



EUROPEAN CENTRAL BANK

EUROSYSTEM

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Mortgage loan pricing in a negative interest rate environment

ECB conference on Credit, Banking and Monetary Policy

Frankfurt, 23 October 2017

***Disclaimer:** The views expressed on the slides are my own and do not necessarily reflect those of the ECB or the Eurosystem.

Background

- Introduction of **negative deposit facility rates** (NDFR):
 - Possible inefficiencies in the transmission of MP?
 - Existence of financial frictions that may hamper the interest rate pass-through?
- Reluctance of retail banks to lower deposit rates below zero.
- Deposit rate inertia may prompt banks to slow down the pace of transmission of interest cuts to lending rates.

Aim

- The behaviour of **mortgage lending rates** before and after the introduction of **NDFR** by the GC in **June 2014**.
- Examine how differences in **banks' funding profile** can influence the interest rate pass-through under a NDFR policy.

Related literature

- **Transmission of non-standard monetary policy measures** in the euro area (Altavilla et al., 2016; Albertazzi et al., 2016).
- **Introduction of NDFR** on bank behaviour in the euro area:
 - Vlassopoulos et al. (2016): bank-level data; 2007-2015; how banks adjusted their balance sheets/ adjustment depended on the amount of excess liquidity held by the banks.
 - Heider et al. (2017): syndicated loans to NFCs; banks with high retail deposit ratios will lend relatively less and to riskier borrowers.

This paper

- Focus on **Italian mortgage market** and use **granular data** to distinguish between different loan types.
- **FRMs: longest-maturity assets** that retail banks originate and **new FRMs' interest rate dynamics under NDFR are likely to differ** from new ARMs.
- Provide **direct evidence on changes in the loan interest rate setting** behaviour of banks.
- Shed light on the **role of overnight deposits** as a potential source of frictions following the onset of NDFR.

Main findings (preview)

- Banks with different **overnight deposit ratios** charge interest rates on the **FRMs** originated after the onset of NDFR differently.
 - +1SD higher overnight deposit ratio in a NDFR environment: +23 bp int. rate
- **No related evidence** of significant differences in setting **ARMs** interest.
- Banks **would resist transmission of NDFR more to assets in which their future income is ‘locked in’**, when compared with similar assets providing income that adjusts based on market conditions.
- Banks with a higher overnight deposit ratio are **more likely to originate ARMs rather than FRMs** after policy rates turn negative.

Data

- **Loan-level residential mortgage data** provided as part of the Eurosystem's collateral eligibility requirements (**RMBSs** and **RACCs**): *interest rate charged* on the loan at origination, *month of origination*, loan characteristics.
- **Credit model provided by Fitch Ratings**: *PDs* (relative riskiness of the borrower and loan at the time of origination in a *consistent manner* across banks and loan types).
- **Bank-level data from SNL Financial**: various bank balance sheet items and reported breakdowns of deposits by type, which include ***overnight***, ***savings*** and ***time deposits***.

Representativeness

- **Concern:** loans destined for securitisation may have been granted under looser lending standards.
- **No evidence** that Italian banks have chosen to securitise loans with substantially weaker risk profiles (see Albertazzi et al., 2015).
- **‘Risk retention requirements’** act as a powerful disincentive for originating banks to securitise loans with higher risk profiles than those that are not securitised.
- Conduct **a number of comparisons** of our data sample with available statistics for Italian residential mortgages: **interest rate**; the **share of ARMs** in any given month; the **original LTV**; the **evolution in residential mortgage lending volumes**.

Advantages of loan level data

- Explore whether the consequences for lending rates of the introduction of NDFR depend on the **loan fixation type**: asymmetries in interest rate pass-through.
 - The loan interest rate setting behaviour of a bank whose net interest income is 'squeezed' by inertial deposit rates is likely to differ depending on whether it is pricing an FRM or ARM.
- Take into account the **risk profile** of the loan and the borrower.
- Use info on **month of loan origination** to focus the sample around the policy change under study.

