Safe but Fragile: Information Acquisition and (Shadow) Bank Runs

Philipp Koenig* David Pothier[†]

*DIW Berlin, [†]Technical University Berlin

FTG London 2017 Conference

June 19, 2017

Motivation: The 2007/08 Financial Crisis

The 2007/08 Financial Crisis featured a **run on the shadow banking system**

Shadow banking system ≡ off-balance sheet *conduits* that invested in opaque securitized assets and financed by wholesale debt (e.g. SIVs, CDOs, SAPs)

▸ Appendix

Two distinctive features of shadow banks are:

1. Rely on market-based liquidity management
2. Have access to liquidity facilities provided by other financial institutions

Shadow banks' liabilities were widely considered safe prior to 2007/08 crash

Motivating question: Did the institutional features of the shadow banking sector contribute to its fragility?

This Paper

Theory of self-fulfilling market and funding liquidity dry-ups

Based on banks' ability to acquire private information about the quality of their assets

Key idea: Private liquidity lines can in fact be a source of financial fragility

- Create incentives for banks to acquire information about their assets
- Leads to *endogenous* adverse selection and reduces asset prices
- Value of banks' liabilities decreases as prices fall $\rightarrow$ creditor runs

Builds on Gorton (2010)'s view that the crisis was a regime change where "informationally insensitive" debt suddenly became "informationally sensitive"

Main Results

1. Information acquisition can lead to self-fulfilling market liquidity dry-ups
   → ***Strategic complementarities in info acquisition*** *(key channel)*
2. Info acquisition can spur inefficient – i.e. belief-driven – creditor runs
   → *Early withdrawals dilute late creditors' claims when asset prices are low*
3. Compare different policies to mitigate info-induced market freezes
   → *Asset purchases can stabilize funding and market liquidity, but at a cost*
   → *Debt purchases can prevent inefficient runs and boost asset prices*
   → ***But**: Liquidity injections – e.g. lowering interest rates – may backfire*

Main Results

1. Information acquisition can lead to self-fulfilling market liquidity dry-ups

   → ***Strategic complementarities in info acquisition*** *(key channel)*

2. Info acquisition can spur inefficient – i.e. belief-driven – creditor runs

   → *Early withdrawals dilute late creditors' claims when asset prices are low*

3. Compare different policies to mitigate info-induced market freezes

   → *Asset purchases can stabilize funding and market liquidity, but at a cost*

   → *Debt purchases can prevent inefficient runs and boost asset prices*

   → ***But***: *Liquidity injections – e.g. lowering interest rates – may backfire*

Main Results

1. Information acquisition can lead to self-fulfilling market liquidity dry-ups

   → ***Strategic complementarities in info acquisition*** *(key channel)*

2. Info acquisition can spur inefficient – i.e. belief-driven – creditor runs

   → *Early withdrawals dilute late creditors' claims when asset prices are low*

3. Compare different policies to mitigate info-induced market freezes

   → *Asset purchases can stabilize funding and market liquidity, but at a cost*

   → *Debt purchases can prevent inefficient runs and boost asset prices*

   → ***But****: Liquidity injections – e.g. lowering interest rates – may backfire*

Related Literature

- **Bank Runs:** Diamond & Dybvig (1983), Morris & Shin (2003), Goldstein & Pauzner (2005), Eisenbach (2016)
- **Adverse Selection and Liquidity Dry-ups:** Akerlof (1970), Eisfeldt (2004), Plantin (2009), Malherbe (2014), Heider et al. (2015)
- **Information Acquisition:** Gorton & Pennacchi (1990), Dang et al. (2013;2015), Gorton & Ordonez (2014), Fishman & Parker (2015), Bolton et al. (2016)
- **Market and Funding Liquidity**: Brunnermeier & Pedersen (2009), Kuong (2015), Biais et al. (2015)
- **Methodology (Global Games):** Carlsson & Van Damme (1993), Morris & Shin (1998), Goldstein (2005)

Model Basics

Three period exchange economy, $t \in \{0, 1, 2\}$

Three groups of risk-neutral agents:

- Banks, $j \in [0, 1]$
- Creditors, $i \in [0, 1]$
- Deep-pocketed outside investors

Banks hold risky long-term assets financed by short-term debt and equity

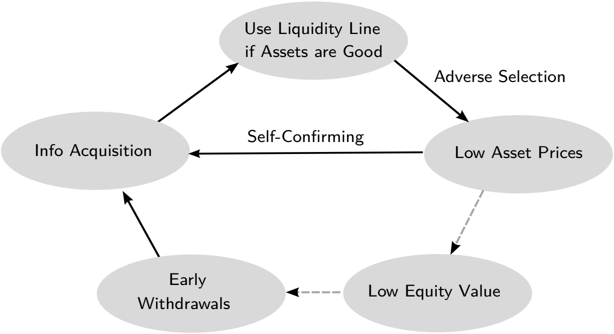
Banks can acquire private information about future asset returns in $t = 0$

Creditors can withdraw short-term debt in $t = 1$

Banks can meet early withdrawals by either:

