

To Ask or Not To Ask? Bank Capital Requirements and Loan Collateralization

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Our views and not necessarily those of the Bank of England or Bank of Portugal

Motivation

- Ongoing debate on the optimal level of bank capital requirements
 - Academic debate (e.g., Admati and Hellwig, 2013)
 - Policy circles: various revisions of Basel agreements
- After the Global Financial Crisis, regulatory and supervisory framework has been (somewhat) tightened
 - Basle III framework
 - Stress tests
- Regulatory frameworks favour collateralized loans over uncollateralized loans
 - Secured loans require less regulatory capital as they have lower risk weights and/or lower LGD

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- Research Question:
 - Do higher capital requirements influence loan collateralization?
 - Yes overall, but much less (no impact) on relationship borrowers

Motivation

- Overcoming asymmetric information is a key challenge for lenders
 - (e.g., Stiglitz and Weiss (1981), Petersen and Rajan (1994,5), Berger and Udell (1995), ...)
- Banks may *overcome asymmetric information by requiring collateral* (Bester, 1987)
- Yet, collateral is costly and often scarcely available
 - Collateral may not be available at the initial stage of a firm's life
 - the use of collateral is costly as pledging involves costs, may restrict the debtor, and value of collateral to creditor is lower than to debtor
 - limited legal enforcement may dampen recovery rates on collateral (e.g., Djankov et al. (JPE2007); Calomiris et al. (JFE2017), Degryse et al. (2016))

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- *Building relationships and screening* is another channel to overcome asymmetric information: *learning borrower's quality over time* (Boot and Thakor, 198; Manove, Padilla and Pagano, 2004)
- The role of bank-firm relationships: to mitigate use of collateral?

Identification strategy

- Investigating impact of higher capital requirements on lending and loan collateralization is challenging
 - Changes apply (mostly) to all banks
 - Changes may be endogenous to economic conditions
- We use EBA capital exercise of Oct 2011 as quasi-natural experiment for identification (as in Gropp et al., RFSforth; Blattner et al., 2018; Mayardomo et al., 2018; Mésonnier and Monks, IJCB2015)
 - imposed higher capital requirements on *some banks*, unrelated to their SME loan portfolio
- Investigate the impact on treated banks' responses
 - loan collateralization
 - Collateral types

Related literature and contribution

- Bank response to higher capital requirements
 - increase capital
 - Reduce risk-weighted assets
 - Decrease assets (Acharya et al. RFS2018; Gropp et al. RFSforth)
 - Collateral channel: increase loan collateralization and modify collateral types
- Relationship banking
 - in crisis times
 - e.g., Bolton et al. RFS2016; Beck et al. JFE2018; Banerjee et al., 2017
 - in normal times:
 - e.g., Boot JFI2000, Liberti and Petersen, 2017
 - strong relationships may (partially) protect firms from “collateral constraints”

The EBA capital exercise as quasi-natural experiment

- In Oct 2011, EBA announced that a set of major European banking groups had to increase their capital buffer to cover risks linked to sovereign exposures
- Announcement was surprise: EBA had conducted stress test in July 2011 and had already released information on banks' sovereign exposures (Mésonnier and Monks IJCB2015)
- 4 Portuguese banks in exercise (out of 8 big ones) had an aggregate shortfall of 22% of their total capital or 30% of their tier1 capital

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- 4 Portuguese banks in exercise (out of 8 big ones) had an aggregate shortfall of 22% of their total capital or 30% of their tier1 capital
- Treated banks reduce risk-weighted assets and thus required regulatory capital: *issue collateralized loans instead of uncollateralized loans*
- EBA capital exercise is a shock to the trade-off in the two lending technologies (collateralized versus information-based) for treated banks