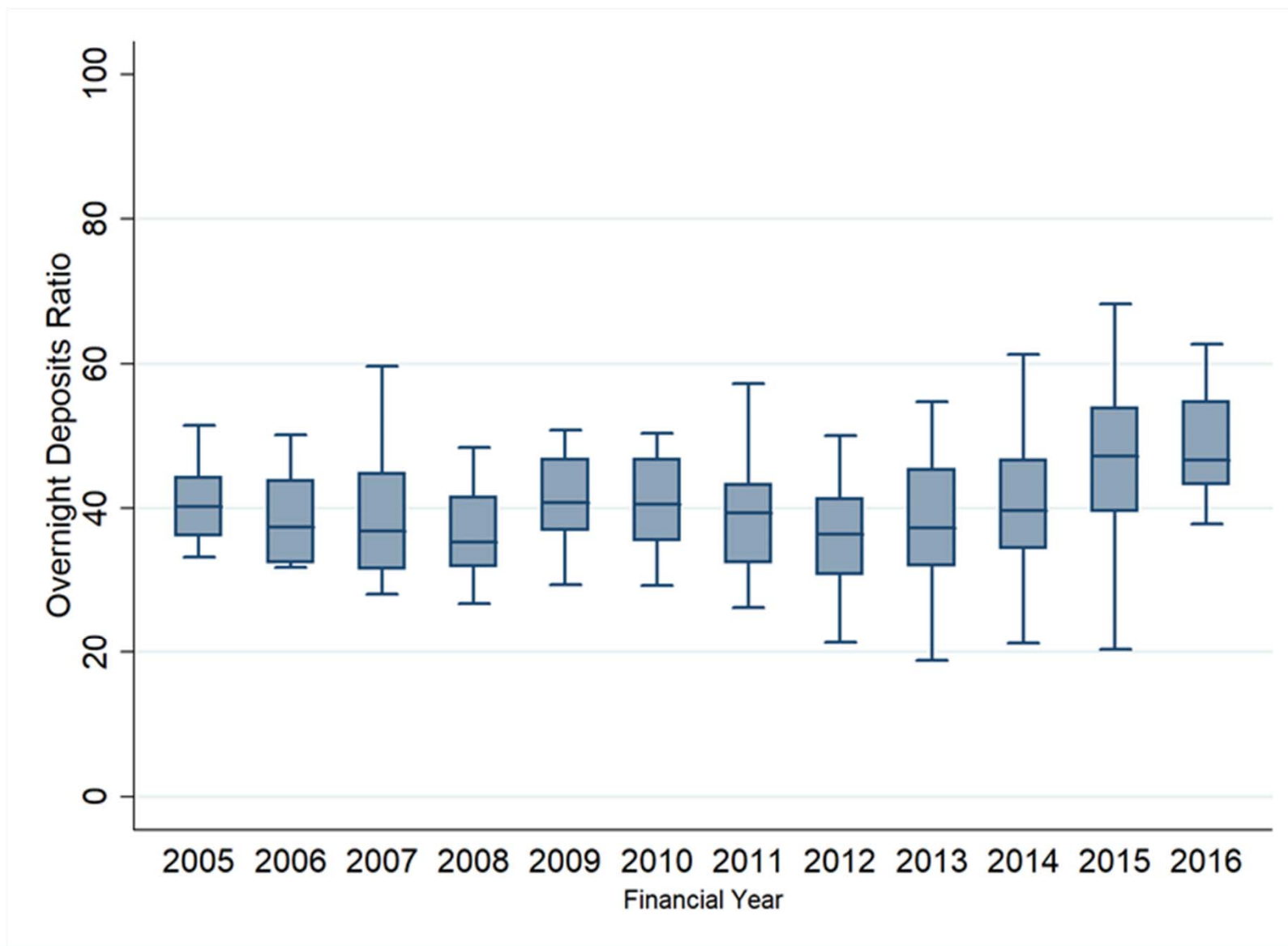
Italian banks

- Both **FRMs and ARMs** are commonly **available** in Italy (unlike in other euro area countries).
- The **banking sector is relatively heterogeneous** (combination of small local banks, larger regional players, as well as a few global banks).
- Italian banks have consistently had **low excess liquidity** when compared with other euro area banks:
 - helps to isolate the effect of NDFR through the overnight deposit ratio channel from an alternative source of friction of potential relevance.
- Sample: **sufficient number of mortgage loans per bank** originated before and after the introduction of NDFR.