- Selling assets to outside investors at price p
- Using a "liquidity back-up line" at unit cost $\beta^{-1} > 1$

Mechanism


Use Liquidity Line
if Assets are Good
Adverse Selection
Low Asset Prices
Self-Confirming
Info Acquisition
Low Equity Value
Early
Withdrawals

Balance Sheet of Banks

- Asset Side
  - Random return in $t = 2$:

$$\tilde{R} = \begin{cases} R_h & \text{with prob. } \pi \\ R_l & \text{with prob. } 1 - \pi \end{cases}$$

  - Expected return $\mathbf{E}_0[\tilde{R}] \equiv \pi R_h + (1 - \pi) R_l$
  - Additional "control rent" Q per unit of asset under management in $t = 2$
  - Control rent is lost if assets are sold to outside investors in $t = 1$
- Liability Side
  - Share $\alpha \in (0, 1)$ of liabilities are short-term (i.e. demandable) claims
  - Claims yield D_1 if withdrawn in $t = 1$, D_2 if rolled over until $t = 2$
  - *D&D*-like contract: $D_1 = \mathbf{E}_0[\tilde{R}]$, D_2 *per capita* equity value of bank in $t = 2$

Sequence of Events

$t = 0$

- Banks choose to acquire information
- Banks acquiring information observe return R_h or R_l

$t = 1$

- Creditors withdraw or roll over their claims
- Banks decide to use liquidity line or asset sales to cover withdrawals
- Market opens and assets trade at price p

$t = 2$

- Asset returns are realized
- Payoffs are made

Â

Outline of the Presentation

1. Banks' Information Acquisition Game
2. Creditors' Roll–Over Game
3. Global Game (Equilibrium Selection)
4. Welfare and Policy Implications
5. Conclusion

Information Acquisition

Information Acquisition Technology

- In $t = 0$, banks have the option to learn the future return of their asset
- Info acquisition implies (opportunity) cost $\psi > 0$
- $\sigma \in [0, 1]$: share of banks acquiring information

Information Sets

- $\Omega_j \in \{n, h, l\}$: bank j's information set given info acquisition decision
- Conditional on information set, expected asset returns are:

$$\mathbf{E}\left[\tilde{R}|\Omega_j\right] = \begin{cases} \mathbf{E}_0[\tilde{R}] & \text{if } \Omega_j = n \\ R_h & \text{if } \Omega_j = h \\ R_l & \text{if } \Omega_j = l \end{cases}$$

Banks' Value Function

Banks facing $\lambda \in [0,1]$ withdrawals choose between LL and AS given Ω_j

Value of a bank that obtains $x_j \geq \alpha\lambda D_1$ units of liquidity by AS is:

$$V^{AS}(x_j|\Omega_j) = \mathbf{E}\left[\max\left\{\left(\tilde{R}+Q\right)\left(1-\frac{x_j}{p}\right)+(x_j-\alpha\lambda D_1),0\right\}\middle|\Omega_j\right]$$

Similarly, for banks tapping their LL:

$$V^{LL}(x_j|\Omega_j) = \mathbf{E}\left[\max\left\{\tilde{R}+Q-\frac{x_j}{\beta}+(x_j-\alpha\lambda D_1),0\right\}\middle|\Omega_j\right]$$

Liquidity Lines *versus* Asset Sales

- Assumption **A1:** Upper bound on the share of short-term claims

$$\alpha \leq \beta$$

A1 implies that banks never default due to illiquidity in $t = 1$

- Assumption **A2:** The cost of liquidity lines β^{-1} is such that

$$\frac{\mathbf{E}_0[\tilde{R}] + Q}{R_l} < \beta^{-1} < \frac{R_h + Q}{\mathbf{E}_0[\tilde{R}]}$$

A2 implies a fixed preference for LL or AS given Ω_j in the absence of default

Lemma (Choice of Liquidity Source)

Informed good banks always use liquidity lines, while informed bad and uninformed banks always use asset sales to meet withdrawals.

Secondary Asset Market

- Assumption **A3:** Lower bound on the value of the control rent

$$Q > \pi(R_h - R_l)$$

A3 implies banks never sell more than $\alpha\lambda D_1$ shares (i.e. no information-based trading)

Given previous Lemma and **A3**, share of good assets supplied to the market is:

$$\tau(\sigma) = \frac{(1-\sigma)\pi}{1-\pi\sigma} \leq \pi, \qquad \text{with } \tau'(\sigma) < 0$$

Competition among investors implies that asset price satisfies:

$$p(\sigma) = \mathbf{E}_1[\tilde{R}] = \mathbf{E}_0[\tilde{R}] - (\pi - \tau(\sigma))(R_h - R_l)$$

Lemma (Secondary Market Price)

Asset price is strictly decreasing in the fraction of informed banks: $p'(\sigma) < 0$.