The EBA capital exercise: Hypotheses

- Hypothesis 1 : loan collateralization

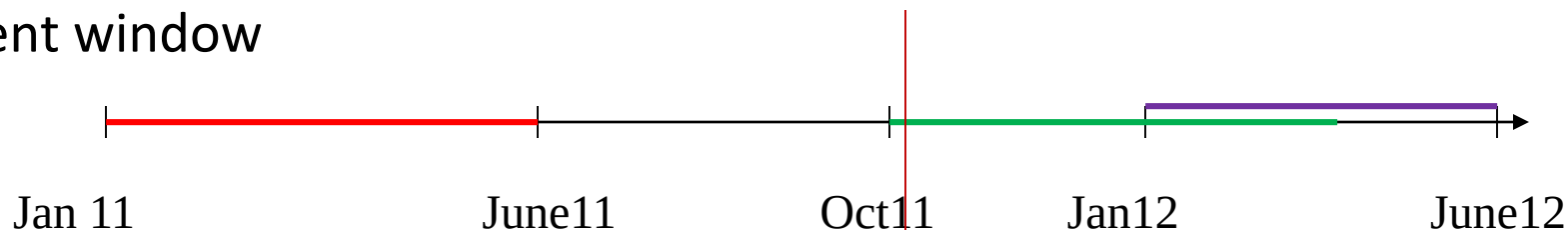
Following the capital exercise, loans granted by treated banks are more likely to be collateralized than those by control banks, but less so for relationship borrowers.

- Hypothesis 2: 'low-risk-weight collateral'

Following the capital exercise, collateralized loans granted by treated banks are more likely to have 'low-risk-weight collateral' than those by control banks, but less so for relationship borrowers.

Data

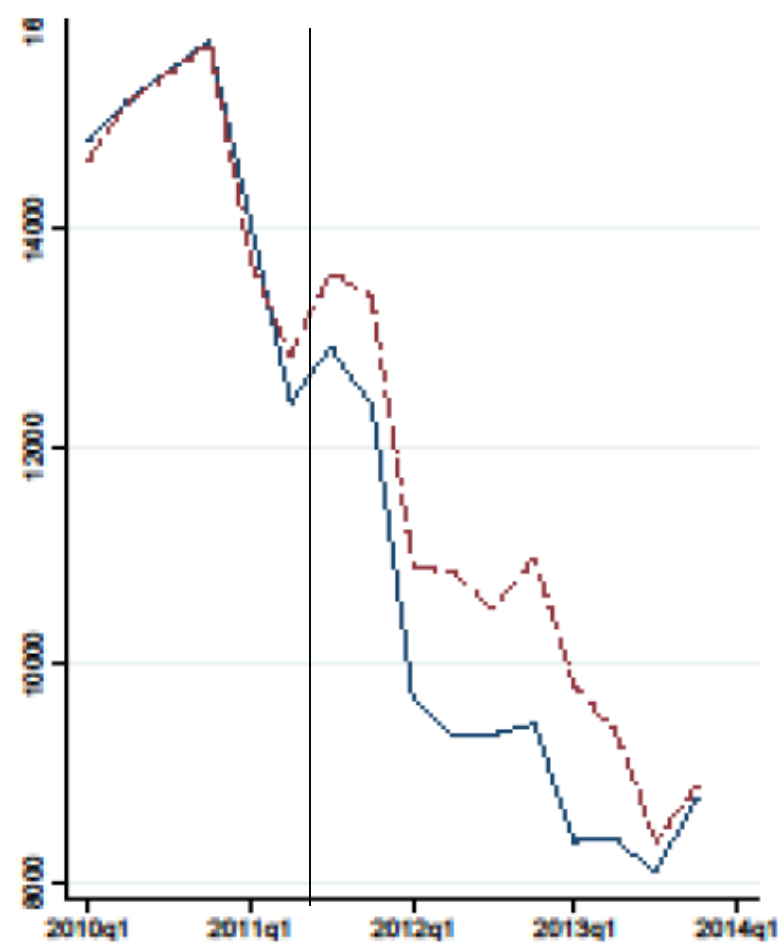
- We combine the following datasets from Portugal:
 - monthly bank-firm exposure information on credit to firms incorporated in Portugal (Central de responsabilidades de credito (CRC) of the Banco de Portugal) – reporting threshold: 50 €;
 - Focus on credit lines
 - Information about collateral pledged on loans
 - annual financial accounts of Portuguese firms (Central Balance Sheet Database (CNSD))
 - Monthly bank balance sheet information (Monetary and Financial Statistics of Banco de Portugal)
- Event window



