DEUTSCHE BUNDESBANK EUROSYSTEM

Discussion by Peter Bednarek
Credit Risk Taking and Maturity Mismatch: the Role of the Yield Curve

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Summary

- **Question**: What is the empirical relation between banks' attitude towards risk and the level and the slope of the yield curve.

- **Motivation**: Provide "missing" evidence of a clear and robust effect of changes in the yield curve components other than the short-term interest rate on risk-taking.

- **Approach**: Two empirical approaches proposed in the previous literature. One by Dell'Ariccia et al (2017), which focuses on the changes in the class of risk to which it belongs the creditor of the marginal loan, and the one by Jimenez et al (2014), which considers the amount of credit granted to risky vs non-risky firms.

- **Results**: A steepening or an upward (parallel) shift of the curve increases banks' credit risk-taking. The effect is stronger for banks with larger duration gap, independently from the sign of the maturity mismatch. But, this increases profitability and risk-bearing capacity of banks with a positive maturity mismatch, as well. The opposite is true for banks with a negative duration gap.

- **Contribution**: The first paper to present robust evidence of a positive and significant relationship between the slope of the yield curve and banks' risk-taking, as measured by both the probability of providing the loan to a riskier firm and the additional amount granted to riskier firms. All in all, both the short and the long end of the yield curve matter.

Vantages

- Two step estimation approach.
- Identification over new loans.
- Paper is laid out very well and easy to read.
- Tests for non-linearity of the risk measure.
- Further step in understanding the link between bank lending, risk-taking and the yield curve.

General comments

- Unfair, but is Italy a good laboratory to understand credit risk taking and interest rate dynamics?
  - 12 percent NPL ratio and an industrial production that didn't recover from the great financial crisis.
  - Part of the Euro crisis countries.
  - Average bank capital ratio 9.9 percent.

- And, given the high NPLs, is the utilized risk measure really a good one?

- Compute other ex-ante risk measures like interest coverage ratio (ICR), leverage, debt overhang. Jensen and Meckling (1976), Duchin and Sosyura (2014), Acharya et al. (2017), te Kaat (2018), IMF (2018) etc.

- Most specifications do not control for loan demand (except in Table 7).
  - In general, too much emphasis on the different firm / bank / makro controls and / or FE. Simplify by utilizing approach by Khwaja and Mian (2008) and control for loan demand by restricting the sample to firms with multiple bank relationships and include firm-time FE (or even better loan-time FE) in all specifications.
  - Run interaction models with bank-time FE.
  - Are (bank) controls lagged?

General (minor) Comments

- What are banking groups, is it bank holding companies?
- Include median in descriptive statistics.
- How many firms have credit relationships with more than one bank?
- Standard errors are missing.
- Measuring bank heterogeneity with other than capital is not totally new. Papers dealing with among others agency problems: liquidity (Acharya and Naqvi, 2012), term structure on the liability side (Calomiris and Kahn, 1991), size/too-big-to-fail (Wheelock and Wilson, 2012), etc.

Duration gap

- Does the duration gap measures the banks business model? Duration gap is heavily dependent on the assumptions regarding the maturity of deposits and long-term assets.
  - o During crisis periods deposits i.e. customers search for save haven. This is the cyclical component of the duration gap, vs the business model which affects the structural component of the duration gap.
  - o In a low interest environment customers shift to high liquid deposits in general. Hence, the duration gap of “classical” / credit granting and deposits collecting commercial banks gets smaller (or negative) and looks rather like the duration gap of investment banks. => Purely mechanical result.
  - o The negative duration in the descriptive statistics is a first indication of this twisted result.
  - o Business models are not so volatile.

- Steepening or upwards shift of the yield is only “bad” for banks with a negative duration gap. Because of mechanical misclassification of classical commercial banks into some sort of investment bank results may be overestimated.