Banks' Information Acquisition Choice

- Given withdrawals $\lambda \in [0,1]$, surplus from information acquisition is:

$$S(\sigma;\lambda) = \pi V^{LL}(\alpha\lambda D_1|h) + (1-\pi)V^{AS}(\alpha\lambda D_1|l) - V^{AS}(\alpha\lambda D_1|n)$$

  equals

$$S(\sigma;\lambda) = \pi\left(\frac{R_h + Q}{p(\sigma)} - \frac{1}{\beta}\right)\alpha\lambda D_1 > 0$$

  gain from holding good assets by using liquidity lines rather than selling them

- Optimal information acquisition decision depends on whether: $S(\sigma;\lambda) \gtrless \psi$
- $S_\sigma(\sigma;\lambda) > 0$: **strategic complementarities in info acquisition** Appendix
- Strategic complementarities → *multiple equilibria* for $\psi \in [\underline{\psi}, \overline{\psi}]$:
  - No information acquisition and high prices: $\sigma^* = 0$ and $p(\sigma^*) = \mathbf{E}_0[\tilde{R}]$
  - Full information acquisition and low prices: $\sigma^* = 1$ and $p(\sigma^*) = R_l$

Banks' Information Acquisition Choice

- Given withdrawals $\lambda \in [0,1]$, surplus from information acquisition is:

$$S(\sigma;\lambda) = \pi V^{LL}(\alpha\lambda D_1|h) + (1-\pi)V^{AS}(\alpha\lambda D_1|l) - V^{AS}(\alpha\lambda D_1|n)$$

  equals

$$S(\sigma;\lambda) = \pi\left(\frac{R_h + Q}{p(\sigma)} - \frac{1}{\beta}\right)\alpha\lambda D_1 > 0$$

  gain from holding good assets by using liquidity lines rather than selling them

- Optimal information acquisition decision depends on whether: $S(\sigma;\lambda) \gtrless \psi$

- $S_\sigma(\sigma;\lambda) > 0$: **strategic complementarities in info acquisition** ▸ Appendix

- Strategic complementarities → *multiple equilibria* for $\psi \in [\underline{\psi}, \overline{\psi}]$:
  - No information acquisition and high prices: $\sigma^* = 0$ and $p(\sigma^*) = \mathbf{E}_0[\tilde{R}]$
  - Full information acquisition and low prices: $\sigma^* = 1$ and $p(\sigma^*) = R_l$

Creditors' Utility Function

- Creditors are subject to an aggregate liquidity shock in $t = 1$

$$U(c_1, c_2) = c_1 + \left(\frac{\eta}{1+\eta}\right) c_2$$

where $\eta > 0$

- For fixed price $p(\sigma)$, creditors' roll over decision depends on whether

$$D_1 \lesseqgtr \frac{\eta}{1+\eta} D_2(\lambda;\sigma) \quad \Leftrightarrow \quad \eta \gtreqless W(\lambda;\sigma) \equiv \frac{D_1}{\max\{D_2(\lambda;\sigma) - D_1, 0\}}$$

where $D_2(\lambda;\sigma)$ is the expected residual *per capita* equity value of banks:

$$D_2(\lambda;\sigma) = \frac{1}{1-\alpha\lambda} \underbrace{\left((\mathbf{E}_0[\tilde{R}] + Q)\left(1 - \frac{\alpha\lambda D_1}{p(\sigma)}\right) + \sigma S(\sigma;\lambda) \right)}_{\equiv \mathbf{E}_0[V^k(\alpha\lambda D_1 | \Omega_j)]}$$

Creditors' Roll–Over Choice

- If $D_2(\lambda;\sigma) \leq D_1$ it is strictly dominant for creditors to withdraw
- If $D_2(\lambda;\sigma) > D_1$ creditor i's choice depends on the behavior of other creditors
- There are two forces at play, as an increase in λ
  1. Dilutes the residual equity value of banks selling assets since $D_1 \geq p(\sigma)$
  2. Raises the info rent accruing to banks using the liquidity line: $S_\lambda(\sigma;\lambda) > 0$

  A2 implies that (1) always dominates (2)
- $W_\lambda(\lambda;\sigma) \geq 0$: **strategic complementarities in withdrawal decision** Appendix
- *Multiple equilibria* for $\eta \in [\underline{\eta}, \overline{\eta}(\sigma)] \to$ "belief-driven" (i.e. non-fundamental) runs
  - No withdrawals and high equity values: $\lambda^* = 0$ and $D_2(\lambda^*) = \mathbf{E}_0[\tilde{R}] + Q$
  - Full withdrawals and low equity values: $\lambda^* = 1$ and $D_2(\lambda^*) < \mathbf{E}_0[\tilde{R}] + Q$

Creditors' Roll–Over Choice

- If $D_2(\lambda;\sigma) \leq D_1$ it is strictly dominant for creditors to withdraw
- If $D_2(\lambda;\sigma) > D_1$ creditor i's choice depends on the behavior of other creditors
- There are two forces at play, as an increase in λ
  1. Dilutes the residual equity value of banks selling assets since $D_1 \geq p(\sigma)$
  2. Raises the info rent accruing to banks using the liquidity line: $S_\lambda(\sigma;\lambda) > 0$

