Banking Supervision, Monetary Policy and Risk-Taking: Big Data Evidence from 15 Credit Registers

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□ The role of banking supervision for bank risk-taking and interactions with monetary policy

- i. Banking supervision: centralised vs. country-level supervision
- ii. Interaction between banking supervision and monetary policy

□ First to use more than 1 Credit Register

✓ To our knowledge, literature has exclusively analysed only 1 credit register for all banking questions,

....but missing external validity and heterogeneous effects across countries

✓ We address both issues by using multiple credit registers (our "*Big Data*")

Preview of questions and results

1. The role of Banking Supervision

Does centralised (ECB) vs. local banking supervision affect bank risk-taking?

2. Interaction with Monetary Policy (MP)

Does the interaction between bank supervision & MP affect risk-taking?

Summary

1. The role of Banking Supervision

Does centralised (ECB) vs. local banking supervision affect bank risk-taking?

- ✓ Yes. Centralised supervision cuts credit supply to high credit risky borrowers (not productive risk-taking), especially in stressed countries.
- ✓ Mechanism 1: Support for weak local institutions (structural hypothesis) rather than crisis-times for the country (cyclical) hypothesis. Multiple credit registers key
- ✓ Mechanism 2: Effects are stronger for largest banks in absolute terms (systemic hypothesis), not for banks large only relatively to their country (capture hypothesis)
- 2. Interaction with Monetary Policy (MP)

Does the interaction between bank supervision & MP affect risk-taking?

- ✓ Yes. MP easing tends to increase bank lending towards riskier firms, but this risk-taking is offset by centralized supervision
- ✓ but does not offset more productive risk-taking

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Contribution to the literature

Banking supervision: Centralized vs. local

Agarwal-Lucca-Seru-Trebbi, *QJE* 2014 Granja, J., and Leuz, C. (2017). Kandrac, J., and Schlusche, B. (2019). Calzolari et al., RFS2019, Beck et al., EP2013

Monetary policy & Risk taking

Adrian-Shin, *Handbook ME*; Kashyap-Stein, *AER* 2000; Dell'Ariccia-Laeven-Suarez, *JF* 2017 Jimenez-Ongena-Peydró-Saurina, *AER* 2012 & *Econometrica* 2014; Rajan 2005 Jackson Hole

> All questions using single credit registers

Mian, 2006; Khwaja and Mian, 2008; Paravisini, 2008; Amiti and Weinstein, 2011; Schnabl, 2012

Contribution

- ✓ Centralized vs. local supervision affects subsequent credit supply/risk-taking (not just risk assessments) + interaction between supervision & monetary policy
- ✓ Underlying mechanisms: (i) institutional quality (structural) vs. countries in crisis times (cyclical) hypotheses; (ii) systemic importance of very large banks rather than just locally large/supervisory capture hypotheses
- ✓ First findings on cross-country heterogeneity using multiple credit registers: results are different for different countries: internal vs. external validity

□ Big data: 15 credit registers

Empirical analysis

- Supervision and risk-taking
- The mechanism
- Supervision and monetary policy

Conclusions

Time and Country coverage

Sample size

- ✓ T: June 2012 December 2017
- ✓ N: 15 Credit Registers

15 Credit Registers

- ✓ AT, BE, CZ, DE, ES, IE, IT, RO, SI, FR, LT, LV, MT, PT, SK
- ✓ Stressed vs. non-stressed countries
- \checkmark Non euro area countries
- ✓ Important event: November 2014 ECB supervisor for some euro area banks, and not for non-euro area banks

Variables

Measures of loan exposure

Loan (bank, firm) identifiers Type of exposure (loans, debt securities) Credit commitment or drawn (value of the loan) Credit lines (the value of credit undrawn)

Credit risk variables

Collateral type (yes, no) Arrears (part of the loan that is past due) Prob. of default (between 0 and 1) Non-performing status

Borrower attributes

Country of residence Institutional sector Sector of economic activity Size

Exploiting granularity via transaction level data

Share of firms with multiple bank relationships (% of total borrowers)



Notes: for each country, the chart shows the share of non-financial corporations with multiple bank relationships as share of total borrowers.

Share of firms with multiple bank relationships (% of total exposure)



Notes: for each country, the chart shows the share of non-financial corporations with multiple bank relationships as share of total exposure.

✓ firm-time (ft), firm-bank (fb), and bank-time (bt) FE or
✓ sector-time (st) (or sector-country-size-time), firm-bank (fb), and bank-time (bt) FE

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Dataset characteristics

	Reporting Threshold	Initial Sample (in million)	# of banks Original Sample	Final Sample (in million)	# of banks Final Sample
Austria	350,000	1.4	1601	0.5	65
Belgium	0	13.3	144	6.2	36
Germany	1,000,000	11.1	1828	4.7	498
Spain	6,000	23.6	283	16.7	133
France	25,000	37.7	522	24.8	295
Ireland	500	4.3	4	-	-
Italy	30,000	148.2	1576	28.2	731
Lithuania	290	0.3	166	0.3	11
Latvia	0	12.7	109	-	-
Malta	5,000	0.1	26	-	-
Portugal	50	8.8	198	6.2	107
Slovenia	0	0.2	26	-	-
Slovakia	0	0.9	30	0.6	11
Romania	4,440	20.2	96	2	52
Czech Republic	0	4.8	41	1.5	18