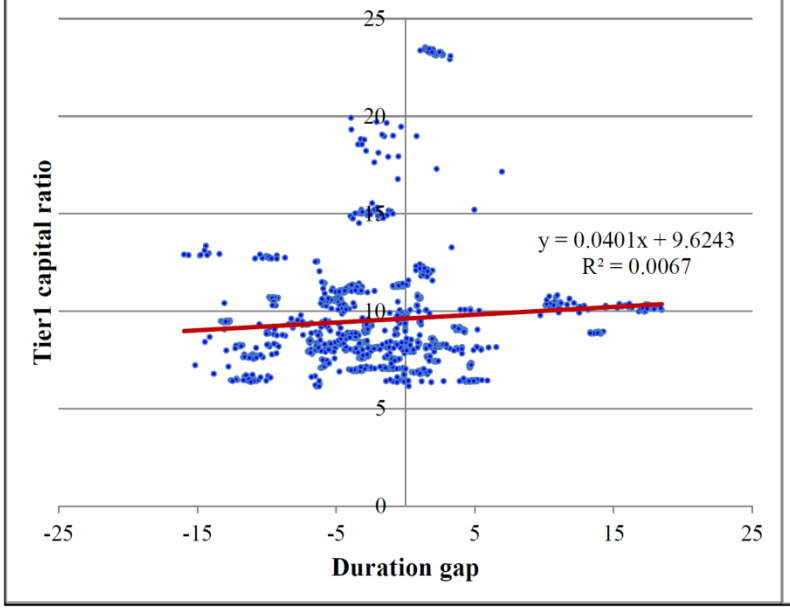
- Duration gap not a good measure for interest rate risk. Utilize instead Basel interest rate shock (coefficient).

Duration gap

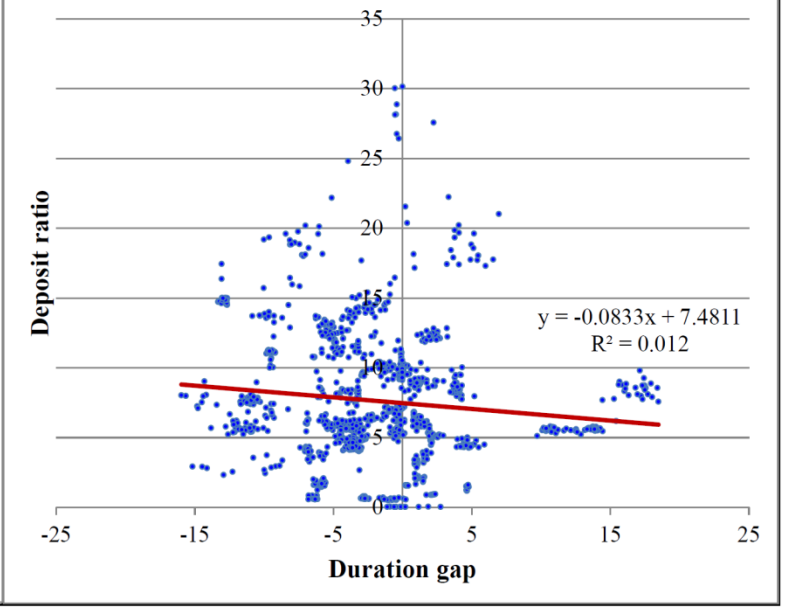
- Twisted duration gap of “classical” commercial banks: It seems as if banks with high NPL and therefore low capital ratios exhibit negative duration gaps. The same is true for banks with high deposits ratios.

FIGURE 3. Cross-section correlation
(half-yearly observations)

