Secured Wholesale Debt, Funding Stability and Moral Hazard

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University of Economics – Prague
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Motivation

Chart 1
Covered bonds, outstanding in Europe

(EUR billions)

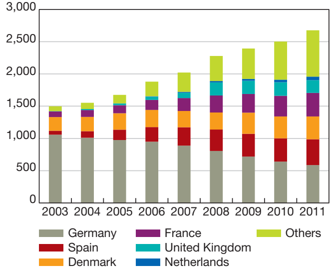
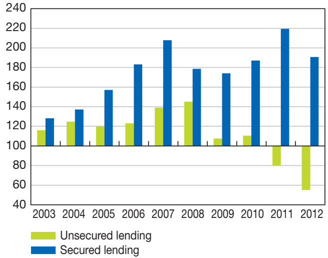


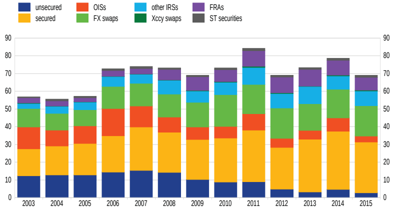
Chart 2
Average daily turnover in secured and unsecured cash lending

(Index: 2002 = 100)



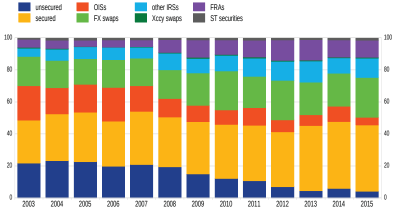
Motivation

Chart 1 Cumulative quarterly turnover in the euro money market
(EUR trillion)



Note: The panel comprised 98 credit institutions.

Chart 2 Breakdown, by segment, of cumulative quarterly turnover in the euro money market
(percentages of total)



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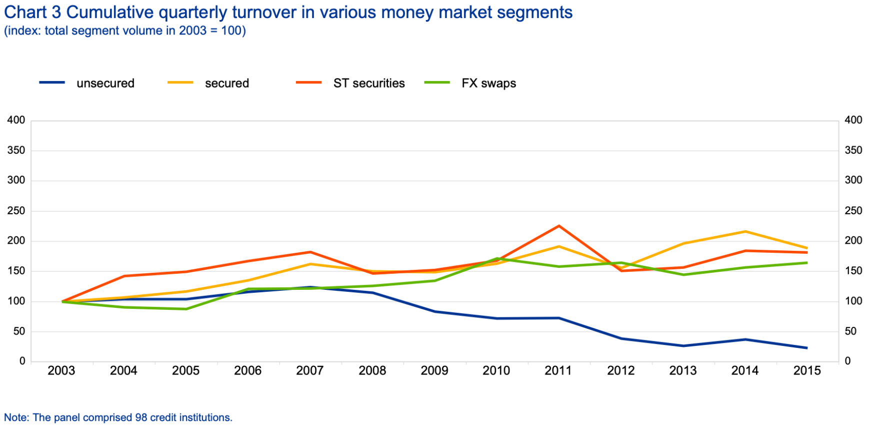
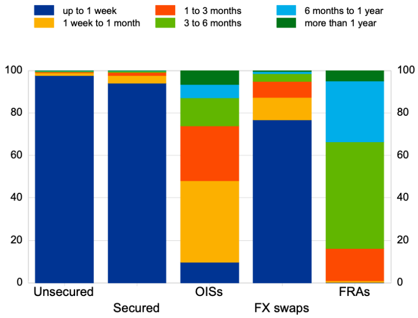


Chart 3 Cumulative quarterly turnover in various money market segments
(index: total segment volume in 2003 = 100)
unsecured
secured
ST securities
FX swaps
400
350
300
250
200
150
100
50
0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Note: The panel comprised 98 credit institutions.

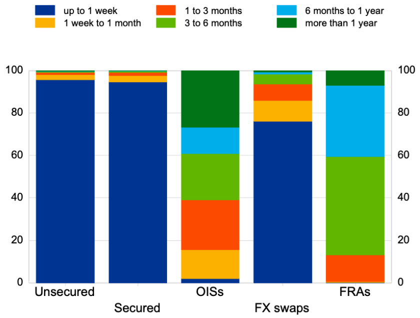
Motivation

Chart 5 Maturity breakdown for various money market segments in 2014
(percentages of total)



Note: The panel comprised 149 credit institutions.

Chart 6 Maturity breakdown for various money market segments in 2015
(percentages of total)



Financial stability aspects of secured bank funding

- Reduce funding risk (+)
- Less access to unsecured funding (–)
- Less monitoring (–)
- Risk shifting to deposit guarantee schemes (–)
- (Less scope for bail in (–))

Main questions:

1. Does secured funding improve funding stability and under what conditions?
2. Can secured funding create moral hazard and under what conditions?

