

Interbank Puzzle

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Motivation

The interbank market is an global, informal market in which banks borrow and lend funds to each other up to established internal limits based on the risk appetite of an institution.

Interbank markets allows

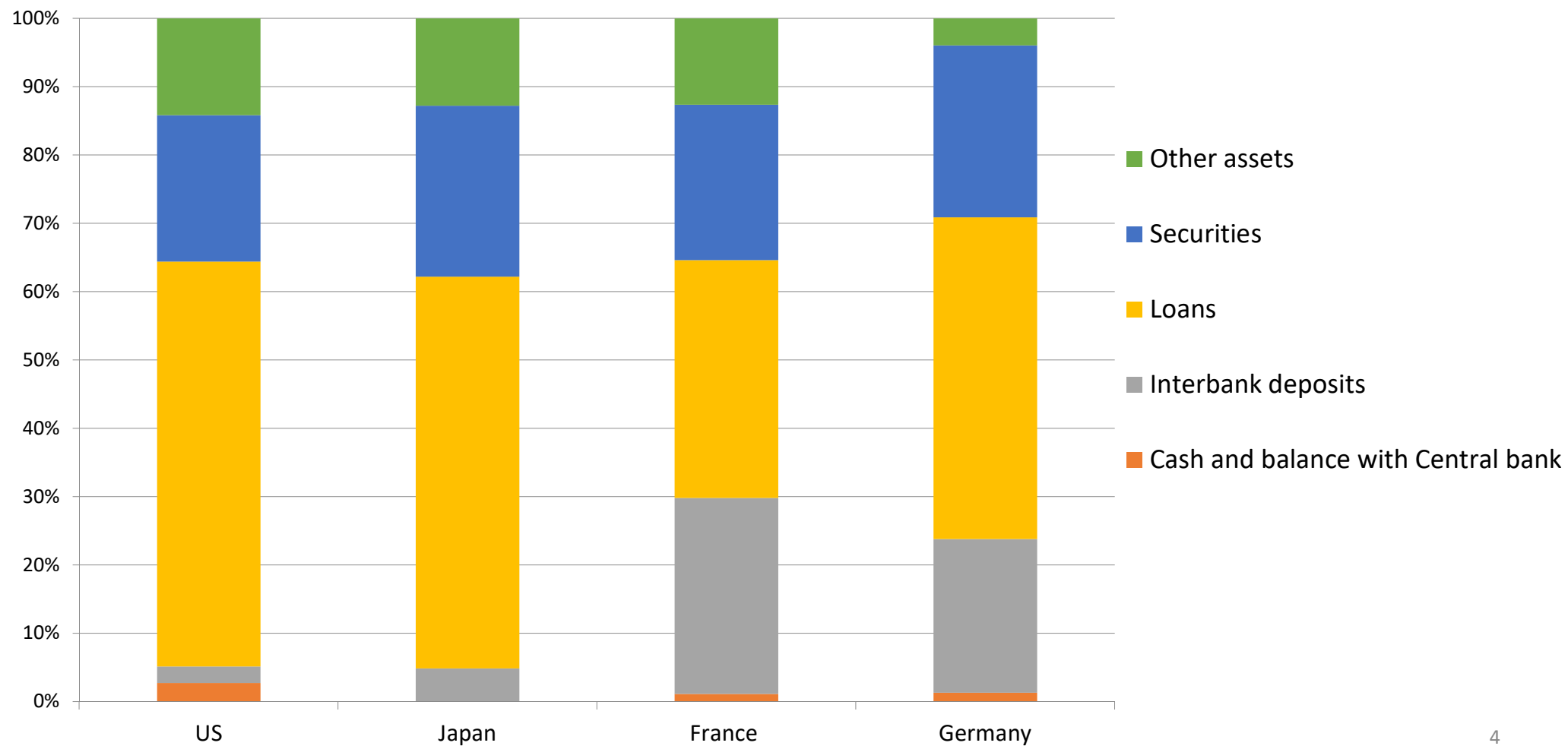
- efficient liquidity transfer between surplus and needy banks (risk-sharing) (Bhattacharya and Gale, 1987; Acharya et al., 2008)
- central bank's intervention to guide policy interest rates (Furfine, 2001)