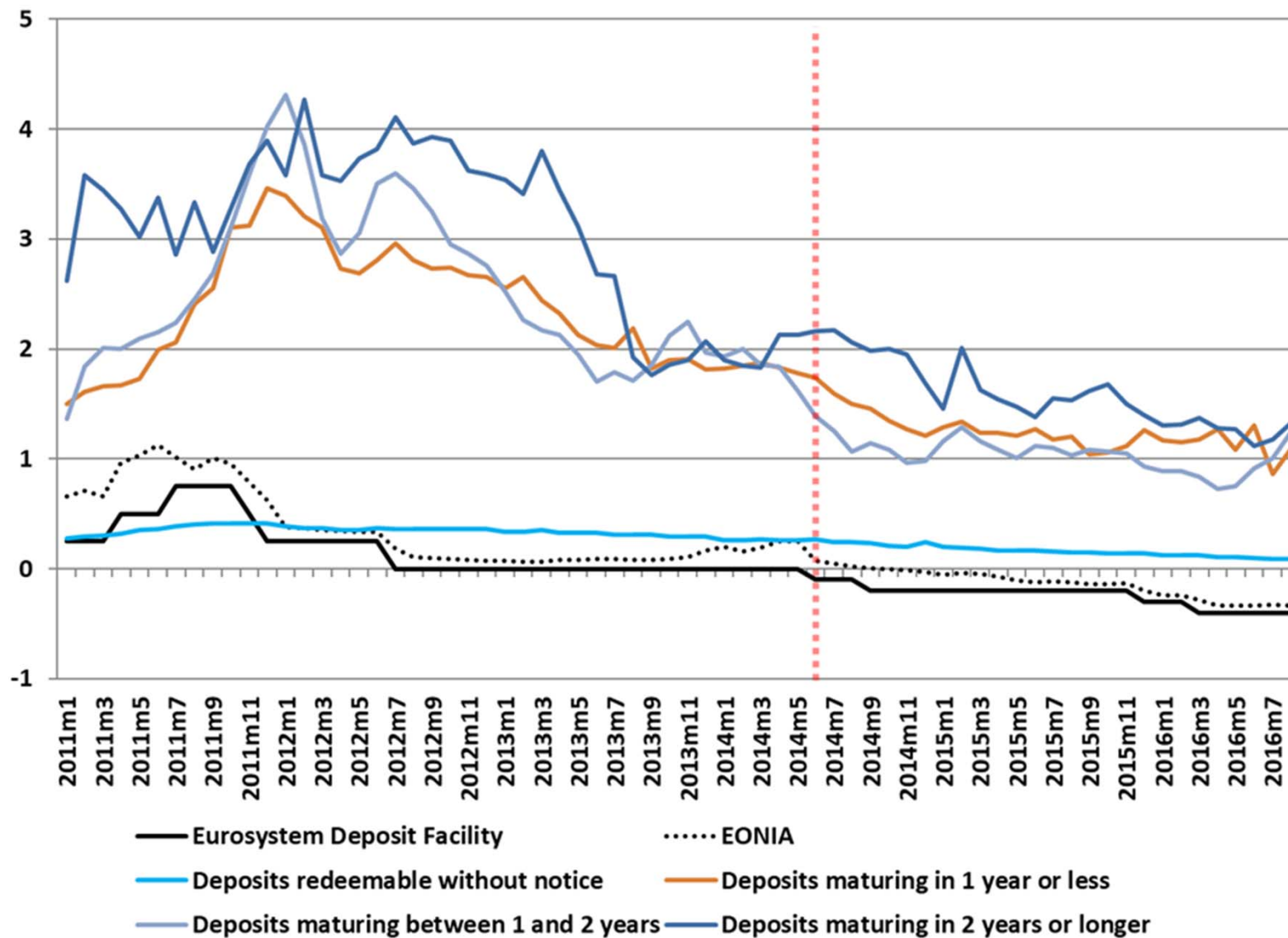
Bank exposure to NDFR

- Consider the relative share of assets funded by the **deposits yielding the lowest interest rates** among the possible deposit types.
- **Overnight deposit rates** are the closest to DFR insofar as there is no need to compensate depositors for having restricted or penalised access to their deposits.
- **Banks with a greater share of overnight deposits** may find their **net interest income ‘squeezed’** once NDFR are introduced.
- Banks whose assets are funded with other types of deposits (or other liabilities) paying out higher rates have greater freedom to pass through the DFR cut.