Descriptive statistics

	Stressed Countries			Non-Stressed Countries			
	Mean	St.Dev.	# obs.	Mean	St.Dev.	# obs.	
Loan volume (Loans)	516	12,078	48,507,843	1,716	15,649	8,526,222	
Borrower Quality (BQ)	0.05	0.19	45,828,620	0.03	0.16	7,396,700	
Centralised Supervision (Sup)	0.34	0.47	48,507,843	0.50	0.50	8,526,222	
Monetary Policy Shock (Shock ^{MP})	-1.04	4.22	48,507,843	-1.15	4.25	8,526,222	
NPL ratio (NPL)	0.20	0.10	48,507,843	0.05	0.04	8,526,222	
Size	5.35	6.22	48,507,691	15.13	11.41	8,526,194	
Large	0.16	0.36	48,507,843	0.07	0.26	8,526,222	
Productivity (Prod)	217.7	183.9	40,171,006	240.69	173.54	6,496,651	

Stressed countries: Italy, Spain and Portugal

Non-Stressed Countries: Austria, Belgium, Germany, Lithuania and Slovakia

□ Big data: 15 credit registers

D Empirical analysis

- Supervision and risk-taking
- The mechanisms
- Supervision and monetary policy

Conclusions

Establishment of European banking supervision

Single Supervisory Mechanism becomes operational in November 2014

Significance criteria

1. Size	the total value of its assets exceeds €30 billion				
2. Economic importance	Total assets exceeding €5 billion and 20% of GDP the Member State.				
3. Cross-border activities	Total assets exceeding €5 billion and the ratio of its cross-border A/L in more than one other participating country to its TA/L above 20%.				
4. Direct public financial assistance	it has requested or received funding from the European Stability Mechanism or the European Financial Stability Facility.				
5. Three most significant institutions	it is one of the three most significant credit institutions in a participating Member State				

Do banks supervised by the ECB/SSM behave differently?

$$\text{Loans}_{b,s,f,t} = \alpha^{\text{FE}} + \delta BQ_{f,t-1} + \theta \text{Sup}_{b,t-1} + \lambda \left(BQ_{f,t-1} \times \text{Sup}_{b,t-1} \right) + \epsilon_{b,s,f,t}$$

firm with
no arrears
$$0 \le BQ_{f,t-1} = \begin{pmatrix} Arrears_{f,t-1} \\ Exposure_{f,t-1} \end{pmatrix} \le 1$$
 all of the firm's exposures are in arrears

$$Sup_{b,t} = \begin{cases} 1 & \text{if b is centrally supervised at period t} \\ 0 & \text{otherwise} \end{cases}$$

Hypothesis to test

 λ < 0: once a bank becomes centrally (SSM/ECB) supervised, it provides less credit to riskier borrowers

	Stressed (Countries	Non Stresse	d Countries
	(1)	(2)	(3)	(4)
Sup _{b,t-1}	0.110*	0.110*	0.0578	0.155**
	(0.0616)	(0.0642)	(0.0652)	(0.0698)
BQ _{f,t-1}	-0.0450	-	-0.0997**	_
	(0.0456)		(0.0439)	
$\mathrm{BQ}_{\mathrm{f,t-1}}$ x $\mathrm{Sup}_{\mathrm{b,t-1}}$	-0.447***	-0.358***	-0.446***	-0.272***
	(0.0673)	(0.104)	(0.112)	(0.0963)
Ν	39,820,155	29,866,102	6,263,603	2,916,268
R-squared	0.682	0.751	0.830	0.859
Fixed effects				
Bank*Firm	Y	Y	Y	Y
Firm*Time	Ν	Y	Ν	Y
Sector*Time	Υ	-	Y	-
Bank	Y	Y	Y	Y

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Banking supervision: ex-ante vs ex-post borrower credit risk

		Stressed	Countries		Non-Stressed Co	untries
	i =	-1		i =	-1	
	(1)	(2)		(5)	(6)	
$BQ_{f,t+i}$	-0.246* (0.0245)	-		-0.185*** (0.0424)	-	
$BQ_{f,t+i}$ x $Sup_{b,t-1}$	-0.434*** (0.0666)	-0.268*** (0.0954)		-0.363*** (0.108)	-0.0450 (0.0980)	
N	40,626,537	30,703,723		6,879,163	3,672,419	
R-squared	0.704	0.771		0.815	0.845	
Fixed effects						
Bank*Firm	Y	Y		Y	Y	
Firm*Time	Ν	Y		Ν	Y	
Sector*Time	Y	-		Y	-	
Bank*Time	Y	Y		Y	Y	

Results:

Centralised supervision leads banks to cut lending to ex-ante riskier borrowers (BQ x Sup <0)