  A2 implies that (1) always dominates (2)
- $W_\lambda(\lambda;\sigma) \geq 0$: **strategic complementarities in withdrawal decision** Appendix
- *Multiple equilibria* for $\eta \in [\underline{\eta}, \overline{\eta}(\sigma)] \rightarrow$ "belief-driven" (i.e. non-fundamental) runs
  - No withdrawals and high equity values: $\lambda^* = 0$ and $D_2(\lambda^*) = \mathbf{E}_0[\tilde{R}] + Q$
  - Full withdrawals and low equity values: $\lambda^* = 1$ and $D_2(\lambda^*) < \mathbf{E}_0[\tilde{R}] + Q$

Self-Fulfilling Liquidity Dry-Ups

Recap: strategic complementarities within groups → multiple equilibria

- Good equilibrium: High market liquidity and no creditor runs
- Panic equilibrium: Low market liquidity and creditor runs

Next: *global game refinement* to single out unique equilibrium
(Global game turns complete information game with multiple equilibria into incomplete information game)

Refinement allows to draw welfare and policy implications

Global Game: Environment

- Banks' costs and creditors' inflows (their *types*) are random and idiosyncratic:

$$\psi_j = \theta + \epsilon_j \qquad \text{and} \qquad \eta_i = \theta + \epsilon_i$$

  where $\epsilon_k \sim U[-\epsilon, \epsilon]$ for $k \in \{i, j\}$ and $\theta \sim U[\underline{\theta}, \overline{\theta}]$

- Each bank and creditor knows private type but does not observe macro-state (θ)

- Focus on symmetric monotone strategies, summarized by thresholds ψ^*_ϵ and η^*_ϵ

$$\textit{info acquisition iff } \psi_j < \psi^*_\epsilon \quad \text{and} \quad \textit{withdraw iff } \eta_i < \eta^*_\epsilon$$

- Equilibrium thresholds $(\psi^*_\epsilon, \eta^*_\epsilon)$ simultaneously solve indifference conditions

$$\psi^*_\epsilon(\eta^*_\epsilon) = \mathbf{E}_\theta[S(\theta)|\psi^*_\epsilon] \quad \text{and} \quad \eta^*_\epsilon(\psi^*_\epsilon) = \mathbf{E}_\theta[W(\theta)|\eta^*_\epsilon]$$

Global Game: Environment

- Banks' costs and creditors' inflows (their *types*) are random and idiosyncratic:

$$\psi_j = \theta + \epsilon_j \qquad \text{and} \qquad \eta_i = \theta + \epsilon_i$$

  where $\epsilon_k \sim U[-\epsilon, \epsilon]$ for $k \in \{i, j\}$ and $\theta \sim U[\underline{\theta}, \overline{\theta}]$

- Each bank and creditor knows private type but does not observe macro-state (θ)

- Focus on symmetric monotone strategies, summarized by thresholds ψ^*_ϵ and η^*_ϵ

$$\textit{info acquisition iff } \psi_j < \psi^*_\epsilon \quad \text{and} \quad \textit{withdraw iff } \eta_i < \eta^*_\epsilon$$

- Equilibrium thresholds $(\psi^*_\epsilon, \eta^*_\epsilon)$ simultaneously solve indifference conditions

$$\psi^*_\epsilon(\eta^*_\epsilon) = \mathbf{E}_\theta[S(\theta)|\psi^*_\epsilon] \quad \text{and} \quad \eta^*_\epsilon(\psi^*_\epsilon) = \mathbf{E}_\theta[W(\theta)|\eta^*_\epsilon]$$

Global Game: Unique Equilibrium

Proposition (Equilibrium Uniqueness and Threshold Ordering)

There exists a unique equilibrium in monotone strategies $\{\psi_\epsilon^*, \eta_\epsilon^*\}$ such that $\psi_\epsilon^* \le \eta_\epsilon^*$. There are no other equilibria in non-monotone strategies.

Appendix

Focus on case with vanishing noise: $\epsilon \to 0$

Two regimes can arise depending on agents' best response under "extreme beliefs":

- If banks believe all creditors withdraw:

$$\overline{\psi}^* = \int_0^1 S(\sigma, 1)\, d\sigma > 0$$

- If creditors believe no bank acquires information:

$$\underline{\eta}^* = \int_0^1 W(\lambda, 0) d\lambda = \frac{D_1}{Q}$$

Global Game: Unique Equilibrium

Proposition (Equilibrium Uniqueness and Threshold Ordering)

There exists a unique equilibrium in monotone strategies $\{\psi_\epsilon^*, \eta_\epsilon^*\}$ *such that* $\psi_\epsilon^* \leq \eta_\epsilon^*$. *There are no other equilibria in non-monotone strategies.*

Appendix

Focus on case with vanishing noise: $\epsilon \to 0$

Two regimes can arise depending on agents' best response under "extreme beliefs":

- If banks believe all creditors withdraw:

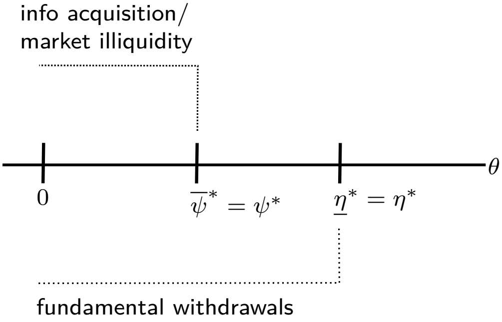
$$\overline{\psi}^* = \int_0^1 S(\sigma, 1)\, d\sigma > 0$$

- If creditors believe no bank acquires information:

$$\underline{\eta}^* = \int_0^1 W(\lambda, 0) d\lambda = \frac{D_1}{Q}$$

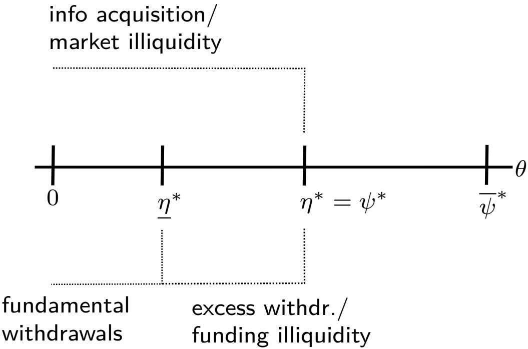
Weak dependence: $0 < \psi^* < \eta^* = \underline{\eta}^*$

- Fundamental withdrawals *may* induce market illiquidity
- *But* no opposite feedback → no excessive withdrawals



Strong dependence: $\psi^* \approx \eta^* \in [\underline{\eta}^*, \overline{\psi}^*]$

- Market illiquidity induces creditors to withdraw for larger set of states
- *Amplification* leads to excessive withdrawals/funding liquidity risk



Inefficiency of Equilibrium

Efficient allocation $\equiv$ maximizes aggregate utility from consumption

Proposition (Efficient Thresholds)

The Pareto-efficient thresholds are $\psi_{SP} = 0$ *and* $\eta_{SP} = \frac{D_1}{Q}$.

Equilibrium is always inefficient

But nature of inefficiency depends on *weak* or *strong* dependency:

- *Weak dependency*: Coordination failure among banks leads to inefficiently high info acquisition. But market illiquidity does not distort creditors' incentives
- *Strong dependency*: Market illiquidity "spills over" and creates a coordination failure among creditors $\rightarrow$ inefficient (i.e. non-fundamental) creditor runs

Inefficiency of Equilibrium

Efficient allocation $\equiv$ maximizes aggregate utility from consumption

Proposition (Efficient Thresholds)

The Pareto-efficient thresholds are $\psi_{SP} = 0$ *and* $\eta_{SP} = \frac{D_1}{Q}$.

Equilibrium is always inefficient

But nature of inefficiency depends on *weak* or *strong* dependency:

- *Weak dependency*: Coordination failure among banks leads to inefficiently high info acquisition. But market illiquidity does not distort creditors' incentives
- *Strong dependency*: Market illiquidity "spills over" and creates a coordination failure among creditors $\rightarrow$ inefficient (i.e. non-fundamental) creditor runs

Policy Implications: Liquidity Injections

Some policies adopted by the Fed to shore up liquidity in financial markets:

1. Liquidity injections (lowering of CB discount rates and repo transactions)
2. Asset purchases, e.g. of newly issued ABSs and legacy MBSs *via* TALF
3. Debt purchases, e.g. of ABCP *via* CPFF ($\approx 25\%$ of outstanding ABCP)

Liquidity Injections: Reduce the cost of private liquidity lines ($\downarrow \beta^{-1}$)

- Such a policy may either raise or lower market and funding liquidity risk

$$\frac{d\psi_\epsilon^*}{d\beta} \gtrless 0 \quad \text{and} \quad \frac{d\eta_\epsilon^*}{d\beta} \gtrless 0$$

- Increases the equity value of banks using their liquidity lines
- Increases incentives to acquire information (exacerbates adverse selection)

Policy Implications: Liquidity Injections

Some policies adopted by the Fed to shore up liquidity in financial markets:

1. Liquidity injections (lowering of CB discount rates and repo transactions)
2. Asset purchases, e.g. of newly issued ABSs and legacy MBSs *via* TALF
3. Debt purchases, e.g. of ABCP *via* CPFF ($\approx 25\%$ of outstanding ABCP)

Liquidity Injections: Reduce the cost of private liquidity lines ($\downarrow \beta^{-1}$)

- Such a policy may either raise or lower market and funding liquidity risk

$$\frac{d\psi_\epsilon^*}{d\beta} \gtrless 0 \quad \text{and} \quad \frac{d\eta_\epsilon^*}{d\beta} \gtrless 0$$

- Increases the equity value of banks using their liquidity lines
- Increases incentives to acquire information (exacerbates adverse selection)