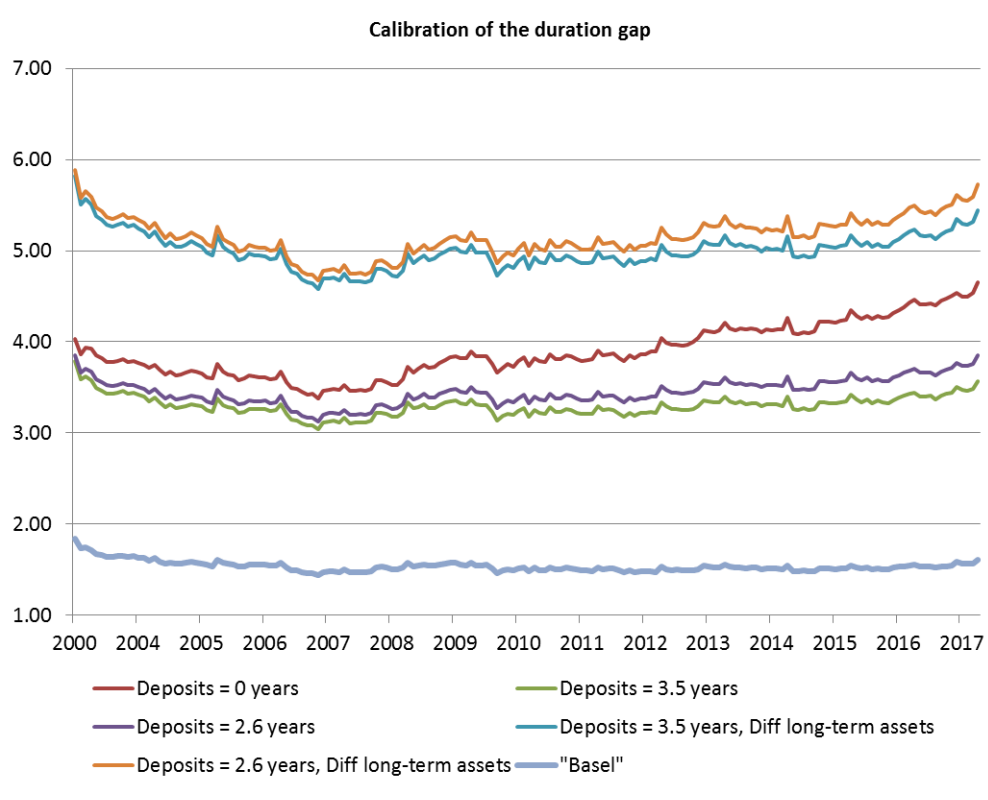
(a) Duration gap vs Tier1 capital ratio



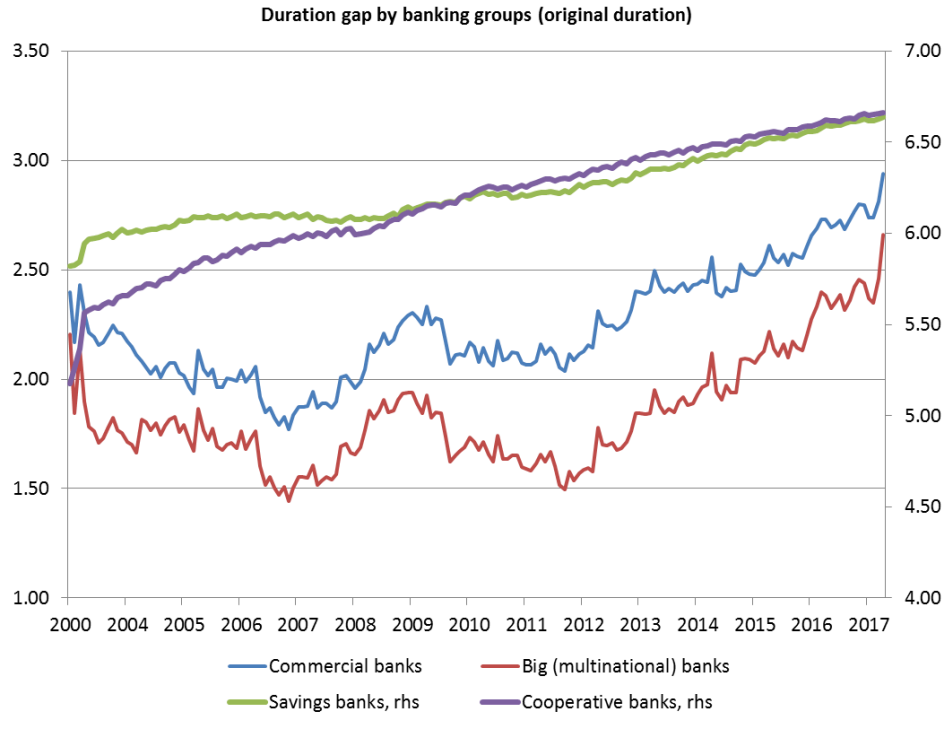
(b) Duration gap vs deposit ratio

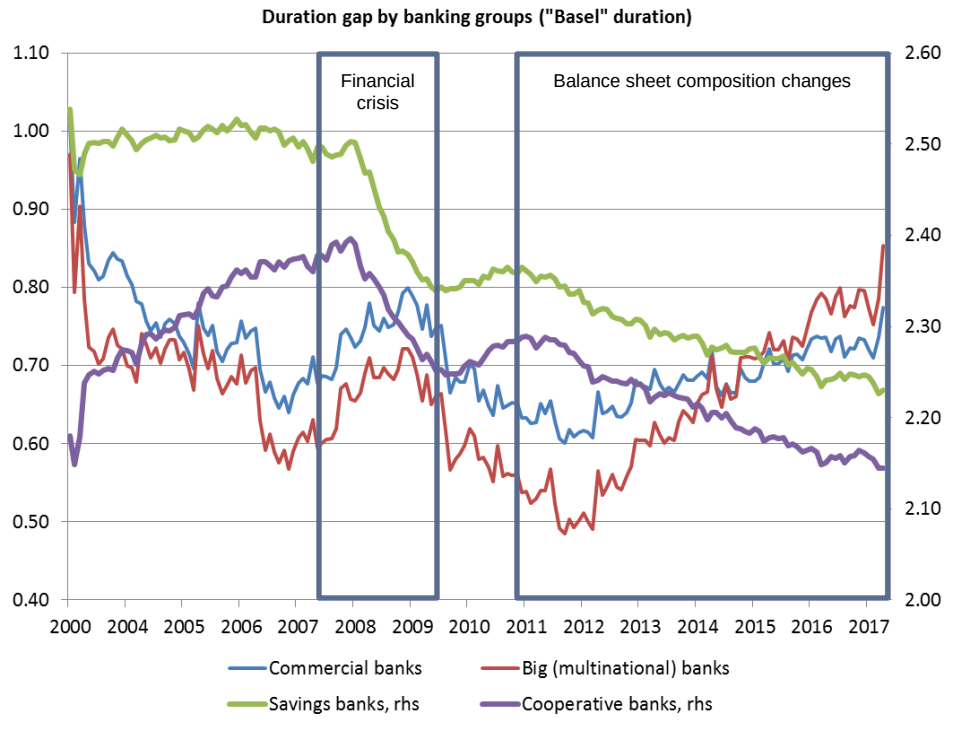


Duration gap



Duration gap