The effect is stronger for stressed countries

Banking supervision: ex-ante vs ex-post borrower credit risk

		Stressed Countries				Non-Stressed Countries			
	i =	i = -1		= 1	i =	-1	i = 1		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
BQ _{f,t+i}	-0.246* (0.0245)	-	-0.135*** (0.0488)	-	-0.185*** (0.0424)	-	-0.0510* (0.0278)		
$\mathrm{BQ}_{\mathrm{f,t+i}}$ x $\mathrm{Sup}_{\mathrm{b,t-1}}$	-0.434*** (0.0666)	-0.268*** (0.0954)	-0.440*** (0.0598)	-0.200** (0.0872)	-0.363*** (0.108)	-0.0450 (0.0980)	-0.255*** (0.0571)	0.101 (0.0937)	
N	40,626,537	30,703,723	41,181,446	31,393,573	6,879,163	3,672,419	6,866,876	3,672,058	
R-squared	0.704	0.771	0.707	0.772	0.815	0.845	0.826	0.846	
Fixed effects									
Bank*Firm	Y	Y	Y	Y	Y	Υ	Y	Υ	
Firm*Time	Ν	Υ	Ν	Y	Ν	Υ	Ν	Y	
Sector*Time	Y	-	Y	-	Y	-	Y	-	
Bank*Time	Y	Υ	Y	Y	Y	Υ	Y	Y	

Results:

Centralised supervision leads banks to cut lending to ex-ante riskier borrowers and also ex-post => Consistent with high credit risk of not illiquid viable firms (bad risk-taking)

The effect is stronger for stressed countries

$$\begin{aligned} &Loans_{c,b,s,f,t} \\ &= \alpha^{FE} + \rho Prod_{c,s,t} + \theta Sup_{b,t-1} + \delta BQ_{f,t-1} + \lambda \left(BQ_{f,t-1} \times Sup_{b,t-1} \right) \\ &+ \tau \left(BQ_{f,t-1} \times Prod_{c,s,t} \right) + \sigma \left(Prod_{c,s,t} \times Sup_{b,t-1} \right) + \Omega X_{b,f,t-1} + \epsilon_{c,b,s,f,t} \end{aligned}$$

 $Prod_{c,s,t}$ is a cost-adjusted measure of sectoral labour productivity for each sector in each country

Hypothesis to test

 σ < 0: once a bank becomes centrally (SSM/ECB) supervised, it decreases credit supply towards more productive firms

Banking supervision and (good) risk-taking: productivity

		Stressed countries				Non-Stressed	l Countries	es i = 1 (8) 3* 3)
	i =	= -1	i =	= 1	i =	-1	i =	1
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mathrm{BQ}_{\mathrm{f,t+i}}$	-0.0756* (0.0401)		-0.174*** (0.0557)		-0.146*** (0.0443)		-0.0563* (0.0253)	
$\mathrm{BQ}_{f,t+i} \textbf{x} \mathrm{Sup}_{b,t+1}$	-0.429*** (0.0659)	-0.285*** (0.0942)	-0.448*** (0.0651)	-0.202** (0.0899)	-0.394*** (0.112)	-0.00276 (0.120)	-0.256*** (0.0513)	0.0386 (0.0972)
Prod _{s,t+i}	-0.213*** (0.0408)		-0.251*** (0.0445)		0.349*** (0.104)		-0.100 (0.0994)	
$\mathrm{BQ}_{f,t+i}\textbf{x}\mathrm{Prod}_{s,t+i}$	0.288*** (0.0812)		0.0995** (0.0414)		0.246** (0.107)		0.399*** (0.0812)	
$\operatorname{Prod}_{s,t+i} \textbf{x} \operatorname{Sup}_{b,t\text{-}1}$	0.0426 (0.0383)	-0.0115 (0.0351)	0.0546 (0.0381)	0.0113 (0.0392)	-0.0220 (0.0635)	0.176 (0.140)	0.116** (0.0580)	0.189 (0.151)
N R-squared	37,753,379 0.714	28,374,474 0.779	32,123,122 0.728	24,285,787 0.789	5,750,158 0.835	2,713,259 0.867	4,676,219 0.855	2,182,565 0.873
Fixed effects								
Bank*Firm	Υ	Υ	Υ	Υ	Υ	Υ	Y	Y
Firm*Time	Ν	Υ	Ν	Υ	Ν	Υ	Ν	Y
Sector*Time	Y	-	Y	-	Y	-	Y	-
Bank*Time	Υ	Υ	Υ	Υ	Υ	Υ	Υ	Y

The centralisation of bank supervision does not curtail lending supply to more productive firms

1. On the cross-section

- ✓ Focusing on banks around threshold to become centrally supervised
- ✓ Controlling for lagged bank size in interactions (in addition to the level)

2. Non euro-area EU countries (external placebo):

✓ Comparing banks in Romania and Czech Republic (not included in SSM) as if they would have followed the ECB rules to define centrally supervised banks

3. On the time series

- \checkmark Checking for alternative dates for the start of bank supervision
- \checkmark Allowing more time for the materialisation of ex-post risk

Number of supervised banks

	201412	201506	201512	201606	201612	201706	201712
IT	14	14	15	15	14	14	12
ES	15	15	14	14	14	14	14
РТ	4	4	4	4	4	4	4
FR	10	10	13	13	13	13	12
AT	6	6	6	6	6	6	5
BE	6	6	6	6	6	6	6
LT	0	3	3	3	3	3	3
SK	3	3	3	3	3	3	3
DE	21	21	22	22	21	21	21

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Robustness: restricted sample for euro area banks (6 banks per country) and placebo test based on non-euro area countries and banks

	Stressed (ressed Countries Non-S		d Countries	EU non EA	
	i = -1	i = 1	i = -1	i = 1	i = -1	i = 1
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathrm{BQ}_{\mathrm{f,t+i}} \mathbf{x} \mathrm{Sup}_{\mathrm{b,t-1}}$	-0.338** (0.155)	-0.167* (0.088)	-0.000281 (0.194)	-0.0618 (0.151)	0.361 (0.250)	0.385 (0.217)
N	1,474,985	1,533,704	227,494	225,952	349,429	319,001
R-squared	0.857	0.861	0.871	0.868	0.826	0.829
Fixed effects						
Bank*Firm	Y	Y	Υ	Y	Y	Y
Firm*Time	Y	Y	Υ	Y	Y	Y
Bank*Time	Y	Υ	Y	Y	Υ	Y

Robustness on the timing of banking supervision



Notes: Estimated coefficient of the interaction BQ*Sup from equation (1), based on different dates for the effective start of bank supervision. The specifications control for Bank*time, Bank*firm, and Firm*time fixed effects (Country*time and sector*time fixed effects are spanned by the previous effects).