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This presentation

What we do

- Stylized model of unsecured and secured bank funding.
- Funding risk modelled as coordination risk.

Main results

- *Catalytic Effect*: Secured debt issuance reduces funding risk
  $\rightarrow$ bank refinancing becomes easier
- *Crowding-in vs Crowding-Out:*
  Issuance of secured funding may lead to more / less unsecured funding (crowding-in / -out) compared to situation with only unsecured debt.
- *Inefficiencies*: Unsecured lending can induce inefficient liquidations, secured lending can induce inefficient investment (moral hazard / risk-shifting).
- *Tiering*: Stronger banks tend to issue unsecured, weaker banks tend to issue secured debt.

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Outline of Presentation

Setting

- Two dates, $t \in \{0, 1\}$.
- Limited liable bank with legacy asset funded by retail deposits and wholesale debt.
- **Maturity mismatch:** Asset matures at $t = 1$, wholesale debt refinanced at $t = 0$.
- Bank balance sheet at $t = 0$:

Assets	Liabilities
securities: 1	retail deposits: $1 - \alpha$
	wholesale debt: α
total assets: 1	total liabilities: 1

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Bank Liabilities

- Retail deposits insured at (normalized) rate of 0, face value D (risk-free rate).
- Retail deposits automatically rolled over until $t = 1$.
- Wholesale debt uninsured, refinanced at $t = 1$ at prevailing market rates.
- Face value of wholesale debt D_k, $k \in \{u, s\}$:
  - if **unsecured**: $D_u > D$.
  - if **secured**, $\beta \in [0, 1] =$ degree of collateralization (share of D_s secured by collateral):
  $$D_s = D_s(\beta) \in [D, D_u]$$
  - Assumptions: $D_s'(\beta) < 0$, $D_s(0) = D_u$, $D_s(1) = D$.

Wholesale Market and Bank Failure

- Wholesale market consists of measure m of identical small risk-neutral financiers.
- Wholesale market sufficiently large: $m > \alpha$.
- Bank fails at $t = 0$ if and only if

$$\lambda m < \alpha$$

where $\lambda \in [0, 1]$ denotes share of financiers willing to invest with the bank.

Bank Asset

- Bank asset indivisible: if bank fails at $t = 0$, asset liquidated for $L \leq 1$.
- If bank refinances and continues until $t = 1$, asset yields stochastic return

$$\tilde{X} = \begin{cases} X_g & \text{with probability } \theta \\ X_b & \text{else} \end{cases}$$

- Solvency probability θ drawn from continuous p.d.f. with support $[0, 1]$ at $t = 0$.
- Assumptions: $X_g > D_u > LD > X_b$
- Keeping the asset until $t = 1$ is efficient if and only if

$$\theta > \theta^{\text{eff}} \equiv \frac{LD - X_b}{X_g - X_b}$$

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Bank Moral Hazard

- At start of $t = 0$, only bank observes θ, and can decide to liquidate or continue.
- If bank continues, assumptions imply default in state b and no default in state g.
- Due to limited liability, bank strictly prefers to continue for all $\theta > 0$.
- Reduced form for risk-shifting and moral hazard *vis-à-vis* deposit insurance.

Debt and Deposit Seniority

- Retail deposits are senior over unsecured wholesale debt.
- Secured wholesale financier has exclusive recourse to collateral βD_s.
- Encumbering assets to secure wholesale debt circumvents seniority of deposits.
  $\rightarrow$ Issuance of secured debt exerts externality on deposit insurer.
- We emphasize this by assuming: $\alpha < \min\left\{ \frac{X_b}{\max_{\{\beta\}}\{\beta D_s(\beta)\}}, 1 - \frac{X_b}{D} \right\}$

Financiers' Investment Problem

- Suppose bank issues only unsecured debt at market rates $D_u > D$.
- Typical financier i faces the following strategic situation:

		Other financiers	
		do not lend	lend unsecured
Financier i	do not lend	D	D
	lend unsecured	0	θD_u

- θ common knowledge among financiers: **multiple equilibria** for $\theta > \frac{D}{D_u}$.
- Eliminating multiplicity *via* global game: Financiers observe private signal

$$\theta_i = \theta + \sigma \epsilon_i$$

where $\sigma \geq 0$ and ϵ_i i.i.d. with mean zero and bounded support.

- Focus on monotone symmetric strategies: financier i lends iff $\theta_i \geq \theta^*$.

