

Systemic Risk and Monetary Policy: The Haircut Gap Channel of the Lender of Last Resort

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Motivation

- In response to recent crises, central banks revived **Lender of Last Resort (LOLR) policies** and implemented large changes to their liquidity operations
- Active debate on the **implication of LOLR policy** on moral hazard and exposing the central bank to undue credit risk (Calomiris et al., 2016, Drechsler et al., 2016 ...)
- As banks access liquidity facilities by posting securities as collateral, LOLR may affect **banks interlinkages** through common collateral exposures.

This paper

Does LOLR policy affect interconnectedness and systemic risk in the banking sector?

- **Haircut gap** as a LOLR policy tool
 - Difference in haircuts applied by the private market and ECB on bonds in repo
- Focus on **bank bonds**
 - Important source of collateral
 - Not studied in the literature
- Micro-level data on ECB and private repo markets: 300+ EA banks; 20,000+ bonds
- Investigate the period of the Sovereign Debt Crisis \implies LOLR played a key role

Summary of results

We document the haircut gap channel of LOLR policy

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 - An increase in interconnectedness across similar banks: correlated bond prices, domestic
 - Higher pledging of bonds issued by systemically important banks
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 - Higher pledging of bonds *issued by systemically important banks*
 - Banks increase *debt cross-holding*
3. LOLR stimulates **issuance** of new bank debt associated with high haircut gap

Contribution to the literature

- **LOLR policies and its effects:** Drechsler et al. (2017), Rochet and Vives (2004), Freixas et al. (2010), Stein (2012), Jasova et al. (2021), Pelizzon et al. (2020)
⇒ New evidence on the effects of LOLR on interconnectedness in the banking sector
- **Systemic risk:** Rochet and Tirole (1996), Allen and Gale (2000), Freixas et al. (2000), Elliott et al. (2014), Acemoglu et al. (2015), Cabrales et al. (2017), Goldstein et al. (2020)
⇒ Explore systemic risk that arises from the cross-holding of bank bonds
- **Sovereign and bank risk nexus:** Acharya et al. (2014), Acharya and Steffen (2015), Battistini et al. (2014), Becker and Ivashina (2018), Altavilla et al. (2017)
⇒ Additional importance of bank bonds that exhibit higher sensitivity to LOLR
- **Monetary policy and risk-taking:** Adrian and Shin (2010), Allen and Rogoff (2011), Dell'Ariccia et al. (2017), Di Maggio and Kacperczyk (2017), Jimenez et al. (2014)
⇒ Evidence on systemic risk-taking, as opposed to individual bank risk-taking

Overview

Data and institutional background

Full sample

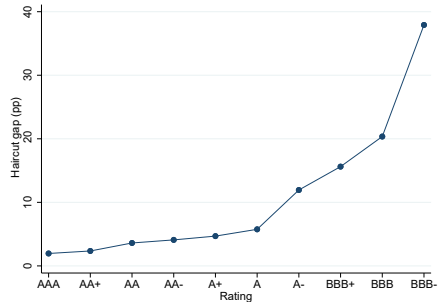
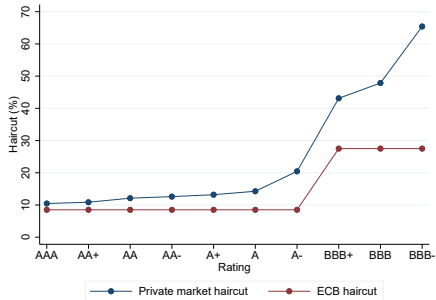
Identification using ECB haircut rules

Data and institutional background

1. **Central bank liquidity and collateral data [ECB's Market Operations Database]**
 - **Security information:** ISIN, issuance date, maturity date, issuer group, type, guarantee
 - **Valuation:** ECB haircut, market value, value-adjusted haircut
 - **Amounts:** amount pledged, total amount outstanding (all market)
 - 300+ banks, 19 countries and 20,000+ unique (bank and gov't) securities
2. **Private repo market [LCH Cleernet, Eurex]**
 - ISIN, private market haircuts
3. **Securities and issuer ratings [Eurosystem Centralized Securities Database]**
 - Ratings by S&P, Moody's, Fitch and DBRS.
4. **Bank-level data**
 - **Individualized Balance Sheet Items (IBSI):** total assets, debt issuances, equity ratios etc.
 - **Bankscope and RIAD:** ownership structure
 - **Datastream:** SRISK calculation (Brownlees and Engle, 2017)
5. **Security holding data [SHS]**
 - Sector level: ISIN-level data by 22 institutional sectors in the euro area

Haircut gap

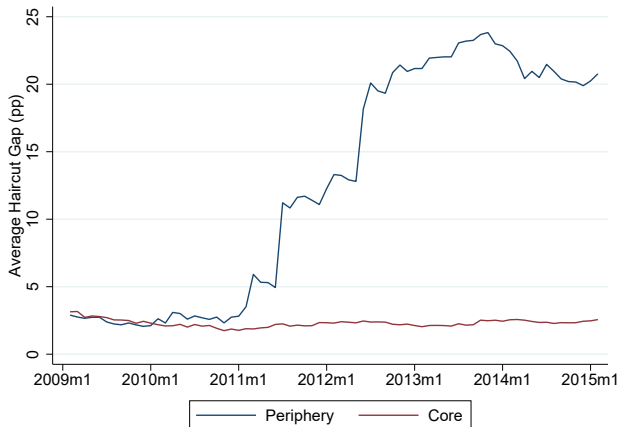
$$\text{HaircutGap}_{s,t} = \text{private market haircut}_{s,t} - \text{ECB haircut}_{s,t}$$