□ Big data: 15 credit registers

D Empirical analysis

- Supervision and risk-taking
- The mechanisms
- Supervision and monetary policy

Conclusions

Mechanism 1: weak local institutions vs. crisis-country hypothesis

Why does centralised supervision reduce (worse) risk-taking?

1. Weak local institutional (structural) hypothesis

Effects are larger in stressed countries (SP, PT, IT) because they have weaker local institutions.

Question: Does the centralisation of banking supervision increase the risk sensitivity depending on ex-ante measures of quality of institutions (from World Bank)?

2. Crisis-times for the country (cyclical) hypothesis

Effects are larger in stressed countries (SP, PT, IT) because they were suffering the Euro Area sovereign crisis. As it is cyclical, we can use ex-ante CDS or time-varying CDS

Question: Does the centralisation of banking supervision increase the risk sensitivity depending on the country CDS?

Use all countries and add both country measures: institutional quality and CDS

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Mechanism 1: weak local institutions vs. crisis-country hypothesis

	D I'	CDC	CDC	T .''' 1 1'.	Institution	nal quality
	Baseline	CDS_0	CDS _{t-1}	Institutional quality	CDS ₀	CDS _{t-1}
	(1)	(2)	(3)	(4)	(5)	(6)
BQ _{c,s,t-1}	-0.499*** (0.0300)	-0.466*** (0.0286)	-0.521*** (0.0309)	-0.577*** (0.0464)	-0.491*** (0.0659)	-0.491*** (0.0513)
BQ _{c,s,t-1} x Sup _{b,t-1}	-1.070*** (0.247)	-1.298*** (0.331)	-1.756*** (0.613)	-2.070*** (0.510)	-2.178*** (0.507)	-1.828*** (0.515)
$BQ_{c,s,t-1} \ge CDS_{c,i}$		-0.000389*** (0.0000689)	-0.00123*** (0.000221)		0.000244 (0.000253)	-0.000869** (0.000377)
BQ _{c,s,t-1} x InstQ _{c,2011}				0.0109*** (0.00364)	-0.0321*** (0.00798)	-0.0182*** (0.00621)
$\mathrm{BQ}_{\mathrm{c},\mathrm{s},\mathrm{t}\text{-}1} \ge \mathrm{Sup}_{\mathrm{b},\mathrm{t}\text{-}1} \ge \mathrm{CDS}_{\mathrm{c},\mathrm{i}}$		-0.000655 (0.000827)	-0.00514 (0.00424)		0.00165** (0.000811)	0.00649 (0.00424)
BQ _{c,s,t-1} x Sup _{b,t-1} x InstQ _{c,2011}				0.0928*** (0.0344)	0.128*** (0.0414)	0.131*** (0.0440)
BQ _{f,s,t-1} x InstQ _{c,2011} x CDS _{c,i}					-0.000153*** (0.0000467)	-0.000146*** (0.0000531)
N R-squared	639,713 0.710	639,713 0.710	639,713 0.710	639,713 0.710	639,713 0.710	639,713 0.710
Fixed effects Country*Time Bank*Time	Y Y	Y Y	Y Y	Y Y	Y Y	Y Y
Sector*Time	Y	Y	Y	Y	Y	Y

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Banking Supervision, Monetary Policy and Risk taking

Mechanism 2: systemic vs. capture hypothesis

Why does centralised supervision reduce excessive risk-taking?

1. Systemic hypothesis

Systemically important banks might have large (direct and indirect) spillovers to other countries, and the supranational supervisor can internalise this externality.

Question: Does the centralisation of banking supervision increase the risk sensitivity of credit supply for very large banks in *absolute size*?

2. Capture hypothesis

Local regulators easier to capture by large banks but *relative size* to their country, e.g. due to revolving doors and lobbying.

Question: Does the centralisation of banking supervision increase the risk sensitivity of credit supply for *relatively* large banks, i.e. big for country but not necessarily systemically important? Related: and for weaker local banks (where capture would lead to a distortion)?

$$\begin{aligned} &Loans_{b,s,f,t} \\ &= \alpha^{FE} + \beta_1 (NPL_{b,t-1} \times BQ_{f,t-1} \times Sup_{b,t-1}) \\ &+ \beta_2 (Size_{b,s,t-1} \times BQ_{f,t-1} \times Sup_{b,t-1}) + \beta_3 (Large_b \times BQ_{f,t-1} \times Sup_{b,t-1}) \\ &+ \Omega X_{b,f,t-1} + \epsilon_{b,s,f,t} \end{aligned}$$

1. Systemic hypothesis

> $\beta_3 < 0$: Decrease in risk taking of large banks when centrally supervised if large is for the Euro Area