Policy Implications: Asset *versus* Debt Purchases

Asset Purchases: Commitment to purchase assets at reservation price $q > R_l$

- Reduces info acquisition by lowering gain from holding good assets
- Also reduces withdraw incentives by raising banks' equity value
- Expected cost of asset price floor $q > R_l$:

$$C^{\mathcal{AP}} = (1-\pi)\int_{\underline{\theta}}^{\min\{\overline{\psi}_q^*,\eta_q^*\}} \alpha D_1 \left(1 - \frac{R_l}{q}\right) \mathrm{d}\theta \; > 0$$

Debt Purchases: Commitment to purchase debt if creditors withdraw early ($\downarrow \alpha$)

- Unambiguously lowers both market and funding liquidity risk

$$-\frac{d\psi_\epsilon^*}{d\alpha} < 0 \quad \text{and} \quad -\frac{d\eta_\epsilon^*}{d\alpha} \leq 0$$

- Setting $\alpha = 0$ implements the efficient allocation
- Government does not incur a loss under this policy, but must be able to absorb large volumes of debt onto its balance sheet in $t = 1$ if $\theta < \underline{\eta}^*$

Policy Implications: Asset *versus* Debt Purchases

Asset Purchases: Commitment to purchase assets at reservation price $q > R_l$

- Reduces info acquisition by lowering gain from holding good assets
- Also reduces withdraw incentives by raising banks' equity value
- Expected cost of asset price floor $q > R_l$:

$$C^{\mathcal{AP}} = (1-\pi) \int_{\underline{\theta}}^{\min\{\overline{\psi}_q^*, \eta_q^*\}} \alpha D_1 \left(1 - \frac{R_l}{q}\right) \mathrm{d}\theta \ > 0$$

Debt Purchases: Commitment to purchase debt if creditors withdraw early ($\downarrow \alpha$)

- Unambiguously lowers both market and funding liquidity risk

$$-\frac{d\psi_\epsilon^*}{d\alpha} < 0 \quad \text{and} \quad -\frac{d\eta_\epsilon^*}{d\alpha} \leq 0$$

- Setting $\alpha = 0$ implements the efficient allocation
- Government does not incur a loss under this policy, but must be able to absorb large volumes of debt onto its balance sheet in $t = 1$ if $\theta < \underline{\eta}^*$

Discussion and Contribution to Existing Literature

A model of (shadow) bank runs:

- Differs from "classical" bank run models *à la* Diamond & Dybvig
- Fragility does not stem from first-come-first-served nature of deposits
- Panic-driven runs only arise if prices fall due to info acquisition by Banks

Self-fulfilling collateral crises:

- Differs from "collateral crises" model of Gorton & Ordonez
- Their paper: info rent from liquidating bad collateral (strategic substitutes)
- Our paper: strategic complementarities $\rightarrow$ belief-driven regime switches

Feedback between market and funding liquidity risk:

- Similarities with "margin channel" studied by Brunnermeier & Pedersen
- But different empirical and policy implications
  - Correlation between asset prices and trading volumes
  - Effect of liquidity injections that relax funding constraints

Discussion and Contribution to Existing Literature

A model of (shadow) bank runs:

- Differs from "classical" bank run models *à la* Diamond & Dybvig
- Fragility does not stem from first-come-first-served nature of deposits
- Panic-driven runs only arise if prices fall due to info acquisition by Banks

Self-fulfilling collateral crises:

- Differs from "collateral crises" model of Gorton & Ordonez
- Their paper: info rent from liquidating bad collateral (strategic substitutes)
- Our paper: strategic complementarities → belief-driven regime switches

Feedback between market and funding liquidity risk:

- Similarities with "margin channel" studied by Brunnermeier & Pedersen
- But different empirical and policy implications
  - Correlation between asset prices and trading volumes
  - Effect of liquidity injections that relax funding constraints

Discussion and Contribution to Existing Literature

A model of (shadow) bank runs:

- Differs from "classical" bank run models *à la* Diamond & Dybvig
- Fragility does not stem from first-come-first-served nature of deposits
- Panic-driven runs only arise if prices fall due to info acquisition by Banks

Self-fulfilling collateral crises:

- Differs from "collateral crises" model of Gorton & Ordonez
- Their paper: info rent from liquidating bad collateral (strategic substitutes)
- Our paper: strategic complementarities → belief-driven regime switches

Feedback between market and funding liquidity risk:

- Similarities with "margin channel" studied by Brunnermeier & Pedersen
- But different empirical and policy implications
  - Correlation between asset prices and trading volumes
  - Effect of liquidity injections that relax funding constraints

Conclusion

- Model of self-fulfilling market and funding liquidity dry-ups based on banks' incentives to acquire private information about their assets
- Novel channel leading to strategic complementarities in info acquisition
- **Liquidity lines can be destabilizing by spurring *endogenous* adverse selection**
- Fragility is amplified by coordination failure among creditors when asset prices fall
- Policy implications: debt purchases can boost both market and funding liquidity, but liquidity injections may backfire