Example: Uncovered bank bond, 1-3 year residual maturity, fixed coupon

Highest haircut gaps: Periphery securities in the Sovereign Debt Crisis

Average haircut gap for securities issued in core and periphery



Robust to country composition

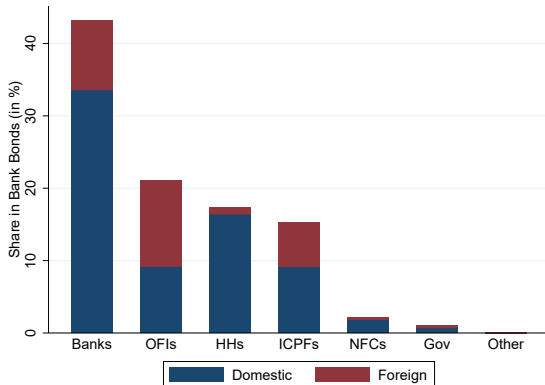
BankB, all countries

BankB, robust to country composition

Banks are an important holder of bank bonds

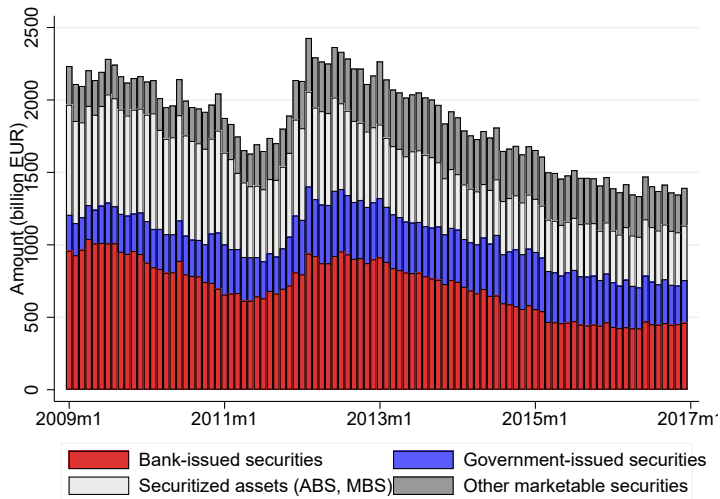
Banks' funding structures are highly intertwined

- **Across sectors:** Banks bond holdings are concentrated in the banking sector
- **BB vs GB:** Government bonds are widely held across the sectors (mutual funds, ICPFs) [Details](#)



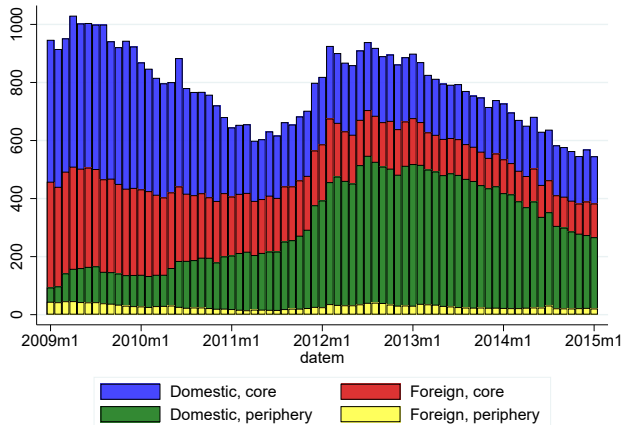
Bank-issued securities are an important source of collateral

Collateral pledging with the ECB: types of marketable securities



Inside the pledged bank bonds

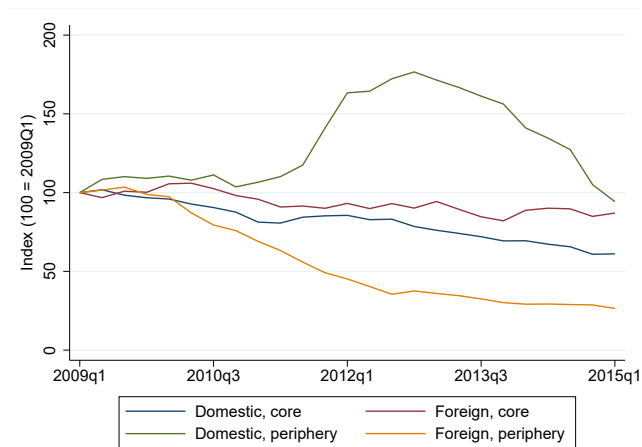
Collateral pledging of bank-issued securities with the ECB



Banks located in distressed **periphery** countries increased pledging of **domestic** bank bonds

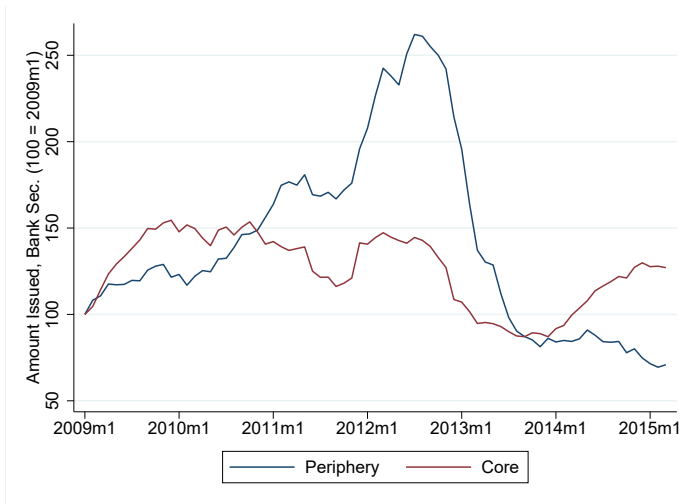
Changes in pledging reflects the changes in holding

↑ pledging of domestic periphery bank bonds is reflected in ↑ holding (and issuances)



Increase in bank bond holding is associated with bond issuances

Banks located in distressed periphery countries also increased issuance of pledgable bonds