Motivation

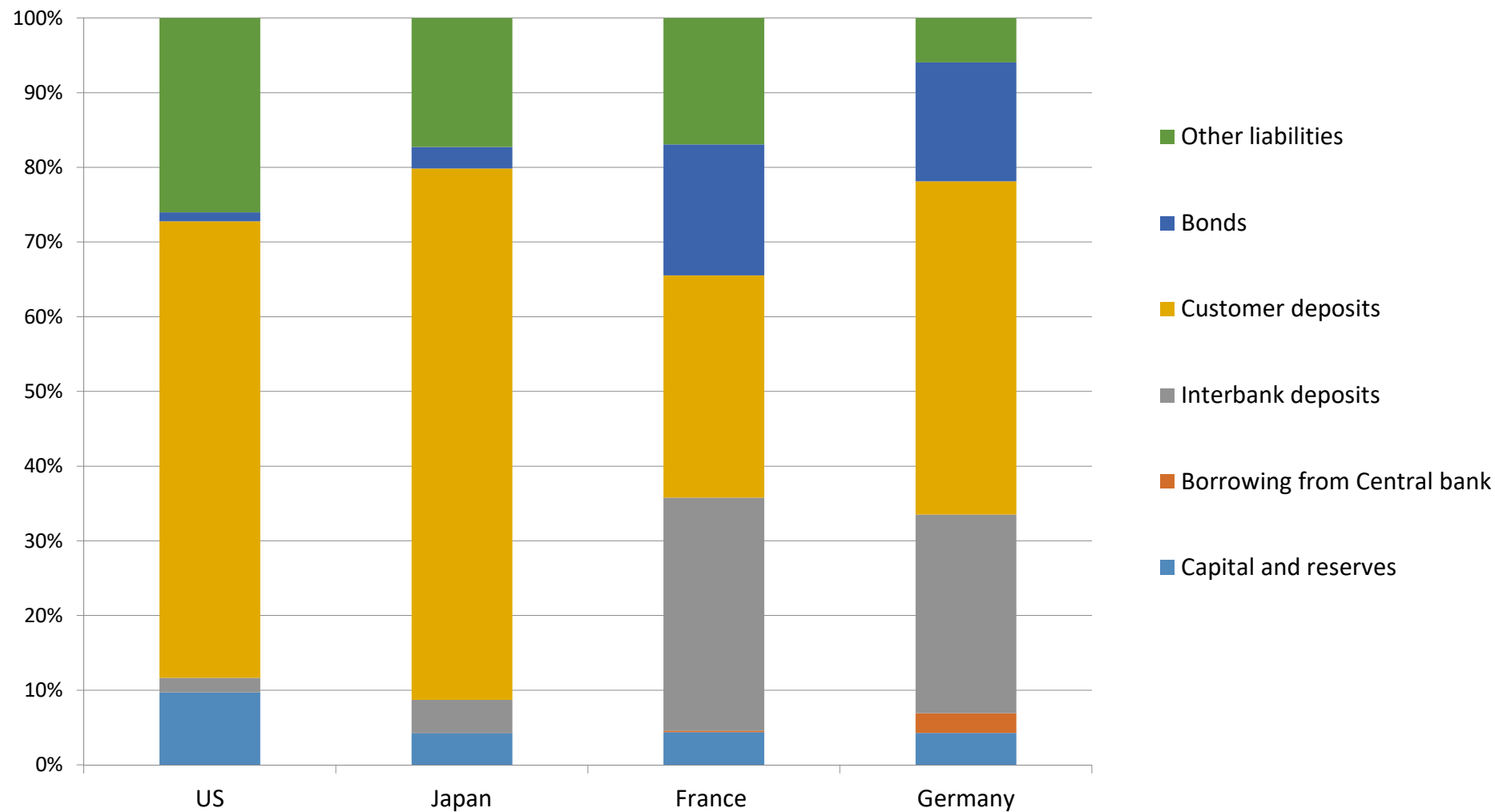
Recent studies suggest that interbank market may differ across countries

- In Germany, the average interbank exposure among commercial banks is longer than one year (Bluhm, Georg and Krahn, 2016)
- In UK and Denmark, loans and deposits with the maturity of one day account form most of the interbank activity (Asena, Iori and Montes-Rojas, 2015; Abildren et al., 2015)

Assets: 10-year average (2000-2009)



Liabilities: 10-year average (2000-2009)