2. (Local) Capture hypothesis

- > $\beta_1 < 0$: Decrease in risk taking of weak banks when centrally supervised
- > $\beta_3 < 0$: Decrease in risk taking of large banks when centrally supervised if large is not for the Euro Area but only for the country (or e.g. largest bank in the country)

Mechanism 2: systemic vs. capture hypothesis

		Stressed Countries				Non-Stressed Countries			
	i =	-1	i =	= 1	i =	: -1	i =	= 1	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
$BQ_{f,t+i}$	-0.171***	-	-0.173***	-	-0.194***	-	-0.184***	-	
$\mathrm{BQ}_{f,t+i}$ x $\mathrm{Sup}_{b,t-1}$	-0.365***	-0.218**	-0.400***	-0.197***	-0.282***	-0.0276	-0.219***	0.0724	
$\mathrm{NPL}_{b,t\text{-}1} \textbf{ x } \mathrm{BQ}_{f,t\text{+}i}$	1.932***	2.106***	1.299***	1.670***	1.441***	2.244***	1.460***	2.054**	
$\mathrm{NPL}_{b,t\text{-}1} \: \textbf{x} \: \mathrm{BQ}_{f,t\text{+}i} \: \textbf{x} \: \mathrm{Sup}_{b,t\text{-}1}$	1.17	1.031	0.97	0.308	-0.492	0.471	0.856	1.287	
$\operatorname{Size}_{b,s,t\text{-}1} \textbf{x} \ \operatorname{BQ}_{f,t\text{+}i}$	0.000203	-0.00448	0.0006	-0.00234	0.00197	0.00268	-0.00148	-0.000256	
$\operatorname{Size}_{b,s,t\text{-}1} \textbf{x} \ \operatorname{BQ}_{f,t\text{+}i} \textbf{x} \ \operatorname{Sup}_{b,t\text{-}1}$	0.00421	-0.000585	0.00478	-0.000975	0.00700	-0.00531	-0.00402	-0.0122**	
$\mathrm{Large}_{b} \textbf{x} \; \mathrm{BQ}_{f,t+i}$	0.358***	0.305*	0.503***	0.398**	0.327***	0.0132	0.648***	-0.342	
$\mathrm{Large}_{b} \textbf{x} \; \mathrm{BQ}_{f,t+i} \textbf{x} \; \mathrm{Sup}_{b,t-1}$	-0.470**	-0.319*	-0.404**	-0.219*	-0.824***	-0.0537	-0.367***	0.152	
N	39,811,038	29,856,793	36,120,663	27,285,698	6,262,908	2,915,490	5,642,723	2,641,856	
R-squared	0.705	0.773	0.716	0.780	0.835	0.866	0.851	0.869	
Fixed effects									
Bank*Firm	Y	Υ	Y	Υ	Υ	Y	Y	Y	
Firm*Time	Ν	Υ	Ν	Υ	Ν	Y	Ν	Υ	
Sector*Time	Υ	-	Υ	-	Y	-	Υ	-	
Bank*Time	Y	Y	Y	Y	Y	Y	Y	Y	
No major difference	s across]	NPL	=>	weak sur	port for c	apture hyp	oothesis		

Important difference for very large banks =>

confirming (initially) systemic hypothesis

Systemic hypothesis?

Thresholds for Large banks



Non-linearity for very large banks

Systemic hypothesis?

	<u> </u>	Restricted	Sample
-0.215** (0.109)	0.206 (0.142)	-0.174 (0.111)	0.112 (0.159)
-0.425*** (0.147)	-0.198 (0.178)	-0.396*** (0.147)	-0.388* (0.196)
-0.438** (0.190)	-0.325* (0.176)	-0.407** (0.190)	-0.513*** (0.192)
-0.470** (0.207)	-0.319* (0.190)	-0.443** (0.206)	-0.508** (0.196)
0.00383 (0.147)	0.0388 (0.107)	0.000374 (0.138)	0.0158 (0.153)
39,811,038	29,856,793	26,535,557	17,059,229
Y	Y	Y	Y
N	Ŷ	N	Y
Y V	-	Y	-
	$\begin{array}{c} -0.215^{**} \\ (0.109) \\ \hline \\ -0.425^{***} \\ (0.147) \\ \hline \\ -0.438^{**} \\ (0.190) \\ \hline \\ -0.470^{**} \\ (0.207) \\ \hline \\ 0.00383 \\ (0.147) \\ \hline \\ 0.00383 \\ (0.147) \\ \hline \\ 39,811,038 \\ \hline \\ Y \\ N \\ Y \\ Y \\ Y \end{array}$	-0.215^{**} 0.206 (0.109) -0.425^{***} -0.198 (0.147) (0.147) (0.178) -0.438^{**} -0.325^{*} (0.190) -0.470^{**} -0.319^{*} (0.207) (0.207) (0.190) 0.00383 (0.147) 0.0388 (0.107) $39,811,038$ $29,856,793$ YY Y YYY YYY YYY Y	$\begin{array}{cccccccccccccccccccccccccccccccccccc$

Results

Non-linearity for very large banks not driven by specific threshold

No difference for the largest bank in a given country – further evidence against local capture hypothesis

Similar results for non stressed countries but weaker with firmtime FE

□ Big data: 15 credit registers

D Empirical analysis

- Supervision and risk-taking
- The mechanisms
- Supervision and monetary policy

Conclusions

Monetary policy in the euro area

Interest rate corridor

Excess Liquidity

(Current Account + Deposit Facilities - Reserve requirements)





ECB monetary policy assets



Source: ECB. Latest observation: 9 November 2018.