Full sample

Empirical strategy: Full sample

$$\frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s} = \alpha_t + \alpha_b + \alpha_s + \alpha_r + \gamma X_{s,t-1} + \beta_1 \text{HaircutGap}_{s,t-1} + \beta_2 (\text{HaircutGap}_{s,t-1} \times H_{s,b}) + \epsilon_{s,b,t}$$

- Exploit the variation in the haircut gap both at the cross-section of securities and over time
- Explore the heterogeneous responses: similarity of the issuing and pledging banks, systemic importance of the issuer etc.
- Saturate with fixed effects and controls
 - Time and Bank FE: control for agg. changes over time and perm. diff across banks
 - ISIN FE: capture security characteristics (i.e. issuer, coupon payments, guarantees)
 - Rating group FE: control for time-varying riskiness of the pledged asset
 - Time-varying security controls: residual maturity, price
- Sample: 2009m1-2015m3

Importance of bank bonds

- Bank bonds are heavily held by other banks who have access to the LOLR facilities \implies more sensitive to the haircut gap
- 1 s.d. \uparrow in HG (12 pp) is associated with a **1.9% increase** in the pledging of bank bonds compared to the mean value of pledged securities

	$\frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s}$		
	(1)	(2)	(3)
HaircutGap _{s,t-1}	0.00369*** (0.000308)	0.00295*** (0.000347)	0.00522*** (0.000594)
HaircutGap _{s,t-1} \times Bank Bonds _s	0.00634*** (0.000780)	0.00567*** (0.000788)	0.00307*** (0.000848)
Controls	No	Yes	Yes
Time FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes
Rating group FE	No	No	Yes
N	3,757,583	3,757,580	3,757,580
R ²	0.867	0.867	0.86

Systemic risk

Explore additional heterogeneities

1. Similarity vs Risk-sharing

- Information frictions and peer monitoring (Rochet and Tirole, 1996)
 - ⇒ Stronger linkages to **similar banks**
- Risk sharing motives (Allen and Gale, 2000, 2007)
 - ⇒ Stronger linkages to **different banks**

2. Bailout expectations (Acharya and Yorulmazer, 2007; Farhi and Tirole, 2012)

- Bailout expectations in the event of a systemic crisis
 - ⇒ Stronger linkages to **systemically important banks** (TBTF) or **cross-pledging of bank bonds**
 - ⇒ “too-many-to-fail” problem

1. Similarity: Systemic risk and bond price correlation

- Higher haircut gaps increase bank linkages between issuing and pledging banks whose **bond prices are ex-ante strongly correlated** \implies higher bank interconnectedness

	$\frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s}$		
	(1)	(2)	(3)
HaircutGap $_{s,t-1} \times$ Correlation $_{s,b,t-1}$	0.0293*** (0.00354)	0.0291*** (0.00354)	0.0291*** (0.00353)
HaircutGap $_{s,t-1}$	0.00278 (0.00194)	0.00284 (0.00196)	0.00153 (0.00174)
Controls	No	Yes	Yes
Time FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes
Rating group FE	No	No	Yes
N	1,112,014	1,112,014	1,112,014
R ²	0.812	0.812	0.812

1. Similarity: Systemic risk and domestic bonds

- The effect of the haircut gap on bank pledging is fully driven by **domestic bonds**
- 1 s.d. \uparrow in HG is associated with a **3.5% increase** in the pledging of domestic bank bonds
- Segmented banking sector: banks are better equipped to monitor peers in the same market

	$\frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s}$		
	(1)	(2)	(3)
HaircutGap _{s,t-1} × Domestic _{s,b}	0.0169*** (0.00146)	0.0159*** (0.00146)	0.0151*** (0.00147)
HaircutGap _{s,t-1} × Foreign _{s,b}	0.00147 (0.00133)	0.000374 (0.00133)	-0.000408 (0.00135)
Controls	No	Yes	Yes
Time FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes
Rating group FE	No	No	Yes
N	2,662,362	2,662,362	2,662,362
R ²	0.869	0.869	0.869

2. Bailout expectations and systemically important banks

Hypothesis: Within domestic banks, high haircut gaps provide incentives to banks to pledge bonds issued by other systematically important banks

Measurement of the systemic importance of issuing bank:

- SRISK (Brownlees and Engle, 2017)
- Size (total assets)
- Leverage (equity ratio)

$$\begin{aligned} \frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s} &= \alpha_t + \alpha_b + \alpha_s + \alpha_r + \gamma X_{s,t-1} \\ &+ \beta_1(\text{SRISK}_{s,t-1} \times \text{Domestic}_{s,b} \times \text{HaircutGap}_{s,t-1}) \\ &+ \beta_2(\text{SRISK}_{s,t-1} \times \text{HaircutGap}_{s,t-1}) + \\ &+ \beta_3(\text{Domestic}_{s,b} \times \text{HaircutGap}_{s,t-1}) + \\ &+ \beta_4 \text{HaircutGap}_{s,t-1} + \beta_5(\text{Domestic}_{s,b} \times \text{SRISK}_{s,t-1}) + \\ &+ \beta_6 \text{Domestic}_{s,b} + \beta_7 \text{SRISK}_{s,t-1} + \epsilon_{s,b,t} \end{aligned}$$