Italian banks' overnight deposit ratios: 2005 - 2016



Evolution of Italian deposit rates and key euro area interest rates



Empirical specification

- $Y_{i,b,t} = \beta_1(ODR_{b,\bar{t}} * D_T) + \beta_2 X_{i,t} + \alpha_b + \varphi_t + \varepsilon_{i,b,t}$
- $D_T = 1$ **post-June 2014.**
- $X_{i,t}$: **loan characteristics** (PDs and loan maturity); time needed for banks to foreclose on residential properties in the event of defaulted loans, based on the region in which the property is located.
- α_b : **bank fixed effects.**
- φ_t : **month-year fixed effects.**
- **Cluster** standard errors at the **bank level.**
- Time window around June 2014: +/- **6m**; +/- **12m**; +/- **18m.**

FRMs: interest rates; +/- 6m

	(1)	(2)	(3)
	2014m1-2014m12	2014m1-2014m12	2014m1-2014m12
VARIABLES			
on_dep_r_2013X062014	0.0111***	0.0111**	0.0109***
	(0.00346)	(0.00453)	(0.00354)
equity_r_2013X062014		-0.000140	0.00624
		(0.0240)	(0.0197)
pd2			0.0599
			(0.0457)
pd3			0.124
			(0.0734)
pd4			0.336***
			(0.0758)
recov			0.0754
			(0.0549)
foreclosuretiming_AAA			0.00570**
			(0.00211)
maturity			0.00236
			(0.00608)
Observations	4,819	4,819	4,220
R-squared	0.316	0.316	0.360

FRMs: interest rates; +/- 12m

	(4)	(5)	(6)
	2013m7-2015m6	2013m7-2015m6	2013m7-2015m6
VARIABLES			
on_dep_r_2013X062014	0.0243***	0.0220***	0.0227***
	(0.00525)	(0.00283)	(0.00333)
equity_r_2013X062014		0.0448***	0.0442***
		(0.0154)	(0.0154)
pd2			0.0683**
			(0.0288)
pd3			0.162***
			(0.0462)
pd4			0.279***
			(0.0679)
recov			0.102***
			(0.0302)
foreclosuretming_AAA			0.00591***
			(0.00175)
maturity			0.0131***
			(0.00188)
Observations	14,387	14,387	12,426
R-squared	0.381	0.383	0.413

FRMs: interest rates; +/- 18m

	(7)	(8)	(9)
	2013m1-2015m12	2013m1-2015m12	2013m1-2015m12
VARIABLES			
on_dep_r_2013X062014	0.0227***	0.0191***	0.0200***
	(0.00597)	(0.00495)	(0.00488)
equity_r_2013X062014		0.0439	0.0425*
		(0.0259)	(0.0215)
pd2			0.0585**
			(0.0274)
pd3			0.144***
			(0.0449)
pd4			0.230***
			(0.0621)
recov			0.0608**
			(0.0236)
foreclosuretiming_AAA			0.00522***
			(0.00173)
maturity			0.0163***
			(0.00162)
Observations	27,876	27,876	23,997
R-squared	0.417	0.419	0.447