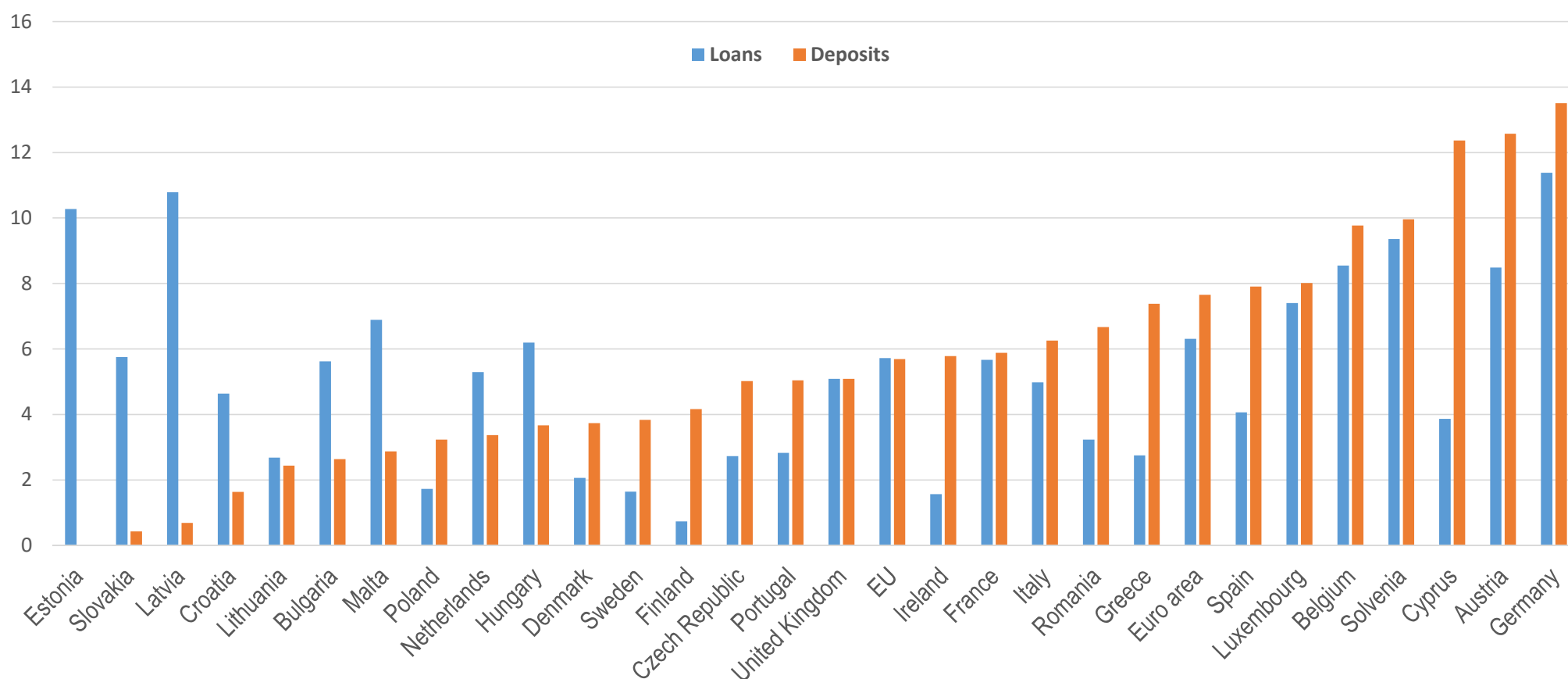
Motivation

Studies show mixed results on the impact of the global crisis on interbank

- precautionary hoarding by settlement banks (Acharya and Merrouche 2009), fewer interbank lending relationships during the crisis (Wetherilt et al. 2009), shifts in timing of interbank loans during the sub-prime turmoil (Halsall et al. 2008) for UK
- low risk of interbank contagion (Memmel and Stein 2008) for Germany
- Interbank rates become more sensitive to borrower characteristics (Angelini, Nobili and Picillo 2009) for Italy
- “Run on repo” with increased haircuts in the \$10 trillion repo market especially for lower quality assets (Gorton and Metrick 2009) for US

EU Interbank market

The figure shows the interbank loans and deposits as % of total assets of all domestic banking groups and stand-alone banks in 2016



The interbank market puzzle

The average ratio of interbank activities to total bank position has been quite stable over time from a long-run perspective (BIS, 1983)

- There could be great variations between banks in their use of the interbank market
- e.g. for the US, the average ratio of loans to depository institutions to total assets of insured commercial banks from 1934 to 2015 is 1.81%; while for Germany, the average ratio of interbank loans from 1950 to 2015 is 20.61%.

The data raises several important questions:

- Why is there such difference in the size of interbank market?
- What determines the interbank participation of banks?
- Is risk sharing better in those countries with larger interbank market size?

Preview of results

Trust is crucial in determining the interbank market size

- Use the length of banking crises and the number of bank failures in the history as a negative shock to the trust,
- If a bank is located in a country that has experienced longer periods of crises or more bank failures in the past, the trust can be weaker and support less interbank activities given the counterparty credit risk and possible adverse selection in this market

Preview of results

Legal and regulatory institutions also play an important role in explaining the difference in interbank market participation at the country-level.

- The institutional factors can mitigate the adverse effect of crises on interbank activities and help to strengthen/rebuild up trust in this market
- Strengthening in legal enforcement can mitigate the impact of crises on the association between market discipline and interbank borrowings.

Preview of results

Trust is NOT a proxy for other determinants of interbank market participation

- Banks with higher liquidity mismatch and risk tend to have higher demand of interbank borrowing during normal periods; whereas during crises, they have less access to the interbank market.
- Larger banks are more likely to play as net borrowers in the interbank market whereas smaller banks might have limited access to this market.

Related literature

Lending relationship in the interbank market

- Borrowing banks with concentrated interbank relationship can be almost completely insulated from exogenous shocks (Afonso et al., 2013; Brauning and Fechet, 2012)
- Data from Portuguese interbank market shows that: relationships are an important determinant of interbank market activities. Larger banks with more imbalance in their reserve deposits are more likely to be borrowers (Cocco et al. 2009).

Interbank liquidity and credit

- Borrowers' counterparty risk during crises (Freixas and Jorge, 2008; Bruche and Suarez, 2010)
- Lenders' liquidity hoarding (Allen et al., 2009; Caballero and Krishnamurthy, 2008; Acharya and Skeie, 2009)

Development and structure of financial system

- bank-based financial systems can intertemporally smooth risk and this leads to higher welfare than market-based system (Allen and Gale, 1987).
- A substantial body of literature tries to explain the differences of financial structure across countries from different perspectives including law, politics and culture (Beck et al., 2001)