Thank you

Collapse of the ABCP Market

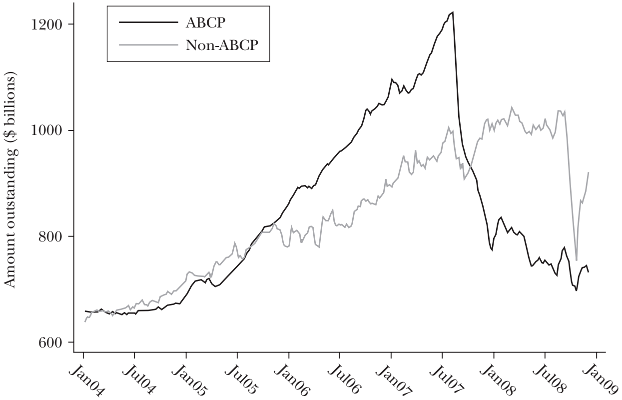


Figure: ABCP Outstanding (in billions USD). *Source: Brunnermeier (2009)*

ABCP Spreads Spiked

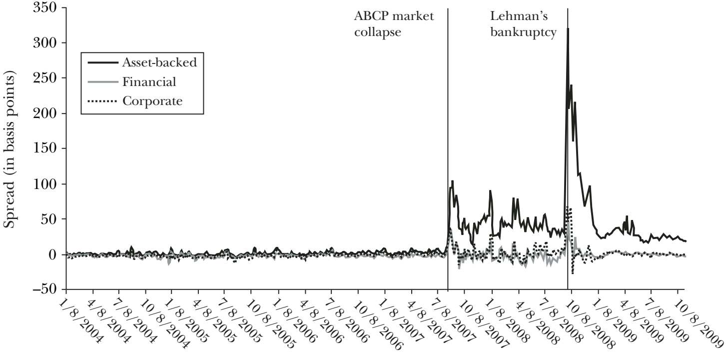


Figure: Spread between ABCP and Fed Funds. *Source: Kacperczyk & Schnabl (2009)*

Creditor Runs on ABCP Issuers

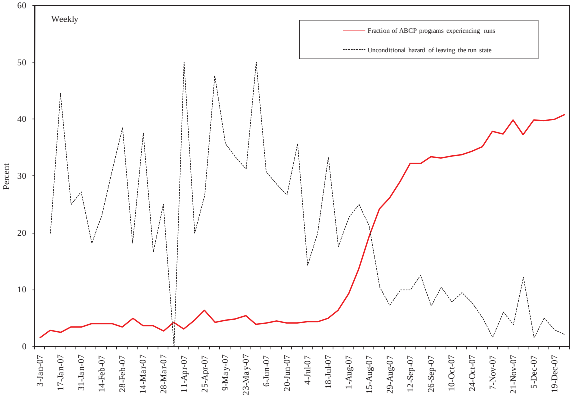


Figure: Share of ABCP programs with withdrawals in excess of 10%. *Source: Covitz et al. (2013)*

Government Purchases of ABCP

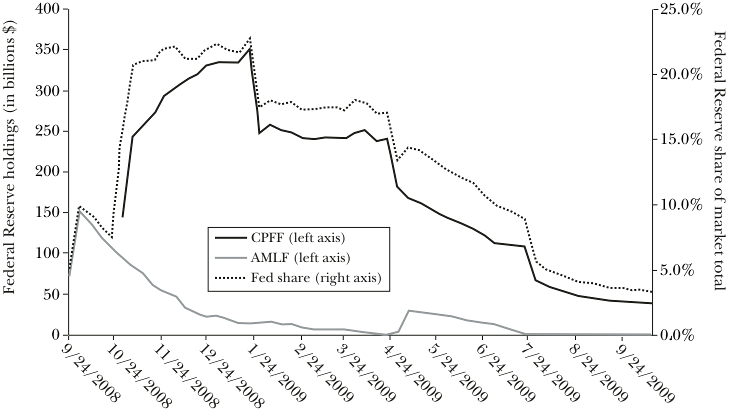


Figure: Holdings of CP by Fed Funding Facilities. *Source: Kacperczyk & Schnabl (2009)*

The Shadow Banking System

Off-balance sheet *conduits* set up by banks, mostly to avoid capital regulation

Invested in long-term assets (e.g. ABS) by issuing short-term debt (e.g. ABCP)

ABCP was mostly bought by open-end mutual funds (e.g. money market funds)

Debt considered safe because of **recourse to sponsoring banks' balance sheet**:

- Liquidity back-up lines (to meet withdrawals)
- Credit enhancements (in case of asset default)

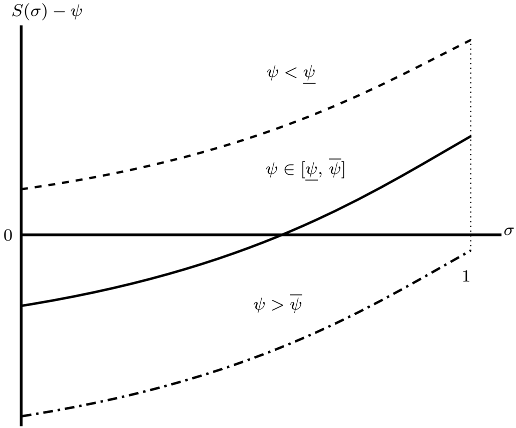
Structured Investment Vehicles (SIVs) only had *partial* recourse