2. Bailout expectations: SRISK

A 1 s.d. \uparrow in HG is associated with a **5.2% increase** in the pledging of domestic bank bonds issued by systemically important banks

	value pledged _{s,b,t} value outstanding _s		
	(1)	(2)	(3)
Domestic _{s,b} \times SRISK _{s,t-1} \times HaircutGap _{s,t-1}	0.0225*** (0.00384)	0.0221*** (0.00384)	0.0224*** (0.00385)
Domestic _{s,b} \times HaircutGap _{s,t-1}	0.00877** (0.00344)	0.00914*** (0.00344)	0.00899*** (0.00344)
SRISK _{b,t-1} \times HaircutGap _{s,t-1}	-0.00943*** (0.00220)	-0.00925*** (0.00220)	-0.0101*** (0.00222)
HaircutGap _{s,t-1}	0.00239 (0.00168)	0.00121 (0.00169)	0.00114 (0.00167)
Controls	No	Yes	Yes
Time FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes
Rating group FE	No	No	Yes
N	2,586,886	2,586,886	2,586,886
R ²	0.872	0.872	0.872

2. Bailout expectations: increase in the cross-holding concentration

- Within dom. bonds: stronger linkages between banks that pledge (hold) each other's bonds
- 1 s.d. \uparrow in HG is associated with a **11% increase** in the pledging of cross-held bank bonds

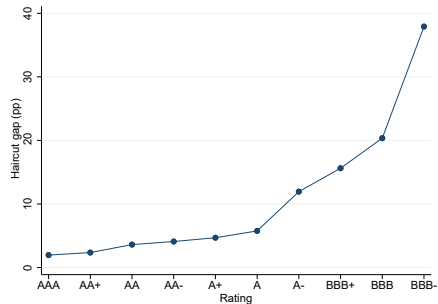
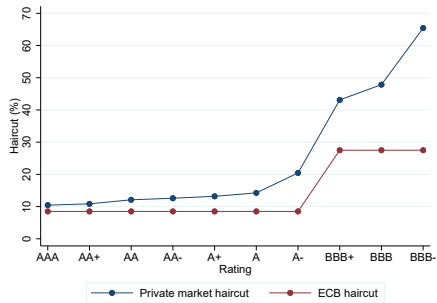
	value pledged _{s,b,t} value outstanding _s		
	(1)	(2)	(3)
CrossPledge _{s,b,t-1} × Domestic _{s,b} × HaircutGap _{s,t-1}	0.0566*** (0.00708)	0.0581*** (0.00720)	0.0577*** (0.00727)
CrossPledge _{s,b,t-1} × HaircutGap _{s,t-1}	-0.0148** (0.00614)	-0.0176*** (0.00624)	-0.0171*** (0.00630)
Domestic _{s,b} × HaircutGap _{s,t-1}	0.00392 (0.00264)	0.00508* (0.00273)	0.00556** (0.00277)
HaircutGap _{s,t-1}	0.000849 (0.00136)	-0.00000507 (0.00138)	-0.00103 (0.00143)
Controls	No	Yes	Yes
Time FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes
Rating group FE	No	No	Yes
N	2,748,282	2,633,826	2,621,815
R ²	0.863	0.869	0.870

Robustness

- Issuer Country x Time fixed effects [Details](#)
- Issuer x Time fixed effects [Details](#)
- ISIN x Time [Details](#)
- (Pledging) Bank x Time fixed effects [Details](#)
- vLTRO Period [Details](#)
- Excluding one country at a time
- Imputation technique: Bayesian Model Averaging (BMA), Simple Linear Regression [Details](#)
- Raw (unimputed) data [Details](#)
- Outcome variable using sectoral holding data [Details](#)
- Measures to systemic importance: size, equity ratio [Details: Size](#) [Details: Equity](#)
- No haircut gap, but just rating [Details](#)

Identification using ECB haircut rules

Identification using ECB haircut rules



1. ECB and private market haircuts differ in their sensitivity to rating changes
⇒ **Kinks and jumps in the haircut gap profile**
2. ECB reacts only to the first best rating of the four agencies (S&P, Moody's, Fitch, DBRS). Private markets can react to any rating change
⇒ **Binding and non-binding downgrades at A- notch**

Systemic risk and domestic bonds (two identifications)

	$\frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s}$				
	Strategy 1: Kinks and Jumps			Strategy 2: Binding Downgrades	
	(1)	(2)	(3)	(4)	(5)
HaircutGap $_{s,t-1} \times \text{Domestic}_{s,b}$	0.0167*** (0.00552)	0.0170*** (0.00550)	0.0160*** (0.00569)	0.0263*** (0.00662)	0.0172*** (0.00632)
HaircutGap $_{s,t-1} \times \text{Foreign}_{s,b}$	-0.0129** (0.00514)	-0.0125** (0.00518)	-0.0136*** (0.00511)	0.00172 (0.00590)	-0.00638 (0.00572)
Controls	No	Yes	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes	Yes
Rating group FE	No	No	Yes	-	-
N	137,587	137,587	137,587	42,130	42,130
R ²	0.891	0.891	0.891	0.925	0.925

Identification using ECB haircut rules: Summary of results

- Correlation of bond prices [Results](#)
- Core vs Periphery [Results](#)
- Systemically important banks [Results](#)

External validity

Compare the effects of haircut gap on bank bond holdings **across different sectors**:

- Higher haircut gap is associated with increased holding of the security only for banks (sector that has access to LOLR liquidity)
- The effect is negative for holdings by sectors without access to LOLR operations

	value held _{s,b,t} value outstanding _s		
	(1)	(2)	(3)
HaircutGap _{s,t-1} × Sector with LOLR access	0.0480*** (0.0062)	0.0463*** (0.0062)	0.0535*** (0.0066)
HaircutGap _{s,t-1} × Sector without LOLR access	-0.0105*** (0.0027)	-0.0125*** (0.0028)	-0.0086*** (0.0032)
Controls	No	Yes	Yes
Time FE	Yes	Yes	Yes
Country × Sector FE	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes
Rating group FE	No	No	Yes
N	861,644	861,644	849,884
R ²	0.6734	0.6734	0.6748