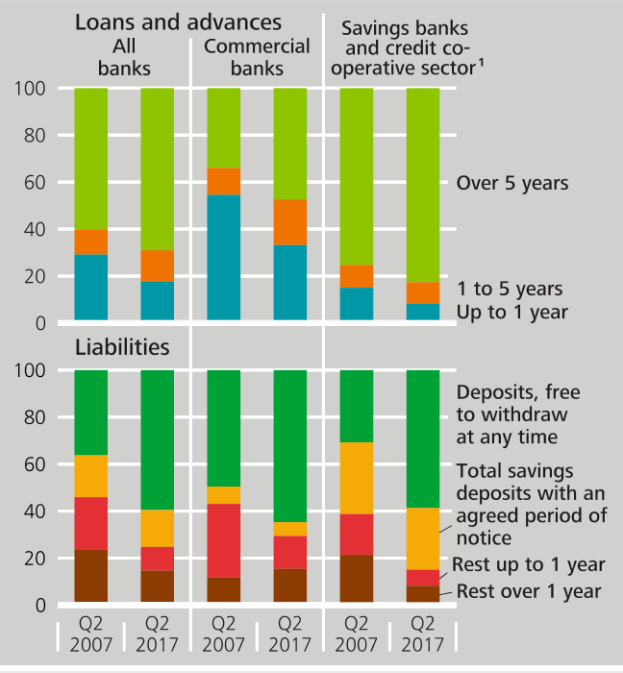


Duration gap

Maturity of loans and advances and liabilities to non-banks*

Chart 4.7

Percentage shares



* According to original maturity. **1** Primary and central institutions in the savings bank and credit cooperative sector.