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Monotone Equilibrium

- Given joint threshold θ^*, bank fails iff $\theta < \hat{\theta}(\theta^*)$ since, by LLN,

$$\lambda < \frac{\alpha}{m} \quad \Leftrightarrow \quad \mathbb{P}\left(\theta_i > \theta^* \middle| \hat{\theta}\right) < \frac{\alpha}{m}$$

- Focus on global game solution for $\sigma \to 0$. In this case:

$$\mathbb{P}\left(\theta_i > \theta^* \middle| \hat{\theta}\right) = \mathbb{P}\left(\theta \leq \hat{\theta} \middle| \theta^*\right) = \frac{\alpha}{m}$$

- Financiers' threshold θ^* determined from indifference condition:

$$\left(1 - \mathbb{P}\left(\theta \leq \hat{\theta} \middle| \theta_u^*\right)\right) \times \theta_u^* \times D_u = D$$

$$\Leftrightarrow \left(1 - \frac{\alpha}{m}\right) \times \theta_u^* \times D_s = D$$

$$\Leftrightarrow \boxed{\theta_u^* = \frac{D}{D_s} \times \frac{1}{1 - \frac{\alpha}{m}}}$$

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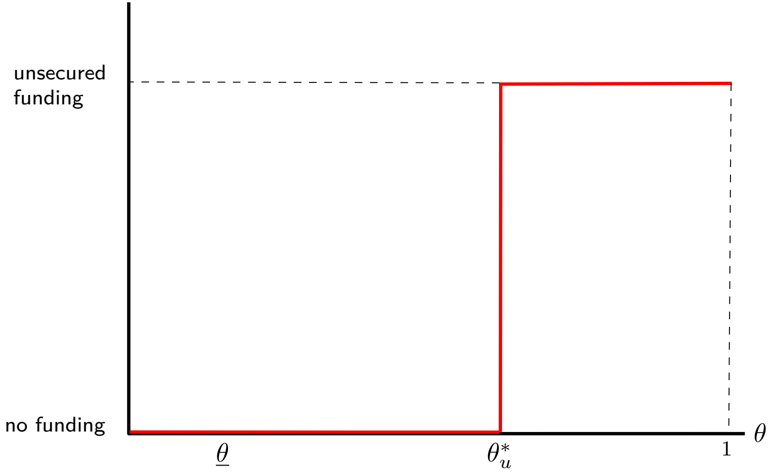
unsecured funding
no funding
$\underline{\theta}$
θ_u^*
1
θ

Refinancing game with secured and unsecured debt

- Bank issues secured and unsecured claims at face values $D_s(\beta)$ and D_u.
- In case of default, secured financier has recourse to asset up to $\beta D_s(\beta)$.
- Secured funding externality: Secured debt issuance dilutes retail depositors.
- Retail depositors still senior to unsecured creditors.

		Other creditors		
		do not lend	lend secured	lend unsecured
Creditor i	do not lend	D	D	D
	lend secured	βD_s	$\theta_i D_s + (1-\theta_i)\beta D_s$	$\theta_i D_s + (1-\theta_i)\beta D_s$
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Monotone equilibrium of three-action game:

- Note: actions are ordered

$$\text{do not lend} \prec \text{lend secured} \prec \text{lend unsecured}$$

- Basteck *et al.* (2013):
  Equilibrium of 3-action game by patching monotone equilibria of 2-action games.
- Switch from no to secured lending at $\theta_s^*(\beta)$.
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Thresholds for binary action games

- Financier i prefers secured over no lending if

$$\theta_i \geq \theta_s^*(\beta) \equiv \frac{D - \beta D_s(\beta)}{(1-\beta)D_s(\beta)} \times \frac{1}{1 - \frac{\alpha}{m}}$$

- For $\sigma \to 0$, financier i prefers unsecured over secured lending if

$$\theta_i \geq \theta_{s,u}^*(\beta) \equiv \frac{\beta D_s(\beta)}{D_u - (1-\beta)D_s(\beta)}$$

- Tacitly assumed: *Catalytic effect of secured debt*, i.e. $\theta_s(\beta) < \theta_s^*(0) \equiv \theta_u^*$
  - Financiers do not switch directly from no to unsecured lending.
  - Secured debt reduces loss-given-default $\to$ raises incentives to lend (#)
  - Secured debt has lower face value $\to$ lowers incentives to lend (##).
  - *Catalytic effect* requires (#) to dominate (##).