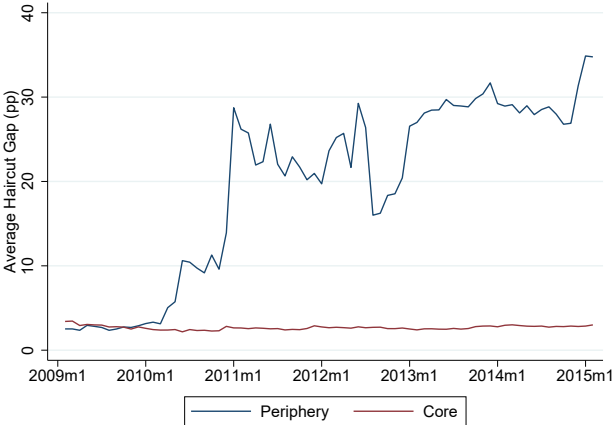
Conclusion & contributions

- We show the effect of LOLR policies on bank interconnectedness and systemic risk
- Importance of bank bonds: critical but less-understood source of collateral, even more sensitive to LOLR than government bonds
- High haircut gaps exacerbate systemic risk which arises from cross-holding of bank bonds
- Our results do not imply that LOLR increases overall systemic risk but that it increases systemic risk at the margin by encouraging the cross-holding of bank bonds

Additional Material

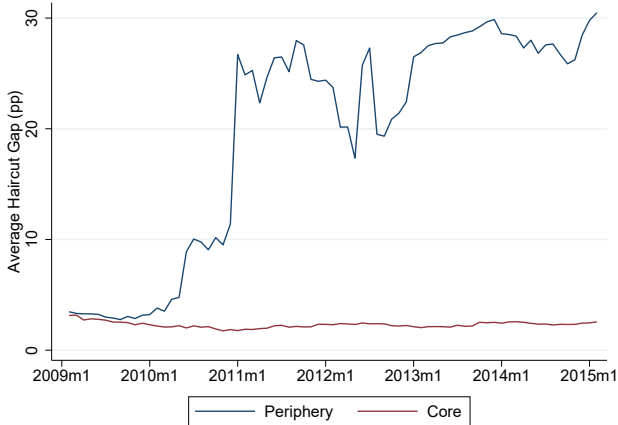
Average haircut gap for securities issued in core and periphery

Bank bonds, all countries



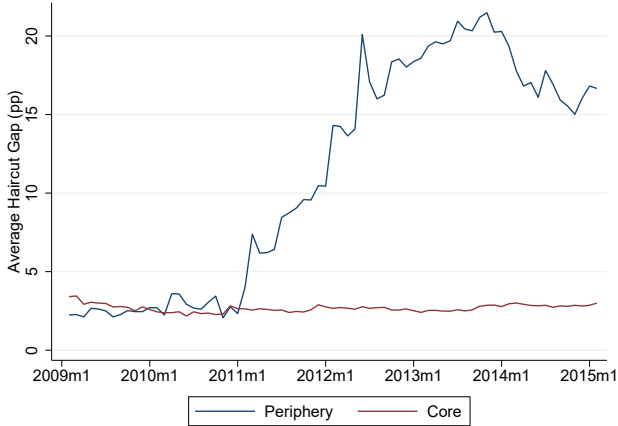
Average haircut gap for securities issued in core and periphery

Bank and gov't bonds, all countries



Average haircut gap for securities issued in core and periphery

Bank bonds, no Greece

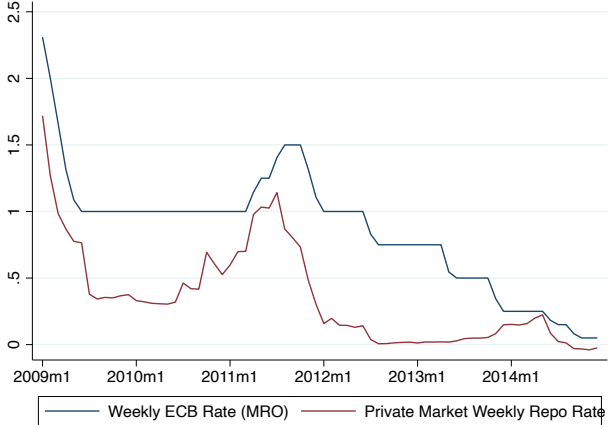


Summary statistics

		N	mean	sd
Bank-Security-Time level				
Haircut gap	in percentage points	3,757,580	6.06	11.97
Private market haircut	in %	3,757,580	11.98	14.86
ECB haircut	in %	3,757,580	5.91	5.96
Value pledged	in % of value outstanding	3,757,580	5.16	18.50
Security-Time level				
Haircut gap	in percentage points	477,104	5.19	10.00
Private market haircut	in %	477,104	11.79	12.53
ECB haircut	in %	477,104	6.60	5.27
Value pledged	in % of value outstanding	477,104	41.40	39.40
Residual maturity	in years	477,104	3.56	4.11
Rating	numerical scale	477,104	4.1	2.7

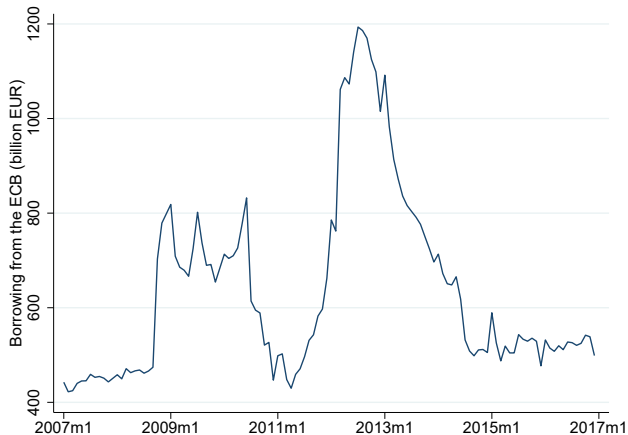
Notes: This table show the summary statistics of key variables for the sample period Jan 2009 – March 2015.