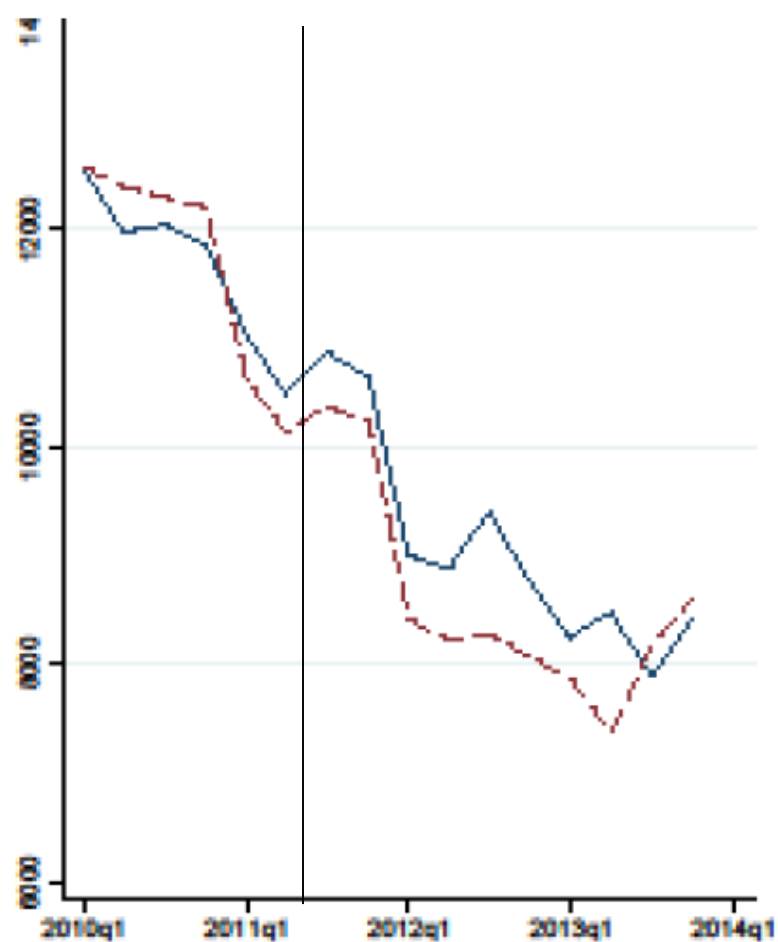
Data

- Time coverage for bank-firm relationship data: from 2005 onwards
- We focus on firms with multiple lending relationships (Khwaja and Mian, AER2008) (but do robustness including single relationship firms and use ILS fixed effects (as in Degryse et al. 2018))
- Two indicators of *bank-firm relationship strength* at loan origination
 - **Relationship Length:** number of months since first loan from bank (in natural logarithm) at the time of loan origination
 - **Cumulative relationship:** number of loan interactions (in natural logarithm) between the bank and the firm *at the time of origination of the new loan*

Collateralized



Uncollateralized



— Control
- - - Treated

Data: Descriptives (1)

	Mean	Median	SD	Min	Max
Dependent variable					
Collateral dummy	0.51	1.00	0.51	0.00	1.00
Low risk weight collateral	0.25	0.00	0.43	0.00	1.00
Relationship variables (firm-level)					
Relationship length (months)	52.83	54	27.76	1	108
Cumulative relationship	14.42	12.81	9.98	1	92
Firm variables					
Age	16.18	13.00	12.98	1.00	177.00
Total assets (thousand euros)	2413.32	630.48	5433.83	18.88	32919.75
Number of employees	27.22	8.00	206.09	1.00	22734
Number of banking relationships	2.58	2.00	1.02	2.00	14.00

- About half of the loans are collateralized
- About 25% of collateralized loans have “low-risk-weight collateral” (i.e., equal to 1 when collateral is “real estate, financial collateral, or guarantee by government or bank”, zero otherwise)
- Relationship length about 50 months, about 13 loan interactions
- Median firm is small

Data: Descriptives (2)

Bank status	Assets	Liquidity ratio	Capital ratio	Loan ratio	Deposit ratio
Treated	20.6	0.092	0.077	0.307	0.297
	8.80	0.021	0.045	0.129	0.121
Control	2.41	0.070	0.079	0.584	0.175
	4.78	0.135	0.107	0.318	0.222
Matched Control	16.1	0.092	0.108	0.332	0.158
	8.82	0.016	0.113	0.016	0.037

- Treated banks are larger -> matched control (4 other big banks)
- Otherwise very similar

