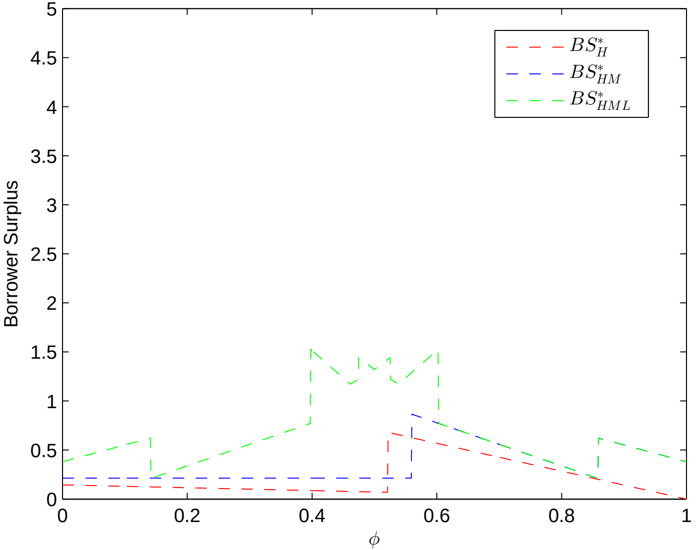
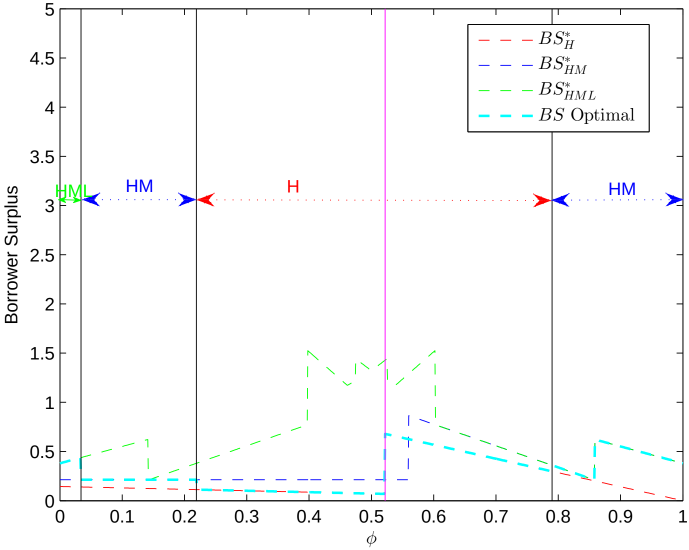


Banks' Decisions

Optimal securitization



Outline

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Equilibrium

Welfare, optimal securitization and financial crises

Conclusion

Welfare

Proposition 1

Securitization decreases welfare.

Note: Welfare = Investors' + Banks' surplus

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  - (Potential) countervailing force: downward adjustment in face value by investor $\rightarrow$ not enough

Welfare

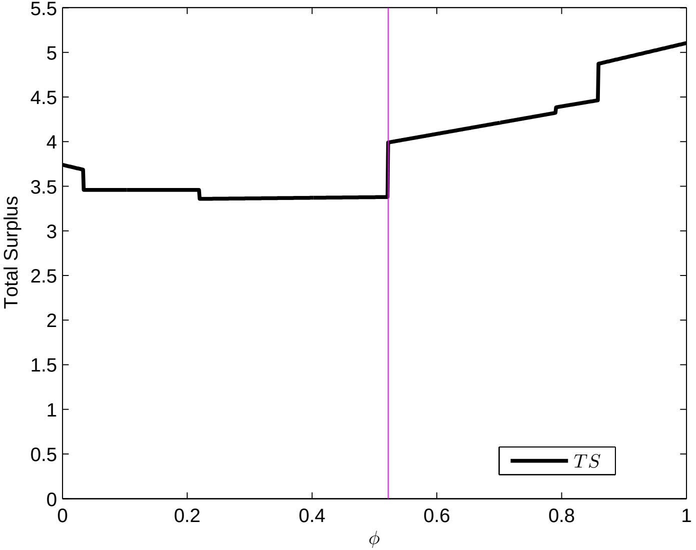
Proposition 1

Securitization decreases welfare.

Note: Welfare = Investors' + Banks' surplus

- *Ineffective liquidation and continuation*
  - Lender cannot effectively liquidate bad projects
  - (Potential) countervailing force: downward adjustment in face value by investor $\rightarrow$ not enough
- *Too-frequent liquidation*
  - With *perfect* info, the investor is able to set a face value he obtains with high probability if his bank is in state H or M.
  - With *less* info, he cannot do that: he obtains the same face value with lower probability when his bank is in state M, or H.
  - Liquidate more often to break the tie: choose the *riskier lottery*

Welfare



Optimal Securitization

Proposition 2

The banks always have an incentive to securitize and set $\phi \in (0, 1)$.

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- Total surplus decreases when $\phi < 1$, but the share of investors' decreases more.

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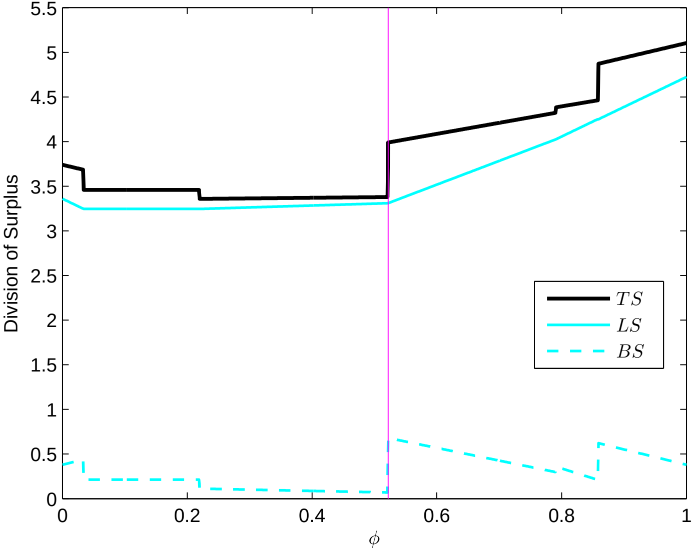
- Compound lottery
  - *Conditional* on signal: dispersion
  - Revision in face value of debt

Optimal Securitization



Proposition 3

There exist equilibria in which securitization increases the probability of financial crises.

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Financial Crises

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- Each compound lottery translates to two outcomes for the bank:
  - Continued in both state H and M, but with smaller expected payoffs;
  - Continued in state H, with higher expected payoff in state H (because of lower D^*), but only 0 in state M and L.

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  - Continued in state H, with higher expected payoff in state H (because of lower D^*), but only 0 in state M and L.
- Banks solves a max-min problem
  - *Twist*: total surplus is also affected

Outline

Conclusions

- Model of optimal choice of securitization
- Securitization determines surplus division between investors and banks
- Banks securitize to maximize their share
- *Excessive runs*
    - Lenders *act* on their information more aggressively
    - Bank *chooses* to be run on

Related Literature

- Dang, Gorton, Holmstrom, Ordonez (2014), Dang, Gorton, Holmstrom (2015)
- Gorton and Pennacchi (1990)
- DeMarzo (2005), Duffie (2008)
- Stanton, Walden, Wallace (2014)