ECB vs Private Market Repo Rates



Total bank borrowing from the ECB

- ECB's LOLR interventions as a reaction to Global Financial and Sovereign Debt Crises
- At the peak, banks borrowed EUR 1.2 trillion from the ECB



Robustness to haircut gap measures

Imputation techniques and unimputed data

	$\frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s}$			
	Random Forest (Baseline)	BMA	Linear regression	Unimputed data
	(1)	(2)	(3)	(4)
HaircutGap _{s,t-1} × Domestic _{s,b}	0.0151*** (0.0014)	0.0163*** (0.0011)	0.0126*** (0.0012)	0.0260*** (0.0060)
HaircutGap _{s,t-1} × Foreign _{s,b}	-0.0004 (0.0013)	0.0019* (0.0010)	0.0012 (0.0010)	-0.0167*** (0.0039)
Controls	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes
Rating group FE	Yes	Yes	Yes	Yes
N	2,662,362	1,985,012	2,111,269	150,567
R ²	0.869	0.838	0.839	0.898

Outcome variable: holding and pledging

	$\frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s}$	$\frac{\text{value held}_{s,c,t}}{\text{value outstanding}_s}$
	Baseline (1)	(2)
HaircutGap _{s,t-1} × Domestic _{s,b}	0.0151*** (0.0014)	
HaircutGap _{s,t-1} × Foreign _{s,b}	-0.0004 (0.0013)	
HaircutGap _{s,t-1} × Domestic _{s,c}		0.0433*** (0.0137)
HaircutGap _{s,t-1} × Foreign _{s,c}		-0.0103 (0.0067)
Controls	Yes	Yes
Time FE	Yes	Yes
Country FE	-	Yes
Bank FE	Yes	No
ISIN FE	Yes	Yes
Rating group FE	Yes	Yes
N	2,662,362	195,250
R ²	0.869	0.881

vLTRO period

	$\frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s}$		
	(1)	(2)	(3)
HaircutGap $_{s,t-1} \times \text{Domestic}_{s,b} \times \text{Post}_t$	0.0138*** (0.00483)	0.0128*** (0.00483)	0.0124*** (0.00484)
HaircutGap $_{s,t-1} \times \text{Domestic}_{s,b}$	0.0180*** (0.00466)	0.0186*** (0.00466)	0.0185*** (0.00466)
HaircutGap $_{s,t-1} \times \text{Post}_t$	-0.0025 (0.00268)	-0.0025 (0.00268)	-0.0019 (0.00278)
HaircutGap $_{s,t-1}$	-0.0104*** (0.00310)	-0.0104*** (0.00311)	-0.0096*** (0.00308)
Controls	No	Yes	Yes
Time FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes
Rating group FE	No	No	Yes
N	541,293	541,293	541,293
R ²	0.875	0.875	0.875

Robustness to fixed effects

	value pledged _{s,b,t} value outstanding _s							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Domestic _{s,b} × SRISK _{s,t-1} × HaircutGap _{s,t-1}					0.0223*** (0.00394)	0.0198*** (0.00448)	0.0219*** (0.00548)	0.0117** (0.00528)
Domestic _{s,b} × HaircutGap _{s,t-1}	0.0157*** (0.00242)	0.0181*** (0.00265)	0.0144*** (0.00299)	0.0115*** (0.00294)	0.0100*** (0.00349)	0.0136*** (0.00391)	0.0110** (0.00454)	0.0115*** (0.00440)
SRISK _{s,t-1} × HaircutGap _{s,t-1}					-0.0117*** (0.00239)	-0.00859*** (0.00323)		
HaircutGap _{s,t-1}	-0.000523 (0.00146)	0.00259 (0.00178)			0.000630 (0.00183)	0.00231 (0.00239)		
Controls	Yes	Yes	Yes	-	Yes	Yes	Yes	-
Issuer Country-Time FE	Yes	-	-	-	Yes	-	-	-
ISIN FE	Yes	Yes	-	-	Yes	Yes	-	-
Issuer-Time FE	No	Yes	-	-	No	Yes	-	-
Bank FE	Yes	Yes	Yes	-	Yes	Yes	Yes	-
Rating group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ISIN-Time FE	No	No	Yes	Yes	No	No	Yes	Yes
Bank-Time FE	No	No	No	Yes	No	No	No	Yes
N	2,662,332	2,617,669	2,483,341	2,468,470	2,586,856	2,582,796	2,412,072	2,397,216
R ²	0.871	0.873	0.900	0.941	0.874	0.876	0.901	0.942

Systemic risk and size of issuing bank

	$\frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s}$		
	(1)	(2)	(3)
$\text{LargeBank}_{s,t-1} \times \text{Domestic}_{s,b} \times \text{HaircutGap}_{s,t-1}$	0.0345*** (0.00423)	0.0344*** (0.00424)	0.0352*** (0.00425)
$\text{Domestic}_{s,b} \times \text{HaircutGap}_{s,t-1}$	0.00367 (0.00287)	0.00385 (0.00288)	0.00353 (0.00287)
$\text{LargeBank}_{s,t-1} \times \text{HaircutGap}_{s,t-1}$	-0.0173*** (0.00231)	-0.0171*** (0.00233)	-0.0183*** (0.00236)
$\text{HaircutGap}_{s,t-1}$	0.00780*** (0.00155)	0.00688*** (0.00154)	0.00635*** (0.00155)
Controls	No	Yes	Yes
Time FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes
Rating group FE	No	No	Yes
N	2,130,742	2,130,742	2,130,742
R ²	0.867	0.867	0.867