H1: Collateral dummy

	(1) Q4,Q1	(2) Q1,Q2	(3) Q1,Q2	(4) Q1,Q2	(5) Q4,Q1	(6) Q1,Q2	(7) Q1,Q2	(8) Q1,Q2
<i>RelationshipLength</i>	-0.026*** [0.001]	-0.025*** [0.001]	-0.027*** [0.001]	-0.031*** [0.001]				
<i>RelationshipLength * Dummy_{ebabank}</i>	0.019*** [0.002]	0.019*** [0.002]	0.010*** [0.003]	0.011*** [0.003]				
<i>RelationshipLength * Post</i>	0.010*** [0.002]	0.013*** [0.002]	0.012*** [0.002]	0.012*** [0.002]				
<i>RelationshipLength * Post * Dummy_{ebabank}</i>	-0.012*** [0.003]	-0.015*** [0.003]	-0.010*** [0.003]	-0.011*** [0.003]				
<i>Post * Dummy_{ebabank}</i>	0.028*** [0.010]	0.028*** [0.011]	0.013 [0.011]	0.023* [0.013]	0.036*** [0.009]	0.029*** [0.009]	0.007 [0.009]	0.016 [0.011]
<i>Cum.relationship</i>					-0.055*** [0.002]	-0.054*** [0.002]	-0.059*** [0.002]	-0.063*** [0.002]
<i>Cum.relationship * Dummy_{ebabank}</i>					0.010*** [0.003]	0.009*** [0.003]	0.003 [0.003]	0.015*** [0.003]
<i>Cum.relationship * Post</i>					0.010*** [0.002]	0.012*** [0.002]	0.012*** [0.002]	0.014*** [0.003]
<i>Cum.relationship * Post * Dummy_{ebabank}</i>					-0.017*** [0.003]	-0.019*** [0.003]	-0.009*** [0.003]	-0.013*** [0.004]
<i>Loan volume</i>	0.134*** [0.000]	0.134*** [0.000]	0.143*** [0.000]	0.143*** [0.000]	0.134*** [0.000]	0.135*** [0.000]	0.143*** [0.000]	0.144*** [0.000]
Bank FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	N	N	Y	N	N	N	Y	N
Firm Time FE	N	N	N	Y	N	N	N	Y
R-squared	0.40	0.40	0.56	0.59	0.40	0.40	0.56	0.59
Number of obs.	570962	541711	540487	564579	570962	541711	540487	564579

- $Dummy_{ebabank} = 1$ if treated bank, 0 otherwise
- Based on column 2: treated banks are 2.8 pp more likely to ask for collateral; a one standard deviation larger relationship length reduces this to 1.4 pp. (i.e., $2.8 - 0.015 \cdot 0.92$)

H2: ‘low-risk-weight collateral’

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Q4,Q1	Q1,Q2	Q1,Q2	Q1,Q2	Q4,Q1	Q1,Q2	Q1,Q2	Q1,Q2
<i>RelationshipLength</i>	0.018*** [0.001]	0.012*** [0.001]	0.020*** [0.002]	0.020*** [0.002]				
<i>RelationshipLength * Dummy_{ebabank}</i>	0.016*** [0.001]	0.024*** [0.001]	0.024*** [0.001]	0.027*** [0.002]				
<i>RelationshipLength * Post</i>	0.044*** [0.003]	0.038*** [0.003]	0.026*** [0.003]	0.028*** [0.003]				
<i>RelationshipLength * Post * Dummy_{ebabank}</i>	-0.078*** [0.005]	-0.079*** [0.003]	-0.049*** [0.004]	-0.063*** [0.005]				
<i>Post * Dummy_{ebabank}</i>	0.332*** [0.018]	0.309*** [0.013]	0.190*** [0.015]	0.239*** [0.018]	0.254*** [0.014]	0.231*** [0.010]	0.144*** [0.012]	0.175*** [0.014]
<i>Cum.relationship</i>					-0.015*** [0.001]	-0.020*** [0.002]	-0.004* [0.002]	-0.002 [0.002]
<i>Cum.relationship * Dummy_{ebabank}</i>					0.022*** [0.001]	0.031*** [0.001]	0.032*** [0.002]	0.035*** [0.002]
<i>Cum.relationship * Post</i>					0.041*** [0.004]	0.035*** [0.003]	0.024*** [0.003]	0.022*** [0.004]
<i>Cum.relationship * Post * Dummy_{ebabank}</i>					-0.075*** [0.005]	-0.076*** [0.003]	-0.049*** [0.004]	-0.060*** [0.005]
<i>Loan volume</i>	0.025*** [0.001]	0.026*** [0.001]	0.021*** [0.001]	0.020*** [0.001]	0.025*** [0.001]	0.026*** [0.001]	0.021*** [0.001]	0.020*** [0.001]
Bank FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	N	N	Y	N	N	N	Y	N
Firm-time FE	N	N	N	Y	N	N	N	Y
R-squared	0.03	0.03	0.31	0.35	0.03	0.03	0.30	0.35
Number of obs.	346565	329563	326636	320608	346565	329563	326636	320608