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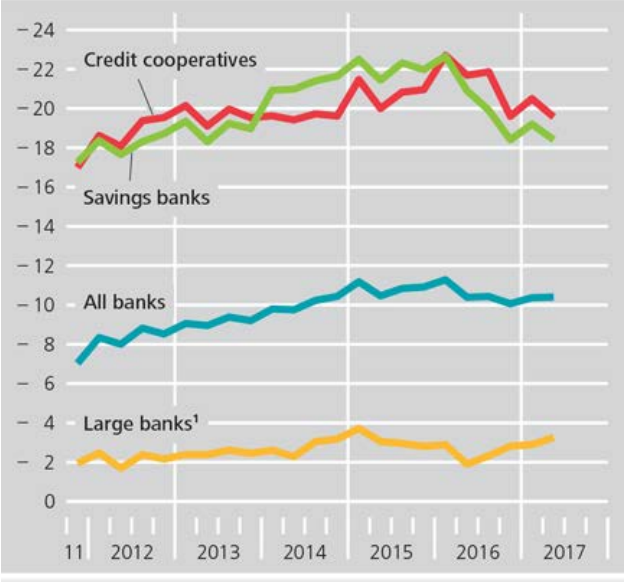
Changes in present value given interest rate rise*

Chart 4.8

As a percentage of regulatory own funds



* Changes in present value of positions in the banking book subject to interest rate risk caused by an abrupt interest rate rise of 200 basis points across all maturities. The analyses are based on reports from institutions for the Basel interest rate coefficient. **1** 12 major German banks with an international focus which did not outsource positions to resolution agencies in the observation period.

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Specific comments

TABLE 3 – Interest rates and credit risk-taking – Dependent variable: (log) amount of new lending for different rating classes

	(1)	(2)	(3)	(4)	(5)
Firm rating	-0.0542***	-0.1166***	-0.0639***	-0.0431***	-0.0316***
Interactions with macroeconomic variables					
Eonia rate * Firm rating	**-0.0101*** **	**-0.0126*** **	**-0.0044*** **	**-0.0013**	**-0.0012**
10-year Eurirs rate * Firm rating		**0.0109*** **	**0.0086*** **	**0.0084*** **	**0.0081*** **
10-year BTP-BUND spread * Firm rating	0.0011	0.0009	0.0021	0.0019	0.0023*
Italian inflation rate * Firm rating	0.0058***	0.0099***	0.0028**	0.0007	0.0001
Italian unemployment rate * Firm rating	-0.0004	-0.0018	-0.0026	-0.0030**	-0.0030***
Italian business cycle * Firm rating	-0.0002	-0.0006	0.0052**	0.0053***	0.0047***
Bank controls					
Duration gap	0.0008***	0.0008***	0.0003	0.0001	-0.0001
Size	0.0984	0.0981	0.0152	-0.0234	0.0048
Tier1 capital ratio	0.0297***	0.0296***	0.0226***	0.0157***	0.0081**
NPL ratio	0.0219**	0.0220**	0.0122**	0.0098*	0.0034
Deposit ratio	-0.0070*	-0.0070*	-0.0032	-0.0012	-0.0013
Liquidity ratio	-0.0087***	-0.0087***	-0.0046***	-0.0025*	0.0007
Profitability	0.0007	0.0006	-0.0008	0.0003	0.0011
Loan-level controls					
Loan cost	-0.2672***	-0.2672***	-0.1352***	-0.0718***	-0.0642***
Loan maturity	0.1751***	0.1750***	0.3743***	0.5235***	0.4965***
Fixed-rate loans	-0.2618***	-0.2621***	-0.2279***	-0.2075***	-0.2035***
Subsidized loans	-0.2958***	-0.2961***	-0.0901	-0.0311	-0.0515
(Year:quarter) fixed effects	yes	yes	yes	yes	yes
Bank fixed effects	yes	yes	yes	yes	no
Firm zip-code*sector fixed effects	no	no	yes	no	no
Firm fixed effects	no	no	no	yes	no
Firm*Bank fixed effects	no	no	no	no	yes
Observations	2,498,790	2,498,790	2,446,268	2,375,238	2,131,448
Number of banks	144	144	144	144	143
Number of firms	359,111	359,111	313,917	235,559	205,307
Adjusted R-squared	0.192	0.192	0.547	0.672	0.754

Notes: panel regression estimates from 2005Q1 to 2016Q4 using the Taxia database. The dependent variable is the logarithm of granted loan by the individual bank to a given borrower. Standard errors are computed using a two-way clustering by bank and firm-quarter. ***,**, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