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Monetary policy surprises

Term structure of OIS yields at different dates (percentages per annum)



Monetary policy surprises



Source: Altavilla, Brugnolini, Gürkaynak, Motto, Ragusa, 2019. Note: policy surprises from high-frequency intraday yields at different maturities during dates of policy announcements Positive (negative) values indicates policy tightening (easing)

Interaction between banking supervision and monetary policy

$$\begin{aligned} Loans_{b,s,f,t} &= \alpha^{FE} + \delta BQ_{f,t-1} + \theta Sup_{b,t-1} + \mu Shock_{t-1}^{MP} + \Omega X_{b,f,t-1} \\ &+ \psi \big(Shock_{t-1}^{MP} \times BQ_{f,t-1} \big) \\ &+ \eta \big(Shock_{t-1}^{MP} \times BQ_{f,t-1} \times Sup_{b,t-1} \big) + \epsilon_{b,s,f,t} \end{aligned}$$

 $X_{b,f,t-1}$ includes all remaining double and triple interactions; also with size

Hypotheses to test:

1) $\psi < 0$ MP easing tends to increase lending towards riskier firms

2) $\eta > 0$ but this is cancelled by centralised supervision

	Stressed Countries		Non Stressee	Countries	
	(1)	(2)	(3)	(4)	
BQ _{f,t-1}	-0.422***		-0.254***		
$\mathrm{BQ}_{\mathrm{f,t-1}}$ x $\mathrm{Sup}_{\mathrm{b,t-1}}$	-0.527*** (0.125)	-0.328* (0.198)	-0.248* (0.133)	-0.113 (0.178)	
$\mathrm{BQ}_{\mathrm{f,t-1}} \mathbf{x} \mathrm{Shock}^{\mathrm{MP}}_{}_{\mathrm{t-1}}}$	-0.0170** (0.00713)		-0.0168*** (0.00583)		
$\mathrm{BQ}_{\mathrm{f,t-1}}$ x $\mathrm{Sup}_{\mathrm{b,t-1}}$ x $\mathrm{Shock}_{\mathrm{t-1}}^{\mathrm{MP}}$	0.0403*** (0.0154)	0.0535** (0.0233)	0.0222*** (0.00811)	0.0278** (0.0125)	
N	39,811,038	29,856,793	6,262,908	2,915,490	
R-squared	0.705	0.773	0.835	0.866	
Fixed effects					
Bank*Firm	Y	Υ	Y	Υ	
Firm*Time	Ν	Υ	Ν	Υ	
Sector*Time	Y	-	Y	-	
Bank*Time	Υ	Y	Y	Y	

Results

Monetary Policy interaction:

- MP easing leads banks to increase lending towards riskier firms (BQ*Shock<0)
- But this risk-taking of MP is canceled by centralized supervision (BQ*Sup*Shock>0)

Impact of monetary policy easing on lending to riskier borrowers



Results

Monetary Policy interaction:

- 1. MP easing leads banks to increase lending towards riskier firms (BQ*Shock<0)
- But this risk-taking of MP is canceled by centralized supervision (BQ*Sup*Shock>0)
- 3. We do not find these effects for good risk taking (ex ante productivity)

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Interaction between banking supervision and monetary policy

Results

	Stressed countries			Non-stressed countries				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BQ _{ft+1}	-0.0280	-0.0588*	-0.0599*		-0.0881	-0.146***	-0.152***	
	(0.0510)	(0.0264)	(0.0324)		(0.0597)	(0.0457)	(0.0453)	
BQ _{f,t-1} x Sup _{b,t-1}	-0.428***	-0.367***	-0.362***	-0.207*	-0.401***	-0.319***	-0.312***	-0.086*
	(0.0622)	(0.0553)	(0.0552)	(0.112)	(0.117)	(0.0977)	(0.0975)	(0.045)
BQ _{ft-1} x Shock _{t-1}	-0.0209**	-0.0143***	-0.0112***		-0.0219***	-0.0275***	-0.0249***	
	(0.00486)	(0.00463)	(0.00432)		(0.00508)	(0.00719)	(0.00712)	
BO EL X Support X Shock		0.0175	0.0370**	0.0475**		0.0165**	0.0117*	0.0372*
- Cthi		(0.0101)	(0.0159)	(0.0241)		(0.0083)	(0.00518)	(0.0197)
Large _b X BQ _{f.t-1}	0.268**	0.328**	0.361**	0.211	0.291***	0.314***	0.328***	0.145
	(0.131)	(0.149)	(0.141)	(0.190)	(0.0791)	(0.0933)	(0.0881)	(0.316)
Large _b X BQ _{f,t-1} X Sup _{b,t-1}		-0.580***	-0.627***	-0.434**		-0.813***	-0.831***	-0.4798*
		(0.208)	(0.202)	(0.205)		(0.163)	(0.158)	(0.255)
Large _b x BQ _{ft-1} x Shock _{t1}		-0.0136	-0.0465***	-0.0223*		-0.0122	-0.033*	-0.141***
		(0.00929)	(0.00841)	(0.0119)		(0.0148)	(0.0178)	(0.0460)
Large, x BOr, x Shock, MP x Sup.			0.0513***	0.0452***			0.0208*	0.164***
			(0.00886)	(0.0146)			(0.0108)	(0.046)
N	39,811,038	39,811,038	39,811,038	29,856,793	6,262,908	6,262,908	6,262,908	2,915,490
R-squared	0.705	0.705	0.705	0.773	0.835	0.835	0.835	0.866
Fixed effects								
Bank*Firm	Y	Y	Y	Y	Y	Y	Y	Y
Firm*Time	N	N	N	Y	N	N	N	Y
Sector*Time	Y	Y	Y	-	Y	Y	Y	-
Bank*Time	Y	Y	Y	Y	Y	Y	Y	Y