Outline of the rest of the talk

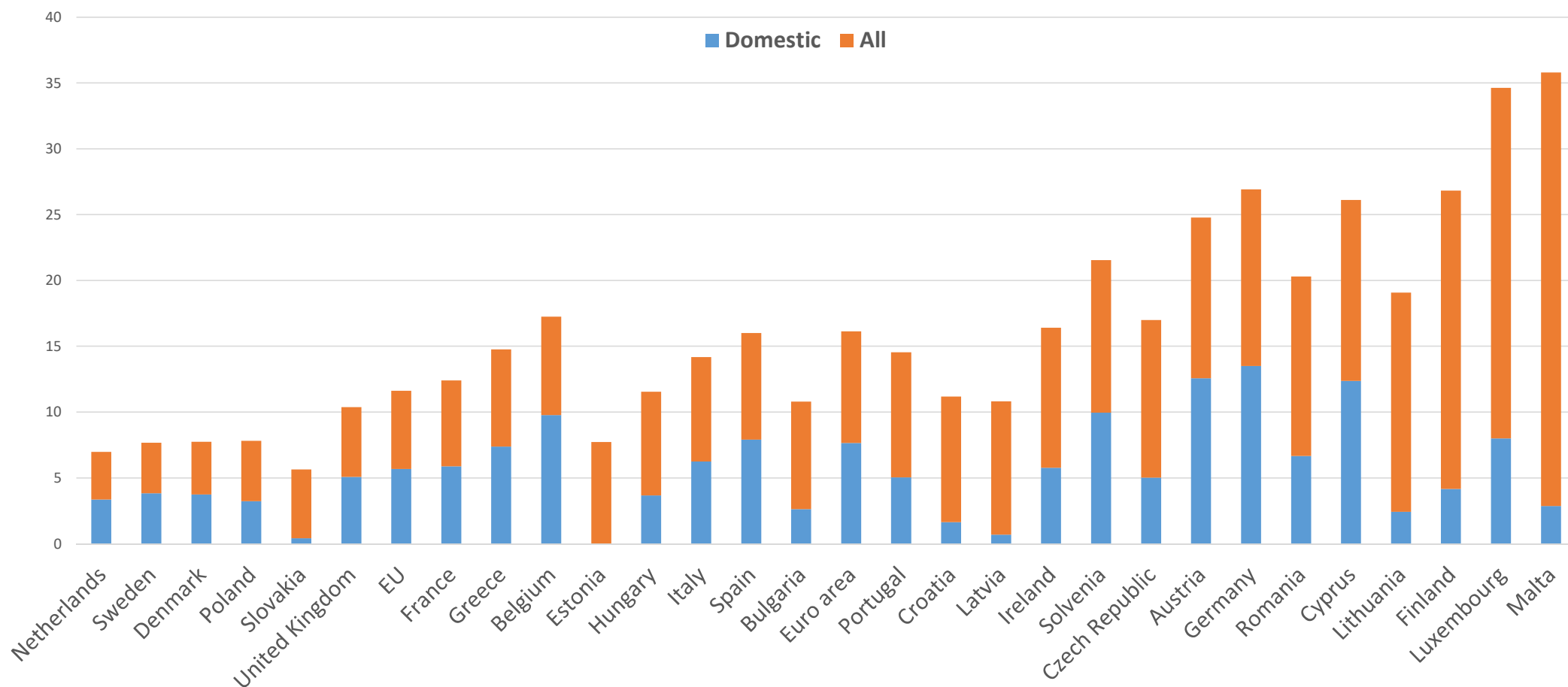
- Country-level evidence
- Bank-level data and sample
- Summary statistics
- Methodology and results
- Robustness checks
- Conclusion

Comparative statistics

	Germany		France		UK		Japan		US	
	Interbank deposits	Interbank loans	Interbank deposits	Interbank loans	Interbank deposits	Interbank loans	Interbank deposits	Interbank loans	Interbank deposits	Interbank loans
2000	29.17%	25.52%	36.09%	32.00%	8.02%	13.22%	3.00%	3.94%	6.88%	4.43%
2001	28.94%	26.42%	34.84%	32.27%	8.52%	13.74%	2.56%	3.75%	7.05%	4.87%
2002	28.87%	27.80%	35.49%	32.62%	9.73%	14.38%	2.38%	5.21%	6.71%	5.01%
2003	28.29%	27.89%	34.08%	30.55%	9.54%	13.74%	1.97%	4.48%	5.91%	4.21%
2004	28.31%	28.48%	34.75%	30.70%	10.30%	13.94%	1.91%	4.25%	5.48%	4.13%
2005	28.45%	29.29%	34.85%	30.50%	10.44%	13.95%	1.81%	4.62%	4.66%	3.46%
2006	28.48%	29.94%	34.83%	29.37%	12.44%	16.06%	1.76%	3.86%	4.60%	3.81%
2007	29.21%	31.57%	36.01%	30.38%	5.68%	10.12%	2.78%	2.68%	4.84%	4.25%
2008	28.96%	32.14%	35.49%	29.53%	6.50%	10.97%	2.57%	3.04%	3.37%	2.63%
2009	26.56%	29.65%	33.32%	28.72%	9.05%	11.92%	3.97%	2.98%	2.46%	1.86%
2010	23.44%	26.12%	31.28%	28.18%	7.93%	8.04%	3.31%	2.96%	2.15%	1.57%
2011	21.83%	26.59%	32.07%	30.97%	8.87%	8.93%	4.90%	4.34%	1.17%	0.93%
2012	21.84%	26.46%	31.70%	30.45%	9.67%	9.76%	4.43%	3.76%	1.29%	0.98%
2013	21.64%	26.84%	30.84%	30.31%	11.27%	11.03%	3.38%	4.81%	1.06%	0.78%
2014	21.76%	26.21%	30.62%	30.03%	8.08%	7.86%	3.76%	10.45%	0.83%	0.55%
Avg 2000-14	26.38%	28.06%	33.75%	30.44%	9.07%	11.84%	2.97%	4.34%	3.90%	2.90%