- $Dummy_{ebabank} = 1$ if treated bank, 0 otherwise
- Based on column 4: for the collateralized loans, treated banks are 24pp more likely to ask for ‘low-risk-weight collateral’; a one standard deviation larger relationship length reduces this to 18 pp. (i.e., $24 - 0.063 \times 0.92$)

Parallel trends and Robustness

- Parallel trends in period before EBA capital exercise
- Treatment intensity: exploiting variation in shortfall
- Matched control
- Drop foreign banks
- Include single relationship firms and use industry-location-size fixed effects

	(1) no foreign	(2) no foreign	(3) matched	(4) matched	(5) all firms	(6) LTRO	(7) LTRO
<i>RelationshipLength</i>	-0.033*** [0.001]	-0.039*** [0.002]	-0.069*** [0.002]	-0.037*** [0.003]	-0.028*** [0.001]	-0.033*** [0.002]	-0.036*** [0.001]
<i>RelationshipLength * Dummy_{chabank}</i>	0.023*** [0.003]	0.014*** [0.003]	0.035*** [0.003]	0.013*** [0.004]	0.032*** [0.002]	0.014*** [0.003]	0.015*** [0.003]
<i>RelationshipLength * Post</i>	0.016*** [0.002]	0.019*** [0.003]	0.046*** [0.002]	0.022*** [0.003]	0.014*** [0.002]	0.016*** [0.002]	0.007*** [0.002]
<i>RelationshipLength * Post * Dummy_{chabank}</i>	-0.019*** [0.003]	-0.021*** [0.004]	-0.049*** [0.003]	-0.023*** [0.004]	-0.014*** [0.003]	-0.017*** [0.004]	-0.009*** [0.003]
<i>Post * Dummy_{chabank}</i>	0.043*** [0.012]	0.046*** [0.015]	0.146*** [0.013]	0.042** [0.017]	0.022** [0.010]	0.031** [0.014]	0.026* [0.014]
<i>Loan volume</i>	0.143*** [0.000]	0.152*** [0.000]	0.134*** [0.000]	0.144*** [0.000]	0.140*** [0.000]	0.144*** [0.000]	0.143*** [0.000]
Bank FE	Y	Y	Y	Y	Y	Y	Y
Firm FE	N	N	Y	N	N	N	N
Firm-time FE	N	Y	N	Y	N	Y	Y
ILS FE	N	N	N	N	Y	N	N
R-squared	0.41	0.61	0.72	0.62	0.43	0.59	0.58
Number of obs.	491197	485342	431336	424561	700947	536549	444471

Robustness - no foreign bank: EBA applied at the consolidated bank level, impact coming from foreign subsidiaries may be different from that from Portuguese headquarters

Firm level outcomes

- Recent work has shown that reduced lending matters for firm-level real variables, such as employee or asset growth (Chodorow-Reich, 2014).
- We ask two further questions:

Do increased collateral requirements cause credit contraction or reallocation away from one sector of the economy to another?

Sectoral outcomes

- Recent work has shown that reduced lending matters for firm-level real variables, such as employee or asset growth (Chodorow-Reich, 2014).
- We ask two further questions:

Do increased collateral requirements cause credit contraction or reallocation away from one sector of the economy to another?

- We study whether supply of pledgeable assets at sectoral level is related to change in credit amount around our experiment.
- We differentiate between sectors that have a high exposure to treated banks
- Such sectors should be more negatively affected after the shock.

One-standard-deviation change in *intangible asset* (19.3 percent) would account

- for 12.6 percentage point of variation in sector lending ($-0.658 \times 0.193 = -0.126$)
- or 38 percent of the standard deviation in sectoral lending growth (33 percent) -
- for around 20 percent of the standard deviation in employment growth in column 4,
- and around 35 percent of the standard deviation in asset growth in column 6.