ARMs: interest rates; +/- 6m; +/- 12m; +/- 18m

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	ARM_plus	ARM_plus	ARM_plus	ARM_plus	ARM_plus	ARM_plus	ARM_plus	ARM_plus	ARM_plus
	2014m1-	2014m1-	2014m1-	2013m7-	2013m7-	2013m7-	2013m1-	2013m1-	2013m1-
	2014m12	2014m12	2014m12	2015m6	2015m6	2015m6	2015m12	2015m12	2015m12
VARIABLES									
on_dep_r_2013X062014	-0.00294*	-0.00309	-0.00202	-0.00294*	-0.00309	-0.00202	-0.00167	-0.00218	-0.000965
	(0.00146)	(0.00199)	(0.00212)	(0.00146)	(0.00199)	(0.00212)	(0.00383)	(0.00484)	(0.00540)
equity_r_2013X062014		0.00148	0.00178		0.00148	0.00178		0.00595	0.00656
		(0.00702)	(0.00766)		(0.00702)	(0.00766)		(0.0160)	(0.0158)
pd2			0.0841***			0.0841***			0.0759***
			(0.0277)			(0.0277)			(0.0210)
pd3			0.147***			0.147***			0.143***
			(0.0259)			(0.0259)			(0.0212)
pd4			0.250***			0.250***			0.252***
			(0.0535)			(0.0535)			(0.0569)
recov			0.0493			0.0493			0.0630
			(0.0631)			(0.0631)			(0.0508)
foreclosurereiming_AAA			0.00476***			0.00476***			0.00458***
			(0.000770)			(0.000770)			(0.000812)
maturity			0.0106*			0.0106*			0.0108**
			(0.00597)			(0.00597)			(0.00432)
Observations	32,975	32,975	29,777	32,975	32,975	29,777	82,987	82,987	74,388
R-squared	0.203	0.203	0.244	0.203	0.203	0.244	0.285	0.285	0.322

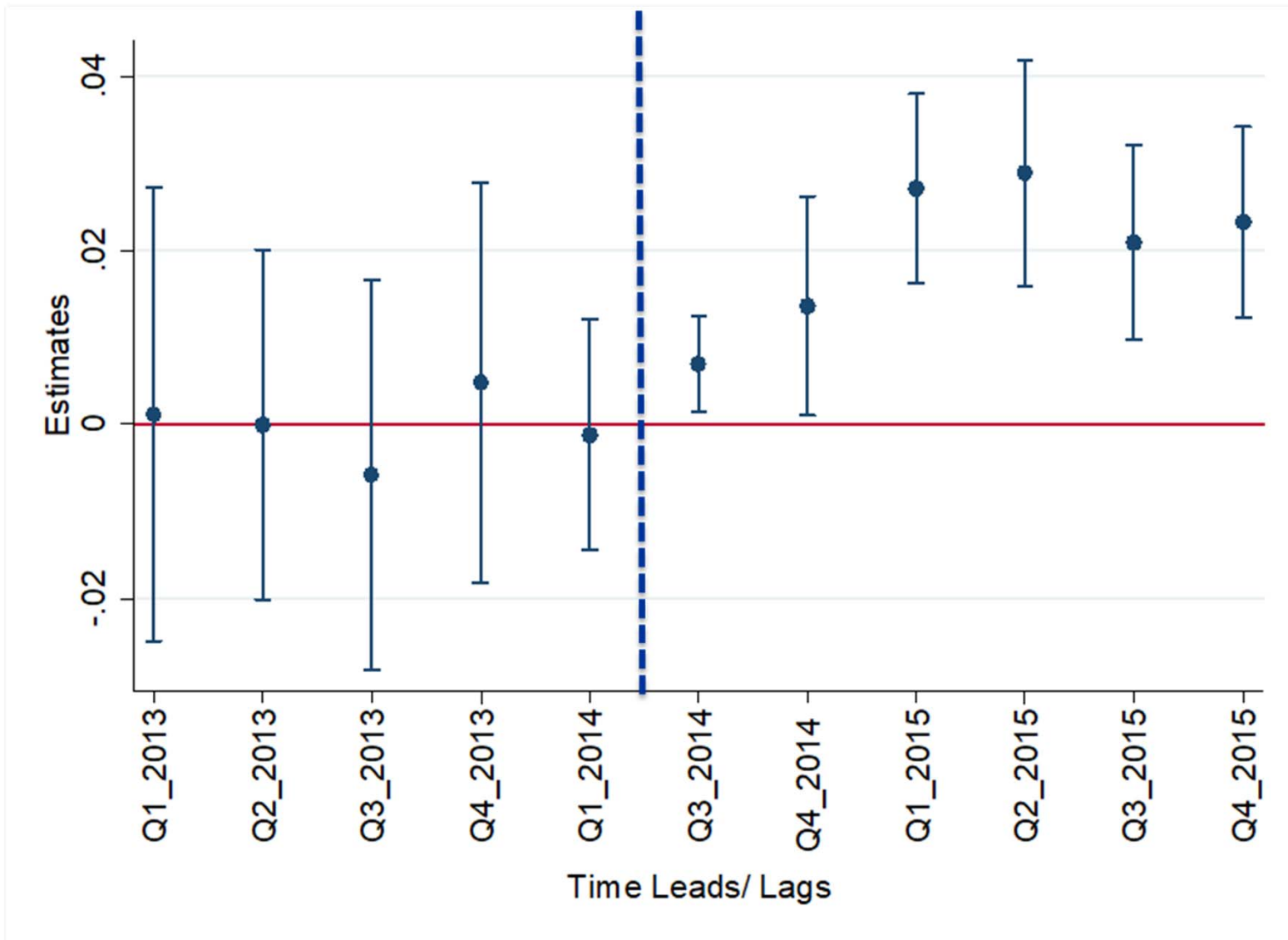
Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