Interbank deposits in domestic and foreign banks

The figure shows the interbank deposits as % of total assets of all banking groups in 2016



- Our sample
 - 11,412 domestic banks over 96 countries (1995-2015)
 - Exclude banks operated in the form of subsidiaries/branches
 - Exclude countries with no more than five banks in the dataset
- Data sources
 - Bank-level data: Bankscope
 - Regulation: Worldwide Governance Indicator (WGI), Kaufmann et al. (1999, 2010, 2017)
 - Legal origins: Djankov et al.(2007)
 - Systemic banking crises: Laeven and Valencia (2013)

Variable definition

Variable	Definitions
<i>Bank characteristics</i>	
Interbank_borrowing	Borrowing and deposits from banks, divided by total assets
LTD	Gross loans, divided by customer deposits
Securities	Total securities, divided by total assets
Equity	Total equity, divided by total assets
ROA	Return on assets
Size	Bank total assets divided by GDP of the country
<i>Country characteristics</i>	
Central bank	Central bank total assets, divided by GDP
Private credit	Private credit by deposit money banks, divided by GDP
Market cap	Stock market capitalization, divided by GDP
Concentration	Assets of three largest commercial banks as a share of total commercial banking assets.
Common law	Equals to 1 if the legal origin of the country is common law.
Rule law	The index of rule of law
Regulation quality	The index of regulation quality
Gov effect	The index of government effectiveness
Accountability	The index of accountability
Political stability	The index of political stability
Crisis	The number of banking crises occurred in the country from 1970-2015.
Failure	Logarithm of the sum of bank failures in the country based on the status of banks
Bank Z-Score	Ratio of return on assets plus capital-asset-ratio to the standard deviation of return on assets

Summary statistics

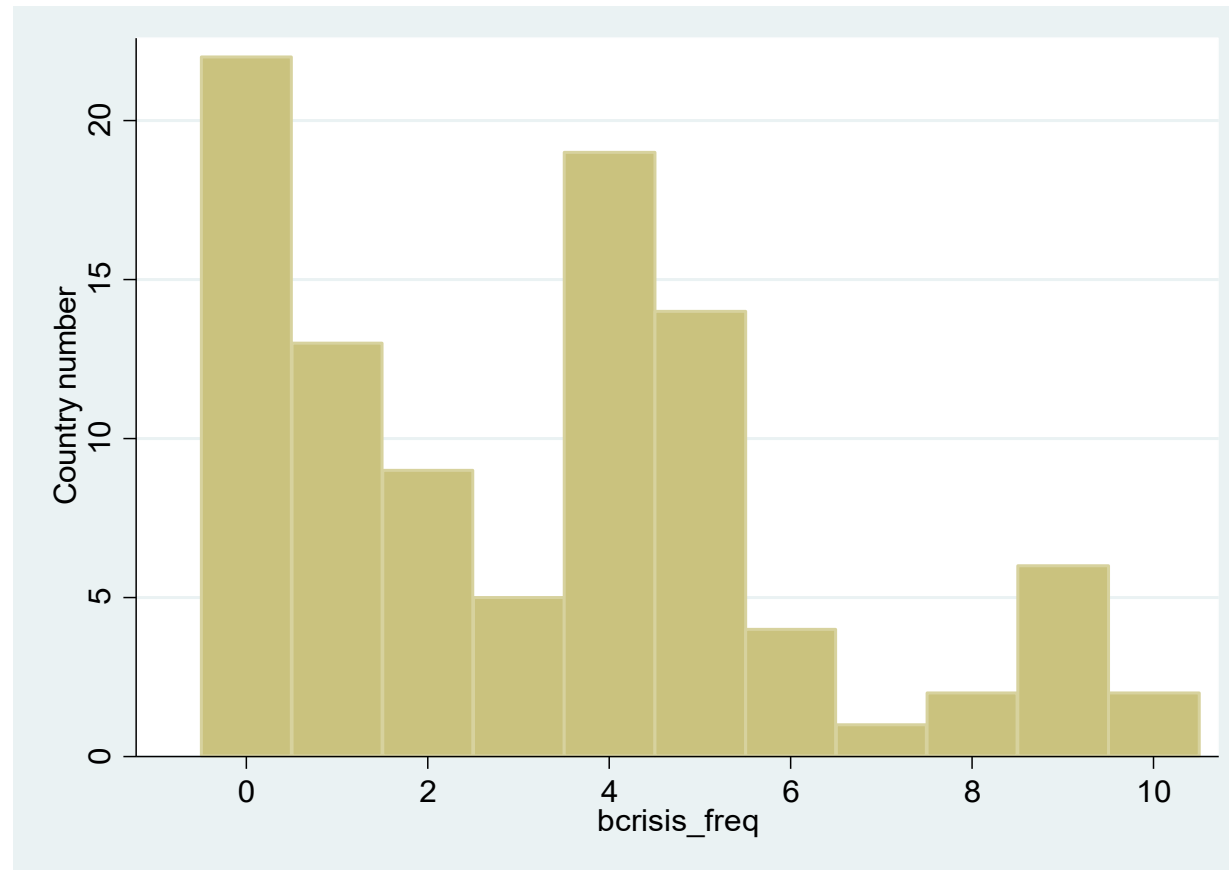
	Obs	Mean	Std. Dev.	Min	Max
Interbank deposits	74,578	0.0775	0.1107	0.0000	1.0000
LtD	74,578	0.9271	0.5621	0.0657	5.4421
Securities	74,578	0.2135	0.1494	0.0000	0.9903
Equity	74,578	0.0947	0.0534	0.0147	0.3309
ROA	74,578	0.0054	0.0103	-0.0606	0.0727
Size	74,578	0.0026	0.0176	0.0000	0.8561
Crisis length	74,572	4.8989	1.4827	0.0000	10.0000
Bank Z-score	74,195	2.9905	2.7138	-0.3123	11.4330
Common law	73,866	0.3517	0.4775	0.0000	1.0000
Rule of law	72,245	1.2728	0.7560	-1.8900	2.1200
Reg. quality	72,212	1.1628	0.5810	-2.1500	2.2500
Gov. effect	72,212	1.3133	0.6904	-1.7100	2.3600
Accountability	72,247	1.0269	0.6211	-2.1000	1.8300
Pol. stability	72,247	0.6239	0.5906	-2.4100	1.6600
Private credit	73,535	0.7884	0.3481	0.0115	2.6246
Market Cap.	72,803	0.7471	0.4832	0.0001	8.5733
Central Bank	73,556	0.0643	0.0737	0.0000	1.1358
Concentration	69,682	0.5515	0.2084	0.2228	1.0000