Table 10: Bank supervision, monetary policy, and large banks

Monetary Policy interaction:

- MP easing leads banks to increase lending towards riskier firms (BQ*Shock<0)
- But this risk-taking of MP is canceled by centralized supervision (BQ*Sup*Shock>0)
- 3. Especially for large banks (Large*BQ*Sup*Shock>0)

□ Big data: 15 credit registers

Empirical analysis

- Supervision and risk-taking
- Mechanisms
- Supervision and monetary policy

\Box Conclusions

Summary

1. The role of Banking Supervision

Does centralised (ECB) vs. local banking supervision affect bank risk-taking?

- ✓ Yes. Centralised supervision cuts credit supply to high credit risky borrowers (not productive risk-taking), especially in stressed countries.
- ✓ Mechanism 1: Support for weak local institutions (structural hypothesis) rather than crisis-times for the country (cyclical) hypothesis. Multiple credit registers key
- ✓ Mechanism 2: Effects are stronger for largest banks in absolute terms (systemic hypothesis), not for banks large only relatively to their country (capture hypothesis)
- 2. Interaction with Monetary Policy (MP)

Does the interaction between bank supervision & MP affect risk-taking?

- ✓ Yes. MP easing tends to increase bank lending towards riskier firms, but this risk-taking is offset by centralized supervision
- ✓ but does not offset more productive risk-taking

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Thank you

Mechanism 1: weak local institutions vs. crisis-country hypothesis

	Regulatory quality		Institutional quality		
	CDS ₀	CDS _{t-1}	CDS ₀	CDS _{t-1}	
	(1)	(2)	(3)	(4)	
BQ _{f,t-1}	-0.480*** (0.0659)	-0.560*** (0.0579)	-0.491*** (0.0659)	-0.491*** (0.0513)	
BQ _{f,t-1} x Sup _{b,t-1}	-2.268*** (0.490)	-0.850* (0.501)	-2.178*** (0.507)	-1.828*** (0.515)	
BQ _{f,t-1} x CDS _{c,t}	-0.00119** (0.000577)	-0.00115** (0.000496)	0.000244 (0.000253)	-0.000869** (0.000377)	
BQ _{f,t-1} x InstQ _{c,2011}	-0.0358 (0.0255)	0.00192 (0.00844)	-0.0321*** (0.00798)		
$BQ_{f,t-1} \ge Sup_{b,t-1} \ge CDS_{c,t}$	0.00613*** (0.00186)	0.0174** (0.00824)	0.00165** (0.000811)	0.00649 (0.00424)	
BQ _{f,t-1} x Sup _{b,t-1} x Inst _{Qc,2011}	0.288*** (0.0848)	0.204*** (0.0787)	0.128*** (0.0414)	0.131*** (0.0440)	
BQ _{f,t-1} x InstQ _{c,2011} x CDS _{c,t}	-0.0000470 (0.0000372)	-0.0000359 (0.0000529)	-0.000153*** (0.0000467)	-0.000146*** (0.0000531)	
N	639,713	639,713	639,713	639,713	
<u>K-squared</u>	0.710	0.710	0./10	0.710	
Country*Time	V	V	V	V	
Bank*Time	ı Y	ı V	ı Y	ı V	
Sector*Time	Ŷ	Ŷ	Ŷ	Ŷ	

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Robustness: Credit drawn

	Stressed	Countries	Non-Stressed Countries		
	i = -1	i = 1	i = -1	i = 1	
	(1)	(2)	(3)	(4)	
$BQ_{f,t-1}$ x $Sup_{b,t-1}$	-0.230*** (0.0706)	-0.241*** (0.0830)	-0.0658 (0.0569)	0.00577 (0.0532)	
N	25,407,607	26,098,126	2,945,492	2,929,344	
R-squared	0.900	0.900	0.940	0.942	
Fixed effects					
Bank*Firm	Y	Y	Y	Y	
Firm*Time	Y	Y	Y	Y	
Bank*Time	Y	Y	Υ	Y	