Systemic risk and equity ratio of issuing bank

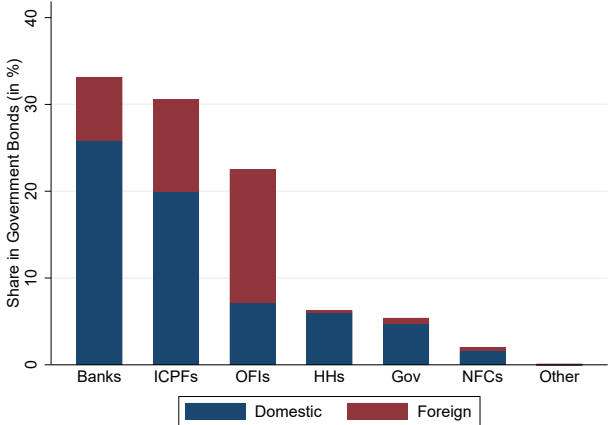
	value pledged _{s,b,t} value outstanding _s		
	(1)	(2)	(3)
LowEquityRatio _{s,t-1} × Domestic _{b,s} × HaircutGap _{s,t-1}	0.0206*** (0.00200)	0.0195*** (0.00199)	0.0203*** (0.00205)
HighEquityRatio _{s,t-1} × Domestic _{b,s} × HaircutGap _{s,t-1}	0.0149*** (0.00286)	0.0134*** (0.00287)	0.0140*** (0.00290)
LowEquityRatio _{s,t-1} × Foreign _{b,s} × HaircutGap _{s,t-1}	-0.0107*** (0.00231)	-0.0119*** (0.00232)	-0.0112*** (0.00231)
HighEquityRatio _{s,t-1} × Foreign _{b,s} × HaircutGap _{s,t-1}	-0.00220 (0.00270)	-0.00368 (0.00271)	-0.00312 (0.00278)
Controls	No	Yes	Yes
Time FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes
Rating group FE	No	No	Yes
N	1,226,806	1,226,806	1,226,806
R ²	0.884	0.884	0.884

No haircut gap, only rating

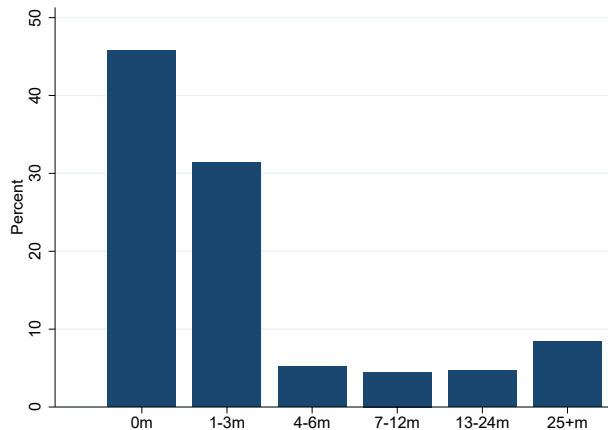
$$\frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s} = \alpha_b + \alpha_s + \alpha_t + \beta(\text{Treated}_s \times \text{Post}_t) + \gamma X_{s,t-1} + \epsilon_{s,b,t}$$

	$\frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s}$	
	(1)	(2)
Treated _{<i>i</i>} × Post _{<i>t</i>}	0.000634** (0.000286)	-0.000600 (0.000740)
Treated _{<i>i</i>} × Post _{<i>t</i>} × Domestic _{<i>s,b</i>}		0.00259*** (0.000962)
Controls	Yes	Yes
Time FE	Yes	Yes
Bank FE	Yes	Yes
ISIN FE	Yes	Yes
N	42,130	42,130
R ²	0.925	0.925

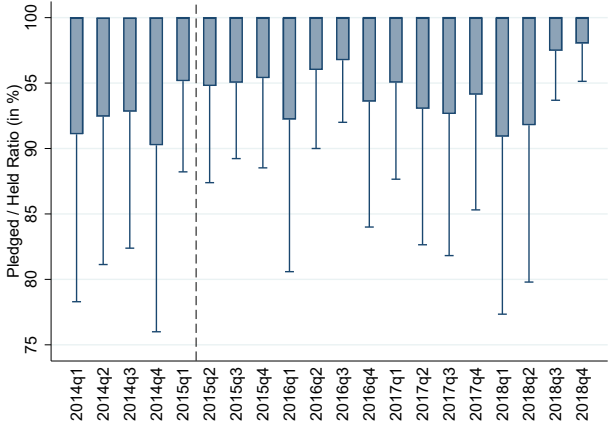
Government bond holdings across sectors



Timing of pledging of newly issued bonds



Ratio of amount pledged to held



Core vs Periphery

	$\frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s}$				
	Strategy 1: Kinks and Jumps			Strategy 2: Binding Downgrades	
	(1)	(2)	(3)	(4)	(5)
$\text{Periphery}_b \times \text{Domestic}_{s,b} \times \text{HaircutGap}_{s,t-1}$	0.0162** (0.00629)	0.0165*** (0.00627)	0.0155** (0.00655)	0.0471*** (0.00750)	0.0376*** (0.00710)
$\text{Periphery}_b \times \text{Foreign}_{s,b} \times \text{HaircutGap}_{s,t-1}$	-0.00846 (0.00669)	-0.00793 (0.00668)	-0.00902 (0.00673)	-0.0116 0.00440	-0.0178 0.00437
$\text{Core}_b \times \text{Domestic}_{s,b} \times \text{HaircutGap}_{s,t-1}$	0.00676 (0.0138)	0.00720 (0.0138)	0.00562 (0.0138)	0.00440 (0.00612)	0.00437 (0.00609)
$\text{Core}_b \times \text{Foreign}_{s,b} \times \text{HaircutGap}_{s,t-1}$	-0.0121** (0.00587)	-0.0117** (0.00591)	-0.0128** (0.00580)	-0.0816*** (0.0190)	-0.0860*** (0.0190)
Controls	No	Yes	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes	Yes
Rating group FE	No	No	Yes	-	-
N	137,587	137,587	137,587	42,130	42,130
R ²	0.891	0.891	0.891	0.925	0.925