Comparison of bank characteristics

Longer vs shorter periods of banking crisis country

	Long	Obs.	Short	Obs.	Diff
Interbank deposits	0.020	33,966	0.123	33,966	0.103***
	(0.000)		(0.001)		(0.001)
LtD	0.862	33,966	0.993	33,966	0.131***
	(0.003)		(0.003)		(0.004)
Securities	0.216	33,966	0.214	33,966	-0.002
	(0.000)		(0.001)		(0.001)
Equity	0.114	33,966	0.083	33,966	-0.031***
	(0.000)		(0.000)		(0.000)
ROA	0.006	33,966	0.004	33,966	-0.002*
	(0.000)		(0.000)		(0.000)
Size	0.001	33,966	0.004	33,966	0.003***
	(0.000)		(0.000)		(0.000)

The length of banking crisis



Main results (1)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
LtD	0.0695***	0.0674***	0.0696***	0.0669***	0.0662***	0.0689***	0.0669***	0.0691***	0.0663***	0.0660***
	(0.00175)	(0.00174)	(0.00176)	(0.00172)	(0.00174)	(0.00178)	(0.00177)	(0.00179)	(0.00176)	(0.00176)
Securities	0.0845***	0.0840***	0.0850***	0.0863***	0.0891***	0.0888***	0.0887***	0.0891***	0.0912***	0.0922***
	(0.00335)	(0.00338)	(0.00335)	(0.00336)	(0.00337)	(0.00347)	(0.00349)	(0.00347)	(0.00348)	(0.00348)
Equity	-0.133***	-0.146***	-0.129***	-0.152***	-0.162***	-0.156***	-0.168***	-0.152***	-0.176***	-0.177***
	(0.00909)	(0.00914)	(0.00905)	(0.00917)	(0.00927)	(0.00925)	(0.00931)	(0.00921)	(0.00937)	(0.00940)
ROA	-0.0766*	-0.0979**	-0.0892**	-0.111***	-0.165***	-0.00541	-0.0332	-0.0171	-0.0582	-0.0869**
	(0.0393)	(0.0393)	(0.0394)	(0.0388)	(0.0388)	(0.0410)	(0.0410)	(0.0410)	(0.0406)	(0.0406)
Size	0.00972***	0.00961***	0.00969***	0.00953***	0.00940***	0.0103***	0.0101***	0.0103***	0.00995***	0.00988***
	(0.000279)	(0.000282)	(0.000278)	(0.000284)	(0.000287)	(0.000289)	(0.000291)	(0.000288)	(0.000294)	(0.000295)

- Banks with higher liquidity mismatch and higher risk in terms of lower equity ratio tend to borrow more from interbank market.
- Larger banks are more likely to be borrowers in the interbank market

Main results (2)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Private credit	0.00912***	0.0183***	0.00601**	0.0237***	0.0251***	0.0153***	0.0242***	0.0123***	0.0299***	0.0284***
	(0.00250)	(0.00243)	(0.00250)	(0.00242)	(0.00244)	(0.00249)	(0.00244)	(0.00249)	(0.00244)	(0.00246)
Mkt. cap.	-0.0507***	-0.0505***	-0.0539***	-0.0491***	-0.0494***	-0.0490***	-0.0487***	-0.0519***	-0.0475***	-0.0480***
	(0.00194)	(0.00191)	(0.00205)	(0.00186)	(0.00189)	(0.00208)	(0.00205)	(0.00219)	(0.00199)	(0.00201)
Central bank	-0.281***	-0.267***	-0.278***	-0.288***	-0.294***	-0.299***	-0.286***	-0.296***	-0.302***	-0.309***
	(0.0113)	(0.0112)	(0.0114)	(0.0112)	(0.0114)	(0.0117)	(0.0115)	(0.0117)	(0.0115)	(0.0117)
Concentration	0.112***	0.120***	0.114***	0.124***	0.136***	0.118***	0.126***	0.119***	0.132***	0.138***
	(0.00495)	(0.00493)	(0.00493)	(0.00491)	(0.00489)	(0.00498)	(0.00495)	(0.00495)	(0.00493)	(0.00493)
Common law	0.0266***	0.0370***	0.0294***	0.0441***	0.0530***	0.0344***	0.0444***	0.0367***	0.0514***	0.0567***
	(0.00247)	(0.00241)	(0.00243)	(0.00234)	(0.00233)	(0.00244)	(0.00239)	(0.00241)	(0.00235)	(0.00234)