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- Tacitly assumed: *Catalytic effect of secured debt*, i.e. $\theta_s(\beta) < \theta_s^*(0) \equiv \theta_u^*$
  - Financiers do not switch directly from no to unsecured lending.
  - Secured debt reduces loss-given-default $\to$ raises incentives to lend ($\#$)
  - Secured debt has lower face value $\to$ lowers incentives to lend ($\#\#$).
  - *Catalytic effect* requires ($\#$) to dominate ($\#\#$).

Thresholds for binary action games

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Catalytic Effect and the Price of Safety

Lemma (Catalytic Effect)

Fix $\hat{\beta} \in (0,1)$. Secured debt with collateralization $\hat{\beta}$ exerts a catalytic effect iff

$$\frac{D_u - D}{D} > \frac{D_u - D_s(\hat{\beta})}{\hat{\beta} D_s(\hat{\beta})} \qquad (\star)$$

- Left-hand side:
  Interest foregone due to default on unsecured debt relative to risk-free claim.
- Right-hand side:
  Return foregone on secured debt per unit of safety $\rightarrow$ Price of safety
- Catalytic effect requires:
  Paying price of safety cheaper than not earning unsecured rate due to default.

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Monotone Equilibrium of 3-action Game

Proposition (Equilibrium with Secured and Unsecured Debt)

1. *Supppose condition* $(\star)$ *holds at* $\hat{\beta}$.

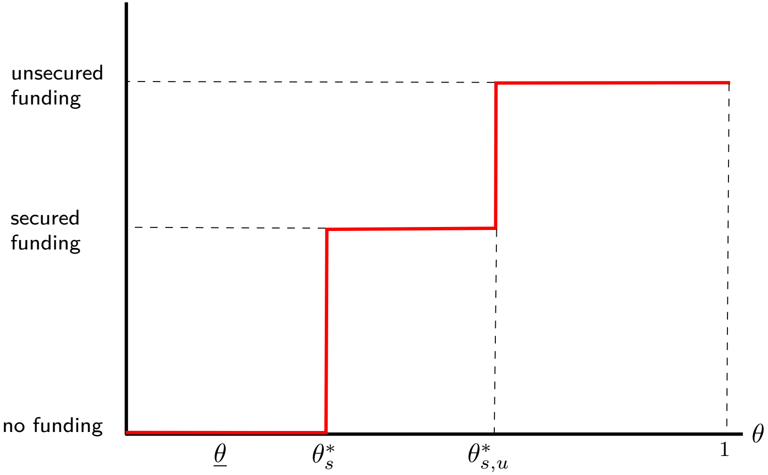
   There exists a unique monotone equilibrium for $\sigma \to 0$ *where financiers:*
   - *do not lend if* $\theta_i < \theta^*_s(\hat{\beta})$;
   - *lend secured if* $\theta_i \geq \theta^*_s(\hat{\beta})$ *and* $\theta_i < \theta^*_{s,u}(\hat{\beta})$;
   - *lend unsecured if* $\theta_i \geq \theta^*_{s,u}(\hat{\beta})$.

   The bank fails for $\theta < \theta^*_s(\hat{\beta})$.

2. *If condition* $(\star)$ *fails at* $\hat{\beta}$*, financiers invest into unsecured debt if*

$$\theta_i \geq \theta^*_u = \theta^*_s(0)$$

   and never invest into secured debt. The bank fails for $\theta < \theta^*_u$.


unsecured funding
secured funding
no funding
$\underline{\theta}$
θ^*_s
$\theta^*_{s,u}$
1
θ

Crowding-In Unsecured Debt

- *Catalytic effect:* Secured debt allows refinancing for larger range of θ: $\theta_s^*(\beta) < \theta_u^*$
- *Crowding-in*: Secured debt allows more unsecured funding: $\theta_{s,u}^*(\beta) < \theta_u^*$

Corollary (Crowding-In Unsecured Debt)

Suppose condition $(\star)$ holds. Secured debt crowds in unsecured funding iff

$$\frac{(1-\frac{\alpha}{m})D_u - D}{D} < \frac{D_u - D_s(\hat{\beta})}{\hat{\beta} D_s(\hat{\beta})} \qquad (\star\star)$$

Otherwise unsecured debt is crowded-out.

- Left-hand side: Loss of holding unsecured debt due to default *conditional* on successful refinancing.
- Right-hand side: Price of safety (again).
- If strategic uncertainty (α/m) large, funding stability improves primarily by crowding-in unsecured debt.