	(1)	(2)	(3)	(4)	(5)	(6)
	sect lending	sect lending	emp growth	emp growth	asset growth	asset growth
<i>Share intan</i>	-0.412*** [0.130]	-0.431*** [0.124]	-0.174* [0.100]	-0.248*** [0.092]	-0.252** [0.104]	-0.369*** [0.097]
<i>Share intan * Share eba</i>	-0.658*** [0.183]	-0.676*** [0.180]	-0.126 [0.141]	-0.290** [0.131]	-0.243* [0.146]	-0.483*** [0.138]
<i>Share eba</i>	0.061 [0.139]	0.062 [0.139]	0.120 [0.130]	0.107 [0.128]	0.082 [0.131]	0.063 [0.129]
Bank FE	Y	Y	Y	Y	Y	Y
Firm FE	N	N	Y	N	N	N
Firm-time	N	Y	N	Y	N	Y
ILS FE	N	N	N	N	Y	N
R-squared	0.06	0.07	0.06	0.09	0.05	0.08
Number of obs.	523.00	523.00	523.00	523.00	523.00	523.00

Firm-level effects

Is increased collateral requirement important for those firm level outcomes, conditional on a loan being granted as well?

- Collateral may impact firms over and above its impact on credit contraction, because pledging imposes opportunity costs on borrowers by tying up assets that might otherwise be put to more productive uses.
- We distinguish between those firms borrowing entirely from EBA banks, from those that borrow from either both groups of banks or from only control banks

1. Treated borrowers experience a relative 2 p.p. decline in asset growth (columns 2 and 6), which is about 3.5 percent of its variation.
2. Firms switch to more tangible assets, that are easier to pledge as collateral. Treated groups increase tangible asset ratio by 0.4 percent, which is about 40 percent of the average change in tangible asset ratio

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	emp growth	ast growth	delta tan	delta rate	emp growth	asset growth	delta tan	delta rate
<i>Borrower treated</i>	-0.001 [0.005]	-0.018*** [0.005]	0.004*** [0.001]	-0.001 [0.001]	-0.004 [0.005]	-0.021*** [0.005]	0.005*** [0.001]	-0.001 [0.001]
<i>Borrower both</i>	-0.004 [0.006]	-0.010* [0.006]	0.004** [0.002]	0.001 [0.001]	-0.013** [0.006]	-0.015*** [0.006]	0.005*** [0.002]	0.001 [0.001]
<i>Loan volume</i>	0.003** [0.001]	0.008*** [0.001]	0.002*** [0.000]	0.001*** [0.000]	0.003** [0.001]	0.005*** [0.001]	0.002*** [0.000]	0.001*** [0.000]
Firm Controls	Y	Y	Y	Y	Y	Y	Y	Y
Sector FE	N	N	N	N	Y	Y	Y	Y
R-squared	0.01	0.01	0.00	0.00	0.03	0.02	0.01	0.01
Number of obs.	43652.00	43670.00	43110.00	37254.00	43652.00	43670.00	43110.00	37254.00

Conclusions

- Use of collateral is pervasive in credit markets – repos, mortgages, funding at central banks
- Regulatory framework favours collateralized lending
- We document a novel channel on how banks respond to higher capital requirements
 - Shift towards collateralized lending
 - Shift towards ‘low-risk-weight collateral’
- Lending by banks switches more away to tangible sectors
- Affected firms experience a decline in asset growth and a shift to tangible investments
- Firms with “stronger relationships” are partially shielded from the impacts of the regulations

A clarifying example

- A bank whose regulatory capital requirement is binding under the new regulation
- The bank is financed by
 - deposits: cost of deposit approximately 1.5%
 - equity capital (cost of equity on average 9%)

The bank is deciding on extending a new loan. It faces a choice:

- 1) Issue a loan with the guarantee of a financial institution. Risk weight is 0%, can be fully financed with deposit at cost of 1.5%
- 2) Issue a loan without guarantee. Risk weight is 100%, must be financed by equity capital, cost is 9%

To make a 1% margin on the loan, the bank would have to ask for 10% interest rate on the second loan (and only 2.5 in the first case).

Conclusion: Much costlier for the bank to extend an unsecured loan.