FRMs: Placebo and Leads/ Lags quarters

VARIABLES	(1) 2013m1-2013m12	(2) 2013m1-2015m12
on_dep_r_2013X062013	-0.00177 (0.00532)	
Leads		
on_dep_r_2013XQ1_2013		0.00112 (0.0133)
on_dep_r_2013XQ2_2013		-2.80e-05 (0.0103)
on_dep_r_2013XQ3_2013		-0.00578 (0.0115)
on_dep_r_2013XQ4_2013		0.00484 (0.0117)
on_dep_r_2013XQ1_2014		-0.00120 (0.00677)
Lags		
on_dep_r_2013XQ3_2014		0.00697** (0.00282)
on_dep_r_2013XQ4_2014		0.0136** (0.00644)
on_dep_r_2013XQ1_2015		0.0271*** (0.00554)
on_dep_r_2013XQ2_2015		0.0289*** (0.00661)
on_dep_r_2013XQ3_2015		0.0209*** (0.00568)
on_dep_r_2013XQ4_2015		0.0232*** (0.00561)

Leads/ Lags: quarter point estimates and 95% CIs



FRMs: DFR from .25 to 0, July 2012

	(1)	(2)	(3)
	2012m2-2013m1	2012m2-2013m1	2012m2-2013m1
VARIABLES			
on_dep_r_2011X072012	0.00436 (0.00427)	0.00455 (0.00485)	0.00468 (0.00513)
equity_r_2011X072012		-0.0199 (0.0348)	-0.0140 (0.0342)
pd2			0.0383 (0.0454)
pd3			0.131** (0.0582)
pd4			0.210*** (0.0655)
recov			0.0937** (0.0417)
foreclosurere timing_AAA			0.00348* (0.00193)
maturity			0.00370 (0.00396)
Observations	8,886	8,886	7,461
R-squared	0.353	0.354	0.374

Other deposit types

	(1)	(2)	(3)	(4)	(5)	(6)
	FRM_plus	FRM_plus	FRM_plus	FRM_plus	FRM_plus	FRM_plus
	2014m1-	2014m1-	2014m1-	2014m1-	2014m1-	2014m1-
	2014m12	2014m12	2014m12	2014m12	2014m12	2014m12
VARIABLES						
snl_tot_time_deps_r_2013X062014	-0.00610** (0.00223)	-0.0131*** (0.00472)	-0.0105*** (0.00354)			
snl_dep_r_2013X062014				-0.00173 (0.00774)	-0.000720 (0.00866)	0.00346 (0.00794)
equity_r_2013X062014		-0.0542 (0.0408)	-0.0376 (0.0347)		0.00633 (0.0349)	0.0241 (0.0298)
pd2			0.0592 (0.0459)			0.0578 (0.0462)
pd3			0.125* (0.0733)			0.123 (0.0745)
pd4			0.337*** (0.0754)			0.337*** (0.0756)
recov			0.0743 (0.0552)			0.0726 (0.0545)
foreclosurertiming_AAA			0.00569** (0.00209)			0.00569** (0.00208)
maturity			0.00247 (0.00607)			0.00233 (0.00607)
Observations	4,816	4,816	4,219	4,819	4,819	4,220
R-squared	0.315	0.316	0.360	0.315	0.315	0.359