To compensate for their higher risk, SIVs also

- Issued longer-term debt (e.g. medium-term notes)
- Engaged in "dynamic liquidity management" (i.e. regularly sold assets to meet funding withdrawals)

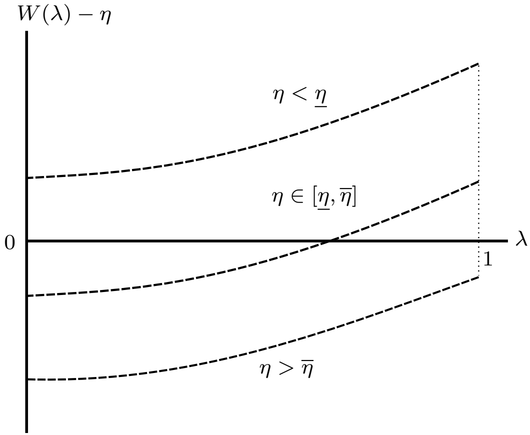
◂ Presentation

Surplus from Info Acquisition



Presentation

Payoff from Withdrawing Early



Presentation

Global Game: Details I

- By law of large numbers

$$\sigma(\theta;\psi_\epsilon^*) = \mathbf{Pr}(\psi_j < \psi_\epsilon^* | \theta) \quad \text{and} \quad \lambda(\theta;\eta_\epsilon^*) = \mathbf{Pr}(\eta_i < \eta_\epsilon^* | \theta)$$

- Equilibrium thresholds $(\psi_\epsilon^*,\, \eta_\epsilon^*)$ given by simultaneous solution to

$$\psi_\epsilon^*(\eta_\epsilon^*) = \mathbf{E}_\theta[S(\theta))|\psi_\epsilon^*] \quad \text{and} \quad \eta_\epsilon^*(\psi_\epsilon^*) = \mathbf{E}_\theta[W(\theta)|\eta_\epsilon^*]$$

- Expectations over θ are

$$\mathbf{E}_\theta[S(\theta)|\psi_\epsilon^*] = \frac{1}{2\epsilon}\int_{\psi_\epsilon^*-\epsilon}^{\psi_\epsilon^*+\epsilon} S(\sigma(\theta),\lambda(\theta))d\theta$$

Changing variable of integration

$$\mathbf{E}_\sigma[S(\sigma)|\psi_\epsilon^*] = \int_0^1 S\left(\sigma, F\left(\sigma + \frac{\eta_\epsilon^* - \psi_\epsilon^*(\eta_\epsilon^*)}{2\epsilon}\right)\right) d\sigma$$

Global Game: Details II

- Similarly,

$$\mathbf{E}_\sigma[W(\lambda)|\eta_\epsilon^*] = \int_0^1 W\left(\lambda, F\left(\lambda + \frac{\psi_\epsilon^* - \eta_\epsilon^*(\psi_\epsilon^*)}{2\epsilon}\right)\right) d\sigma$$

- Best response under "extreme beliefs" (dominance regions):
  - If firms believe either no or all creditors withdraw

$$\underline{\psi}^* = 0 \quad \text{and} \quad \overline{\psi}^* = \int_0^1 S(\sigma, 1)\, d\sigma > 0$$

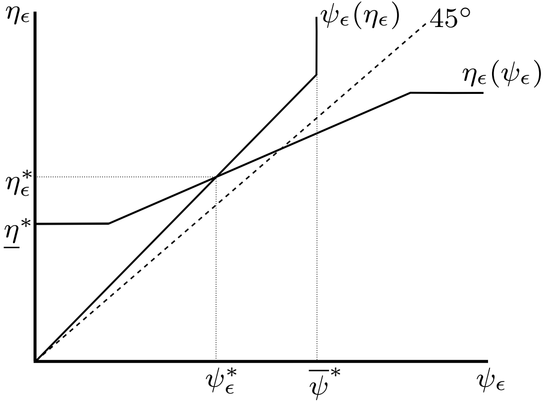
  - If creditors believe either no or all firms acquire info

$$\underline{\eta}^* = \frac{D_1}{V} \quad \text{and} \quad \overline{\eta}^* = \int_0^1 W(\lambda, 1) d\lambda \leq \infty$$

- Uniqueness and ranking of thresholds follows from:

$$\frac{d\eta_\epsilon^*}{d\psi_\epsilon^*} < 1 \quad \text{and} \quad \frac{d\psi_\epsilon^*}{d\eta_\epsilon^*} < 1$$

Best Response Correspondences



Strong *versus* Weak Dependence

Condition for strong dependence $\overline{\psi}^* \geq \underline{\eta}^*$ is:

$$\pi \int_0^1 \alpha D_1 \left(\frac{R_h + Q}{p(\sigma)} - \frac{1}{\beta} \right) \mathrm{d}\sigma \geq \frac{D_1}{Q}$$

Strong dependence arises when:

- Debt maturity is short (high α)
- Outside liquidity is cheap (low β^{-1})
- Control rent is large (high Q)

◂ Presentation