Correlation

	$\frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s}$				
	Strategy 1: Kinks and Jumps			Strategy 2: Binding Downgrades	
	(1)	(2)	(3)	(4)	(5)
HaircutGap _{s,t-1} × Correlation _{s,b}	0.0250* (0.0139)	0.0247* (0.0139)	0.0278** (0.0134)	0.0965*** (0.0253)	0.0969*** (0.0253)
HaircutGap _{s,t-1}	-0.0163** (0.00660)	-0.0153** (0.00671)	-0.0149*** (0.00573)	-0.0403*** (0.0114)	-0.0491*** (0.0116)
Controls	No	Yes	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes	Yes
Rating group FE	No	No	Yes	-	-
N	46,089	46,089	46,089	17,210	17,210
R ²	0.891	0.891	0.891	0.943	0.943

Systemic risk: high SRISK banks

	$\frac{\text{value pledged}_{s,b,t}}{\text{value outstanding}_s}$				
	Strategy 1: Kinks and Jumps			Strategy 2: Binding Downgrades	
	(1)	(2)	(3)	(4)	(5)
$\text{Domestic}_{s,b} \times \text{HaircutGap}_{s,t-1} \times \text{SRISK}_{s,t-1}$	0.0387** (0.0173)	0.0391** (0.0173)	0.0391** (0.0173)	0.0481* (0.0253)	0.0449* (0.0255)
$\text{Domestic}_{s,b} \times \text{HaircutGap}_{s,t-1}$	0.00249 (0.0112)	0.00225 (0.0112)	0.00225 (0.0112)	-0.0129 (0.0240)	-0.0108 (0.0242)
$\text{SRISK}_{s,t-1} \times \text{HaircutGap}_{s,t-1}$	-0.0227** (0.00984)	-0.0235** (0.00985)	-0.0231** (0.00986)	-0.0013 (0.0140)	0.0045 (0.0156)
$\text{HaircutGap}_{s,t-1}$	0.000276 (0.00537)	0.00110 (0.00539)	0.0000760 (0.00532)	-0.0001 (0.0138)	-0.0145 (0.0153)
Controls	No	Yes	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes	Yes	Yes
Rating group FE	No	No	Yes	-	-
N	129,911	129,911	129,911	33,242	33,242
R ²	0.896	0.896	0.896	0.9331	0.9331

1. Similarity: core vs periphery

- Disproportionately higher buildup of systemic risk in periphery countries where security haircut gaps are the most sizable

	value pledged _{s,b,t} value outstanding _s		
	(1)	(2)	(3)
Periphery _b × Domestic _{s,b} × HaircutGap _{s,t-1}	0.0170*** (0.00173)	0.0170*** (0.00175)	0.0168*** (0.00181)
Periphery _b × Foreign _{s,b} × HaircutGap _{s,t-1}	0.00343* (0.00185)	0.00300 (0.00186)	0.00175 (0.00188)
Core _b × Domestic _{s,b} × HaircutGap _{s,t-1}	0.00352 (0.00318)	0.00222 (0.00341)	0.000382 (0.00343)
Core _b × Foreign _{s,b} × HaircutGap _{s,t-1}	0.00194 (0.00139)	0.000946 (0.00142)	-0.0000805 (0.00146)
Controls	No	Yes	Yes
Time FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
ISIN FE	Yes	Yes	Yes
Rating group FE	No	No	Yes
N	2,791,549	2,675,861	2,662,362
R ²	0.862	0.869	0.869

Do higher haircut gaps also impact the decision to issue new securities?

Issuance: Security-level analysis

$$\log(\text{value issued})_{s,t} = \alpha_t + \alpha_r + \alpha_c + \beta \mathbb{E}_{t-1}(\text{HaircutGap}_{s,t}) + \gamma X_{s,t} + \epsilon_{s,t}$$

	$\log(\text{value issued})_{s(t)}$			
	(1)	(2)	(3)	(4)
$\mathbb{E}_{t-1}(\text{HaircutGap}_{s,t})$	0.845*** (0.153)	1.378*** (0.352)	2.633*** (0.398)	2.426*** (0.368)
Controls	Yes	Yes	Yes	Yes
Date issued FE	Yes	Yes	Yes	Yes
Rating group FE	No	Yes	No	No
Rating FE	No	No	Yes	Yes
Country of issuer FE	No	No	No	Yes
N	8,245	8,245	8,243	8,242
R ²	0.0580	0.108	0.142	0.282

A 1 pp increase in the HG is associated with the 2.4% increase in the value of bond issuances

Do higher haircut gaps also impact the decision to issue new securities?

Issuance: Bank-level analysis

$$\log(\text{value outstanding})_{b,t} = \alpha_t + \alpha_r + \alpha_b + \beta \text{HaircutGap}_{b,t-1} + \epsilon_{b,t}$$

	$\log(\text{value outstanding})_{b,t}$			
	(1)	(2)	(3)	(4)
HaircutGap $_{b,t-1}$	0.274*** (0.0480)	0.774*** (0.0552)	0.579*** (0.0874)	0.537*** (0.0924)
Time FE	No	Yes	Yes	Yes
Issuing bank FE	Yes	Yes	Yes	Yes
Rating group FE	No	No	Yes	No
Rating FE	No	No	No	Yes
N	25,212	25,212	23,327	20,599
R ²	0.954	0.955	0.955	0.963

- The issuance of new debt goes beyond replacement of maturing debt
- High haircut gaps incentivize banks to issue additional bank bonds and increase the total dependence on the bond market financing