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Robustness

- Add bank-specific, time-varying controls: one-year lag of banks' equity ratio; total assets; ratio of bank's total loans.
- Examine the extent to which banks' cash holdings (relative to total assets) in the years of our sample window could also influence their responsiveness to NDFR (as in Vlassopoulos et al., 2016).
- Investigate whether relatively larger banks at the time NDFR was introduced respond differently in terms of the loan interest rates in question (e.g. due to larger banks being able to rely on economies of scale and scope to provide more competitive pricing than smaller banks, in a manner independent of these two groups' relative differences in overnight deposit ratios).
- Loans to SMEs (median maturity = 5 yrs): no effect.

FRMs vs. ARMs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	FRM_plus	FRM_plus	FRM_plus	FRM_plus	FRM_plus	FRM_plus	FRM_plus	FRM_plus	FRM_plus
	prevalence	prevalence	prevalence	prevalence	prevalence	prevalence	prevalence	prevalence	prevalence
	2014m1-	2014m1-	2014m1-	2013m7-	2013m7-	2013m7-	2013m1-	2013m1-	2013m1-
	2014m12	2014m12	2014m12	2015m6	2015m6	2015m6	2015m12	2015m12	2015m12
VARIABLES									
on_dep_r_2013X062014	-0.00122** (0.000588)	-0.00103** (0.000466)	-0.000795 (0.000524)	-0.00419*** (0.00130)	-0.00432** (0.00163)	-0.00420** (0.00184)	-0.00210 (0.00124)	-0.00233 (0.00185)	-0.00251 (0.00197)
equity_r_2013X062014		-0.00206 (0.00126)	-0.00107 (0.00120)		0.00152 (0.00643)	0.00225 (0.00631)		0.00272 (0.00795)	0.00329 (0.00766)
pd2			0.00642 (0.00956)			0.00676 (0.0106)			0.00297 (0.0128)
pd3			-0.000438 (0.0146)			-0.00778 (0.0188)			-0.0122 (0.0226)
pd4			-0.0299 (0.0227)			-0.0470 (0.0294)			-0.0567* (0.0330)
recov			-0.00776 (0.00654)			-0.00267 (0.00800)			-0.000613 (0.0108)
foreclosurereading_AAA			0.00158* (0.000925)			0.00206** (0.000876)			0.00227*** (0.000745)
maturity			-0.00363** (0.00175)			-0.00476** (0.00226)			-0.00598** (0.00248)
Observations	37,961	37,961	34,164	74,525	74,525	66,574	111,204	111,204	98,712
R-squared	0.101	0.101	0.116	0.164	0.164	0.179	0.184	0.184	0.203

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Conclusions

- Examine the behaviour of **Italian mortgage lenders before and after** the introduction of **NDFR** by the ECB in June 2014.
- When policy rates enter negative territory, **banks with higher ratios of overnight deposits to total assets**:
 - tend to charge higher rates on new FRMs than justified by borrower or bank characteristics.
 - do not seem to change the setting of the interest rates on ARMs.
 - more likely to originate ARMs vs FRMs.
- **Funding structure of banks** may have implications for their lending behaviour in a negative interest rate environment and potentially act as a source of friction for the pass-through of MP.