- Does the result of riskier lending due to higher long-term interest rate is driven by the pre (Euro) crisis period?
  - It could be that more (riskier) credit is granted in pre-crisis period.
  - Suggestion: Sample split or interaction model.
  - But, survival bias could still be an issue.
- Duration gap seems to be economically and statistically unimportant.
- Policy conclusion concerning too far reaching and counterintuitive: No financial stability risk, because of a flat slope of the yield curve (due to expansionary monetary policy).
  - IMF (2018): Increasing riskiness of credit allocation in Japan, Spain, Germany, (India, Korea and UK).
  - Asset price booms
  - Spiking interest rate risks
  - Lower bank profitability that is associated with less opportunities to retain earnings and to strengthen capital buffers
  - …

Specific comments

TABLE 5 – Interest rates and credit risk-taking: the role of the duration gap

	A) Dependent variable: rating class of new loan				B) Dependent variable: (log) amount of new lending for different rating classes			
	duration gap > 0		duration gap < 0		duration gap > 0		duration gap < 0	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Eonia rate	**-0.0261*** **	**-0.0182** **	**-0.0291*** **	**-0.0089**				
10-year Eurirs rate	**0.0665*** **	**0.0612*** **	**0.0675*** **	**0.0531*** **				
Firm rating					-0.0444***	-0.0429***	-0.0469**	-0.0356
Eonia rate * Firm rating					**0.0021**	**0.0032**	**-0.0034***	**-0.0039***
10-year Eurirs rate * Firm rating					**0.0100*** **	**0.0090*** **	**0.0069** **	**0.0070** **
Bank fixed effects	yes	-	yes	-	yes	-	yes	-
Firm fixed effects	yes	-	yes	-	yes	-	yes	-
Firm*Bank fixed effects	-	yes	-	yes	-	yes	-	yes
(Year:quarter) fixed effects	-	-	-	-	yes	yes	yes	yes
Other macro variables	yes	yes	yes	yes	-	-	-	-
[(Other macro variables) * (Firm rating)]	-	-	-	-	yes	yes	yes	yes
Bank controls	yes	yes	yes	yes	yes	yes	yes	yes
Loan-level controls	yes	yes	yes	yes	yes	yes	yes	yes
Number of banks	121	119	140	139	121	121	140	140
Number of firms	144 192	122 660	163 087	138 260	144 192	144 192	163 088	163 088
Observations	1 049 169	910 423	1 224 020	1 060 542	1 049 169	910 423	1 224 020	1 060 542
Adjusted R-squared	0.746	0.793	0.730	0.789	0.684	0.760	0.676	0.757

Notes: panel regression estimates from 2005Q1 to 2016Q4 using the Taxia database. In panel a) the dependent variable is the risk rating assigned by Cerved group to a given borrower ; in panel b) the dependent variable is the logarithm of granted loan by the individual bank to a given borrower. Standard errors are computed using a two-way clustering by bank and firm- quarter. ***,**, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

- Why not estimate an interaction model on the total sample?
- Coefficient for short-term interest rate in (7) and (8) only significant at the 10 percent level. Stark interpretation of the differences between duration gap > / < 0 in Panel B should be distinctively more cautious. (Missing in cross sectional analysis later on.)