- Interbank market usage is more likely in bank-based financial systems
- The level of concentration is positively related to the level of interbank borrowing

Main results (3)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Crisis length	0.0695***	0.0674***	0.0696***	0.0669***	0.0662***	0.0689***	0.0669***	0.0691***	0.0663***	0.0660***
	(0.00175)	(0.00174)	(0.00176)	(0.00172)	(0.00174)	(0.00178)	(0.00177)	(0.00179)	(0.00176)	(0.00176)
Bank z-score	0.0845***	0.0840***	0.0850***	0.0863***	0.0891***	0.0888***	0.0887***	0.0891***	0.0912***	0.0922***
	(0.00335)	(0.00338)	(0.00335)	(0.00336)	(0.00337)	(0.00347)	(0.00349)	(0.00347)	(0.00348)	(0.00348)
Rule of law	0.0260***					0.0232***				
	(0.000937)					(0.000903)				
Reg. quality		0.0258***					0.0218***			
		(0.00117)					(0.00112)			
Gov. effect			0.0311***					0.0281***		
			(0.00106)					(0.00103)		
Accountability				0.0194***					0.0147***	
				(0.000987)					(0.000935)	
Pol. stability					0.0145***					0.0138***
					(0.00101)					(0.00101)

- The history of banking crisis and bank risk tend to be negative associated with interbank borrowing.
- Legal and regulatory institutions matter for the interbank market size

Main results (4)

The number of bank failures tend to be negative associated with interbank borrowing.

	(1)	(2)	(3)	(4)	(5)
Bank failure	-0.00842***	-0.00808***	-0.00766***	-0.00755***	-0.00756***
	(0.000629)	(0.000654)	(0.000613)	(0.000655)	(0.000665)
Common law	0.0552***	0.0712***	0.0563***	0.0764***	0.0887***
	(0.00339)	(0.00341)	(0.00333)	(0.00333)	(0.00337)
Rule of law	0.0307***				
	(0.00127)				
Reg. quality		0.0261***			
		(0.00171)			
Gov. effect			0.0368***		
			(0.00133)		
Accountability				0.0239***	
				(0.00182)	
Pol. stability					0.0157***
					(0.00140)

The role of banking crisis

	(1)	(2)	(3)	(4)	(5)
Treated	-0.0272***	-0.0265***	-0.0292***	-0.0268***	-0.0275***
	(0.00148)	(0.00147)	(0.00151)	(0.00147)	(0.00148)
Rule of law	0.0161***				
	(0.000953)				
Reg. quality		0.0104***			
		(0.00127)			
Gov. effect			0.0175***		
			(0.00105)		
Accountability				0.00666***	
				(0.000970)	
Pol. stability					0.00171
					(0.00107)

- Endogeneity issue: our results might be affected by financial structure characteristics
- Treated=1 if the country has more than 5 years of banking crises from 1970-2015; and 0 otherwise.

The mitigating role of institutions

During crises, efficient liquidity transfer may not occur between surplus and needy banks.

In countries with better legal enforcement, regulatory quality or stronger government effectiveness and political stability, the marginal effect of the occurred banking crisis would be mitigated.

	(1)	(2)	(3)	(4)	(5)
Crisis length	-0.00505***	-0.00521***	-0.00518***	-0.00534***	-0.00364***
	(0.000360)	(0.000363)	(0.000364)	(0.000370)	(0.000368)
Crisis	-0.0549***	-0.0766***	-0.0467***	-0.0659***	-0.0412***
	(0.00351)	(0.00416)	(0.00363)	(0.00366)	(0.00318)
Rule of law	0.0217***				
	(0.00116)				
Rule of law*Crisis	0.0407***				
	(0.00206)				
Reg. quality		0.0189***			
		(0.00160)			
Reg. quality*Crisis		0.0590***			
		(0.00301)			
Gov. effect			0.0234***		
			(0.00125)		
Gov. effect*Crisis			0.0399***		
			(0.00220)		
Accountability				0.0120***	
				(0.00125)	
Accountability*Crisis				0.0524***	
				(0.00263)	
Pol. stability					0.00736***

The role of institutional improvement

Normally, banks that have higher liquidity mismatch, lower equity ratio are more likely to resort to interbank market for temporary liquidity; during crises, these banks get less financed.

If legal enforcement is strengthened, such effect during crises would be mitigated.