	Stressed countries			Non-stressed countries				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BOcid	-0.0280	-0.0588*	-0.0599*		-0.0881	-0.146***	-0.152***	
DQt,t-1	(0.0510)	(0.0264)	(0.0324)		(0.0597)	(0.0457)	(0.0453)	
$BQ_{ft-1} \mathbf{x} Sup_{bt-1}$	-0.428***	-0.367***	-0.362***	-0.207*	-0.401***	-0.319***	-0.312***	-0.086*
	(0.0622)	(0.0553)	(0.0552)	(0.112)	(0.117)	(0.0977)	(0.0975)	(0.045)
$BQ_{ft,1} \times Shock_{t,1}^{MP}$	-0.0209**	-0.0143***	-0.0112***		-0.0219***	-0.0275***	-0.0249***	
	(0.00486)	(0.00463)	(0.00432)		(0.00508)	(0.00719)	(0.00712)	
BO ₆₊₁ x Sup _{k+1} x Shock. ^{MP}		0.0175	0.0370**	0.0475**		0.0165**	0.0117*	0.0372*
2 Qtt-1 H conhort H concent-1		(0.0101)	(0.0159)	(0.0241)		(0.0083)	(0.00518)	(0.0197)
Large _b X BQ _{fr-1}	0.268**	0.328**	0.361**	0.211	0.291***	0.314***	0.328***	0.145
	(0.131)	(0.149)	(0.141)	(0.190)	(0.0791)	(0.0933)	(0.0881)	(0.316)
$Large_b \times BQ_{f,t-1} \times Sup_{b,t-1}$		-0.580***	-0.627***	-0.434**		-0.813***	-0.831***	-0.4798*
		(0.208)	(0.202)	(0.205)		(0.163)	(0.158)	(0.255)
Large, $\mathbf{x} BO_{f+1} \mathbf{x} Shock_{1}^{MP}$		-0.0136	-0.0465***	-0.0223*		-0.0122	-0.033*	-0.141***
		(0.00929)	(0.00841)	(0.0119)		(0.0148)	(0.0178)	(0.0460)
Large _b x BQ _{f,t-1} x Shock _{t-1} ^{MP} x Sup _{ht-1}			0.0513***	0.0452***			0.0208*	0.164***
			(0.00886)	(0.0146)			(0.0108)	(0.046)
N	39,811,038	39,811,038	39,811,038	29,856,793	6,262,908	6,262,908	6,262,908	2,915,490
R-squared	0.705	0.705	0.705	0.773	0.835	0.835	0.835	0.866
Fixed effects								
Bank*Firm	Y	Y	Y	Υ	Υ	Υ	Y	Y
Firm*Time	Ν	Ν	Ν	Υ	Ν	Ν	Ν	Y
Sector*Time	Υ	Υ	Υ	-	Υ	Υ	Υ	-
Bank*Time	Υ	Υ	Υ	Υ	Υ	Υ	Y	Y

Banking Supervision and Monetary Policy

Altavilla C. – Boucinha M. – Peydró J-L. – F. Smets

Banking Supervision, Monetary Policy and Risk taking

	Non-performing but not in default	Default because of unlikely to pay	Default because of past due more than 90 days	Default because of both unlikely to pay and past due more than 90 days	Default
Austria	Y	Y	Y	Y	Y
Belgium	Ν	Υ	Υ	Υ	Ν
Cyprus	Y	Υ	Υ	Ν	Ν
Germany	-	-	-	-	-
Spain	Ν	Y	Y	Ν	Ν
France	-	-	-	-	-
Ireland	Y	Ν	Ν	Ν	Y
Italy	Y	Y	Y	Y	Y
Lithuania	Ν	Y	Y	Ν	Ν
Latvia	Ν	Ν	Y	Ν	Ν
Malta	Y	Y	Y	Υ	Ν
Portugal	Y	Y	Y	Ν	Y
Romania	-	-	-	-	-
Slovenia	Y	Y	Ν	Υ	Ν
Slovakia	Υ	Y	Υ	Ν	Ν

Definition of variables used in the regression

	Exposure	NPL Ratio	NPL Ratio excl. Sector	Borrower Quality
Austria	Credit Drawn + Undrawn	Non-performing status	Non-performing status	Arrears / Exposure
Belgium	Credit Drawn + Undrawn	Non-performing status	Non-performing status	Arrears / Exposure
Germany	Credit Drawn	Probability of default	Probability of default	Probability of default
Spain	Credit Drawn + Undrawn	Non-performing status	Non-performing status	Arrears / Exposure
France	Credit Drawn + Undrawn	Non-performing status	-	-
Italy	Credit Drawn + Undrawn	Non-performing status	Non-performing status	Arrears / Exposure
Lithuania	Credit Drawn + Undrawn	Non-performing status	Non-performing status	-
Portugal	Credit Drawn + Undrawn	Non-performing status	Non-performing status	Arrears / Exposure
Slovakia	Credit Drawn + Undrawn	Non-performing status	Non-performing status	Arrears / Exposure
Romania	Credit Drawn + Undrawn	Non-performing status	Non-performing status	Arrears / Exposure

Exploiting granularity at bank-firm level

Bank NPL ratio (share of total exposure)





Note: Stressed countries are IT, ES, PT; Non-stressed countries are AT, BE, DE, LT, SK, FR. Percentile of firm-bank-time on the x-axis. Pooling data at country, time, bank, borrower level.

Note: Stressed countries are IT, ES, PT; Non-stressed countries are AT, BE, DE, LT, SK, FR. Pooling data at country, time, bank level. NPL ratio on x-axis.

Bank NPL ratio by year (share of total exposure)

Non-performing loans: large cross-country heterogeneity



Bank NPL is a key component of bank balance sheet strength, which is crucial not only for bank risktaking and supervision but also for monetary policy (e.g. Shin, 2016; Freixas-Rochet, 2008), and there is much more variation across banks on NPLs than on capital

Lending to riskier borrowers depending on productivity



The change in credit supply due to the reduction in firm creditworthiness is larger for less productive firms