Specific comments

TABLE 7 – Interest rates and credit risk-taking: the role of bank capital

	A) Dependent variable: rating class of new loan				B) Dependent variable: (log) amount of new lending for different rating classes			
	duration gap > 0		duration gap < 0		duration gap > 0		duration gap < 0	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Eonia rate * Tier1 ratio	**-0.0010**	**0.0045**	**0.0030**	**0.0040****	-0.0215	-0.0141	0.0057	0.0083
10-year Eurirs rate * Tier1 ratio	**0.0022**	**0.0022**	**-0.0017**	**-0.0065****	0.0480***	0.0303*	-0.0054	0.0069
Eonia rate * |Duration gap|		**-0.0001**		**-0.0014*****		0.0019		-0.0053**
10-year Eurirs rate * |Duration gap|		**0.0020****		**0.0032****		-0.0069***		-0.0070
Eonia rate * NPL ratio		0.0036		0.0001		-0.0054		0.0169**
10-year Eurirs rate * NPL ratio		-0.0007		0.0015		0.009		-0.0049
Eonia rate * Deposit ratio		-0.0005		-0.0001		-0.0041		-0.0086
10-year Eurirs rate * Deposit ratio		0.0019		0.0007		-0.002		0.0037
Eonia rate * Liquidity ratio		0.0002		0.0001		-0.0001		0.0028*
10-year Eurirs rate * Liquidity ratio		-0.0002		-0.0004		-0.0049*		-0.0037*
Eonia rate * Size		-0.0017		0.0008		0.0192		0.0102
10-year Eurirs rate * Size		-0.100**		-0.0011		-0.0213		-0.0447**
Eonia rate * Firm rating * Tier1 ratio					**0.0054**	**0.0023**	**0.0002**	**-0.0003**
10-year Eurirs rate * Firm rating * Tier1 ratio					**-0.0059****	**0.0011**	**-0.0027**	**-0.0051****
Eonia rate * Firm rating * |Duration gap|						**-0.0006*****		**0.0012*****
10-year Eurirs rate * Firm rating * |Duration gap|						**0.0015*****		**0.0016***
Eonia rate * Firm rating * NPL ratio						-0.0004		-0.0015
10-year Eurirs rate * Firm rating * NPL ratio						-0.0008		-0.0009
Eonia rate * Firm rating * Deposit ratio						0.0013		0.0015*
10-year Eurirs rate * Firm rating * Deposit ratio						0.0007		-0.0010
Eonia rate * Firm rating * Liquidity ratio						0.0004		-0.0001
10-year Eurirs rate * Firm rating * Liquidity ratio						0.0003		0.0001
Eonia rate * Firm rating * Size						-0.0017		-0.0013
10-year Eurirs rate * Firm rating * Size						0.0020		0.0019
Firm*(Year:quarter) fixed effects	-	-	-	-	yes	yes	yes	yes
(Year:quarter) fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Firm*Bank fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Bank controls	yes	yes	yes	yes	yes	yes	yes	yes
Loan-level controls	yes	yes	yes	yes	yes	yes	yes	yes
[Other macro vars]*[Tier1 ratio]*[Firm rating]	-	-	-	-	yes	yes	yes	yes
[Other macro vars]*[Other bank controls]*[Firm rating]	-	-	-	-	no	yes	no	yes
Observations	910 423	910 423	1 060 542	1 060 542	323 188	323 188	381 677	381 677
Adjusted R-squared	0.793	0.761	0.790	0.790	0.677	0.679	0.688	0.688

Notes: panel regression estimates from 2005Q1 to 2016Q4 using the Taxia database. In panel A) the dependent variable is the risk rating assigned by Cerved group to a given borrower; in panel B) the dependent variable is the logarithm of granted loan by the individual bank to a given borrower. Standard errors are computed using a two-way clustering by bank and firm-quarter. ***,**, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

- Why splitting the sample?
- Interpretation of triple interaction terms is tricky, if all variables are continuous. Compute marginal effects at representative values (e.g. median capital ratio).
- How is it possible to include firm-time, firm and firm-bank FE at once?
- Over- or maybe miss-interpretation of the changing significance of the triple interaction term coefficient' from (5) to (6) and from (7) to (8) ["10-year Eurirs rate + Firm rating + Tier 1 ratio"].
- Double interaction terms of interest rate with firm risk missing.

Suggestions

- Utilize Basel interest rate shock (coefficient) to capture interest rate risks.
- Bundesbank conducted a low-interest-rate survey, where we asked the banks to estimate the impact of different changes in the yield curve on their balance sheet. Maybe something similar at Banca d'Italia that you can use (https://www.bundesbank.de/en/press/press-releases/results-of-the-2017-low-interest-rate-survey-667444)
- Sensitivity tests of the duration cap, especially regarding deposits.
- Robustness tests with firm-time, loan-time and bank-time FE.
- Expand you analysis to loan growth dynamics (Δ ln loans) à la Jiménez et al. (2014). So far dependent variable analyzed is only in levels.
- Compute likewise to the IMF (2018) the riskiness of credit allocation in Italy over time and cross check those results with the ones presented. If your results are true one should expect a decline in the riskiness of credit allokation.

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