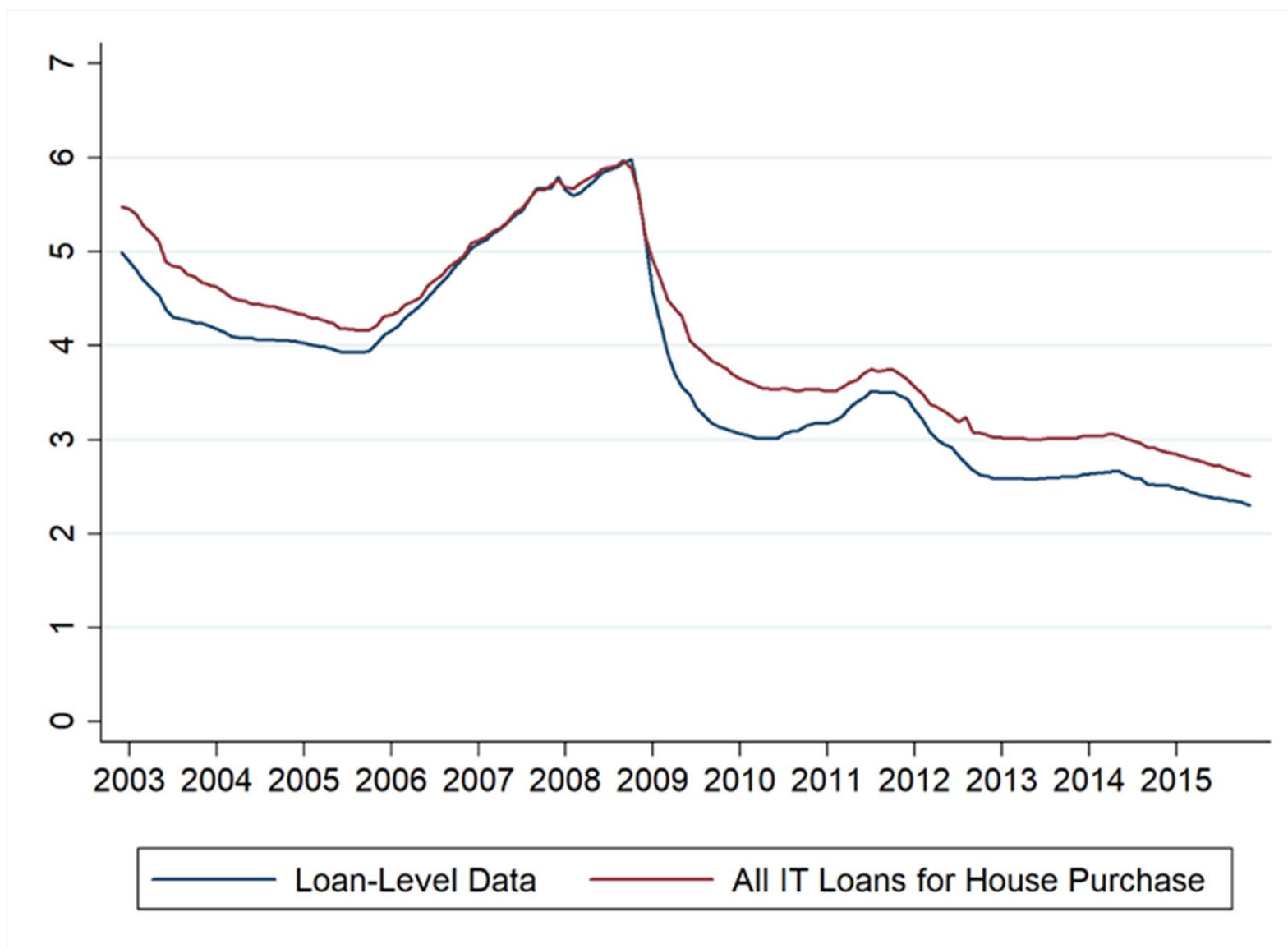


Thank you!

Summary statistics

<i>Banks sample</i>	Mean	Median	Std. dev.
Overnight Deposits Ratio in %	38.11	37.30	9.98
Total Deposits Ratio in %	49.72	47.30	10.30
Time Deposits Ratio in %	8.55	7.35	10.47
Equity Ratio in %	7.24	7.03	3.25
Retail Loans Ratio in %	68.90	71.80	14.22
Cash Ratio in %	8.22	3.80	12.49
Total Assets	20.15	7.5	31.73
<i>Loans sample</i>	Mean	Median	Std. dev.
Probability of Default in %	2.75	0.81	13.06
Recoveries in %	100.69	80.24	55.03
Foreclosure Timing in Years	6.14	6.01	1.25
Maturity in Years	21.01	20.08	6.86
Original Interest Rate in % (FRM)	3.58	3.45	1.07
Original Interest Rate in % (ARM)	2.80	2.74	0.90
<i>Sample size</i>			
Number of Banks	31		
Number of Loans	111,634		
Share of FRMs in %	24.98		

Representativeness check: residential mortgage interest rates



Representativeness check: loan to value ratios