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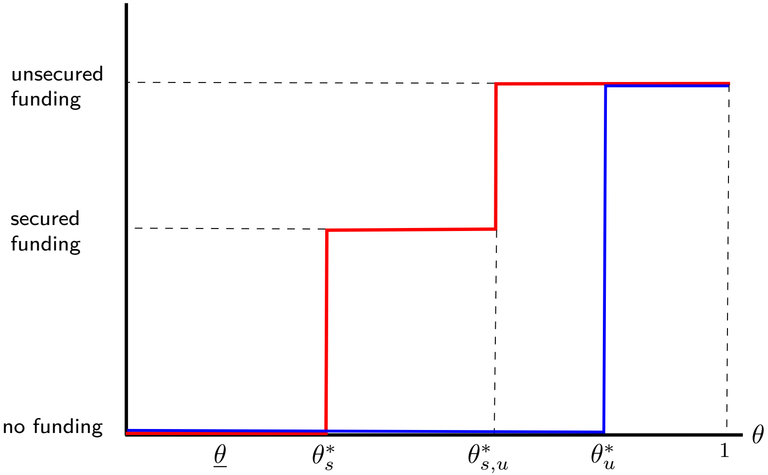

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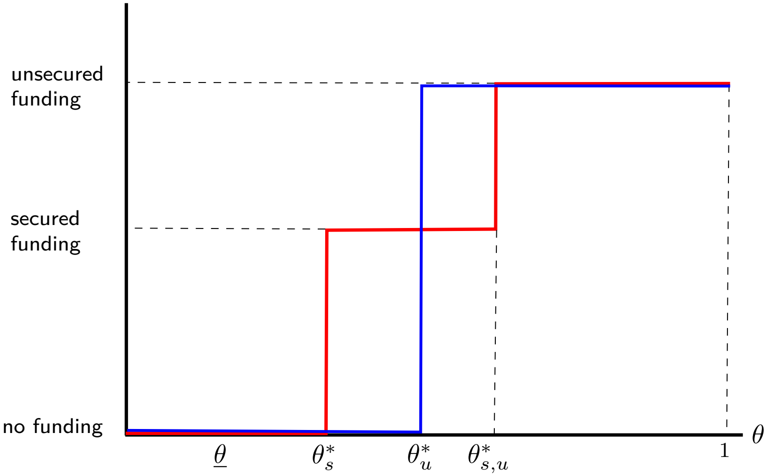

Inefficient Liquidations with Unsecured Debt

- Limited liability can induce moral hazard, i.e. bank attempts refinancing for $\theta < \theta^{\text{eff}}$.
- With only unsecured debt, moral hazard prevented, but at expense of inefficient liquidations.

Proposition (Inefficient Liquidations)

Unsecured funding inefficiently prevents moral hazard since

$$\theta_u^* > \theta^{\text{eff}}$$

- This follows because for $\theta_i > \theta_u^*$:

$$LD < D < \theta_i D_u \left(1 - \frac{\alpha}{m}\right) < \theta_i D_u < \theta_i X_g < \theta_i X_g + (1 - \theta_i) X_b$$

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Bank Moral Hazard and Secured Funding

- Secured funding may enable moral hazard, i.e. allow bank to refinance for $\theta < \theta^{\text{eff}}$.

Proposition (Bank Moral Hazard)

There exists β^{mh} such that secured debt with collateralization β^{mh} induces moral hazard, $\theta^*(\beta^{\text{eff}}) < \theta^{\text{eff}}$, if:

$$-\frac{D_s'(1)}{D} > 1 - \left(1 - \frac{\alpha}{m}\right)\theta^{\text{eff}} \qquad (\star\star\star)$$

- Higher strategic uncertainty (higher α/m) attenuates moral hazard.
- Illiquid (low L) or high return assets (high X_g or X_b) also attenuate moral hazard.
- Reason: Such assets have a low efficiency point s.t. inefficient liquidation problem more severe than moral hazard.

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Empirical Implications

- Model predicts cross-sectional tiering:
  - Banks with strong balance sheets, high θ, predominantly issue unsecured debt.
  - High reliance on secured debt sign of weak balance sheets.
- In low interest rate environments, banks more susceptible to moral hazard through secured debt issuance.
- Banks holding illiquid assets are less suscpetible to moral hazard; conversely banks with very liquid assets (e.g. market-based banking), more susceptible to moral hazard.

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Relation to Literature

- Global game theory: Frankel et al. (2003), Basteck et al. (2013), Basteck Daniels (2013)
- Global game banking models: Morris Shin (2004), Rochet Vives (2004), Goldstein Pauzner (2005), Vives (2014), König (2015)
- Global games with secured debt: Ahnert et al. (2018), Matta Perrotti (2015)

Revisiting financial stability aspects

- **Reducing coordination risk (+)**
- **Less monitoring (-)**
- **Less access to unsecured funding (+/-)**
- **Risk shifting to deposit guarantee schemes (-)**