	$\Delta\text{Rule law}>0$	$\Delta\text{Rule law}\leq 0$	$\Delta\text{Reg } q>0$	$\Delta\text{Reg } q\leq 0$
LtD	0.0976***	0.0978***	0.109***	0.0981***
	(0.0240)	(0.00260)	(0.0240)	(0.00260)
LtD*Crisis	0.0705*	-0.0547***	-0.0289	-0.0550***
	(0.0406)	(0.00287)	(0.0446)	(0.00287)
Equity	0.162**	0.0933***	0.212***	0.0929***
	(0.0638)	(0.00699)	(0.0616)	(0.00698)
Equity*Crisis	-0.660***	-0.366***	-0.268**	-0.372***
	(0.134)	(0.0190)	(0.111)	(0.0191)
ROA	-0.174	0.0593**	0.296	0.0581**
	(0.225)	(0.0289)	(0.324)	(0.0289)
ROA*Crisis	-0.787*	-0.168	-0.145	-0.191*
	(0.431)	(0.105)	(0.638)	(0.103)
Crisis length	0.000537	-0.00341***	0.000506	-0.00346***
	(0.00262)	(0.000386)	(0.00301)	(0.000384)

Robustness check (excl. US Banks)

US banks account for 40.5% (4,621/11,412) in our bank-level sample.

The economic impact of legal and regulatory institutions is even stronger when we excl. US banks in our sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
LtD	0.0697***	0.0674***	0.0697***	0.0673***	0.0667***	0.0691***	0.0669***	0.0692***	0.0666***	0.0662***
	(0.00181)	(0.00180)	(0.00181)	(0.00179)	(0.00181)	(0.00184)	(0.00183)	(0.00184)	(0.00182)	(0.00183)
Securities	0.0722***	0.0724***	0.0733***	0.0779***	0.0838***	0.0766***	0.0774***	0.0775***	0.0838***	0.0862***
	(0.00587)	(0.00595)	(0.00586)	(0.00586)	(0.00583)	(0.00593)	(0.00600)	(0.00592)	(0.00592)	(0.00589)
Equity	-0.134***	-0.149***	-0.127***	-0.157***	-0.168***	-0.160***	-0.176***	-0.153***	-0.186***	-0.187***
	(0.0119)	(0.0119)	(0.0118)	(0.0120)	(0.0121)	(0.0121)	(0.0122)	(0.0120)	(0.0123)	(0.0124)
ROA	-0.174**	-0.217***	-0.208***	-0.224***	-0.331***	-0.119	-0.169**	-0.152*	-0.201**	-0.260***
	(0.0792)	(0.0793)	(0.0790)	(0.0788)	(0.0782)	(0.0801)	(0.0802)	(0.0799)	(0.0798)	(0.0794)
Size	0.0125***	0.0125***	0.0124***	0.0126***	0.0123***	0.0130***	0.0129***	0.0129***	0.0129***	0.0127***
	(0.000384)	(0.000388)	(0.000381)	(0.000393)	(0.000397)	(0.000396)	(0.000401)	(0.000393)	(0.000407)	(0.000407)
Common law	0.0455***	0.0483***	0.0512***	0.0399***	0.0504***	0.0575***	0.0595***	0.0630***	0.0522***	0.0604***
	(0.00425)	(0.00430)	(0.00427)	(0.00426)	(0.00451)	(0.00406)	(0.00415)	(0.00409)	(0.00407)	(0.00431)
Crisis freq.	-0.00564***	-0.00566***	-0.00563***	-0.00618***	-0.00436***					
	(0.000351)	(0.000353)	(0.000352)	(0.000361)	(0.000348)					
Bank z-score						-0.00147***	-0.00149***	-0.00142***	-0.00149***	-0.00148***
						(0.000197)	(0.000198)	(0.000198)	(0.000197)	(0.000198)

Eurozone banks and Large and Small banks

	Eurozone		Bank size	
	11 countries	19 countries	Q1	Q3
LtD	0.149*** (0.00272)	0.148*** (0.00274)	0.0876*** (0.00225)	0.0501*** (0.00195)
Equity	-0.227*** (0.0200)	-0.221*** (0.0199)	-0.227*** (0.0167)	-0.117*** (0.00885)
ROA	-0.470*** (0.145)	-0.504*** (0.146)	0.225*** (0.0565)	0.0155 (0.0422)
Securities	0.163*** (0.00644)	0.155*** (0.00649)	0.115*** (0.00456)	0.0646*** (0.00378)
Size	0.00816*** (0.000481)	0.00851*** (0.000478)	0.0114*** (0.000411)	0.00692*** (0.000381)
Crisis length	-0.0178*** (0.000950)	-0.0166*** (0.000991)	-0.00658*** (0.000390)	-0.00583*** (0.000459)
Bank z-score	-0.00143*** (0.000173)	-0.00161*** (0.000175)	-0.00182*** (0.000168)	-0.00118*** (0.000155)

To conclude

Trust is crucial in determining the interbank market size.

- Higher trust helps to obtain liquidity in the unsecured interbank market through mitigating info asymmetries
- If a bank is located in a country with longer periods of banking crisis or more bank failures in the past, trust can be weaker and support less interbank activities.

Institutional factors such as legal enforcement/regulation quality matter, and can further mitigate the impact of banking crises or failures.

- Law and institutions may play as a substitute for market discipline in the interbank market.

But more research is needed...

Thank you!