Bank Profitability and Risk-Taking in a Low Interest Rate Environment: The Case of Thailand

Lathaporn Ratanavararak
Nasha Ananchotikul

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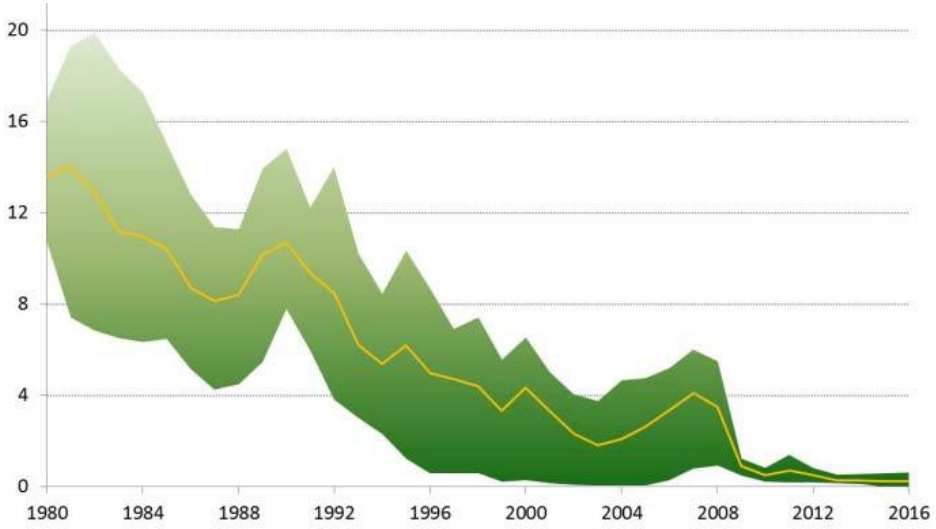
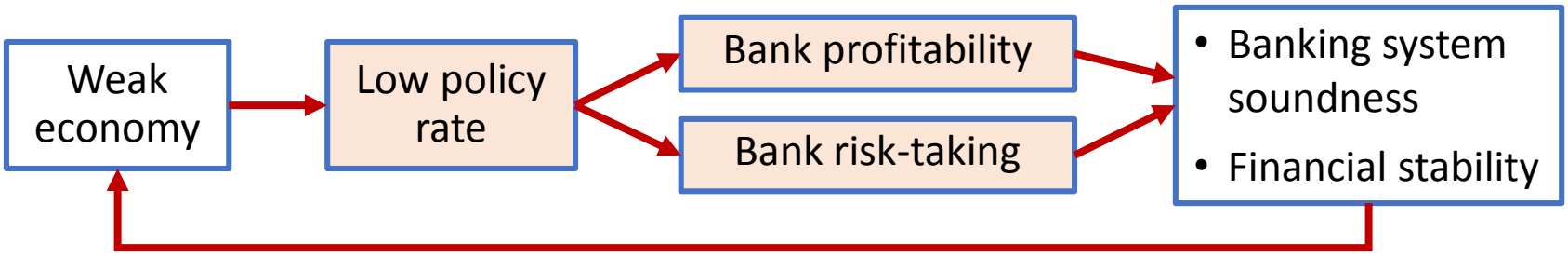
Low interest rate environment

Short-term interest rates in main advanced countries

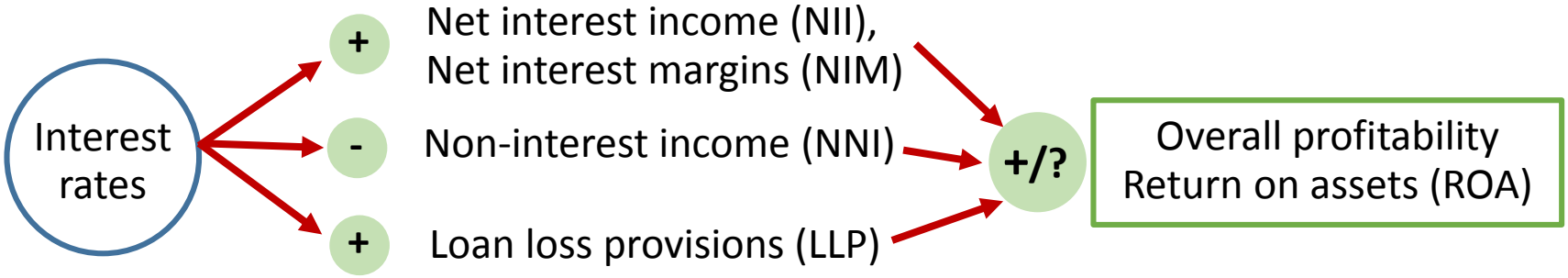


- Monetary policy rates in many countries have been low for a prolonged period of time

Source: Carletti & Ferrero (2017)
Note: The sample includes Germany, France, UK, Italy, Japan, US and the Euro area. The borders of the green area are the min and max. The yellow line is the average nominal interest rate. Short-term rates are yields on 3-month deposits, or Treasury bills.



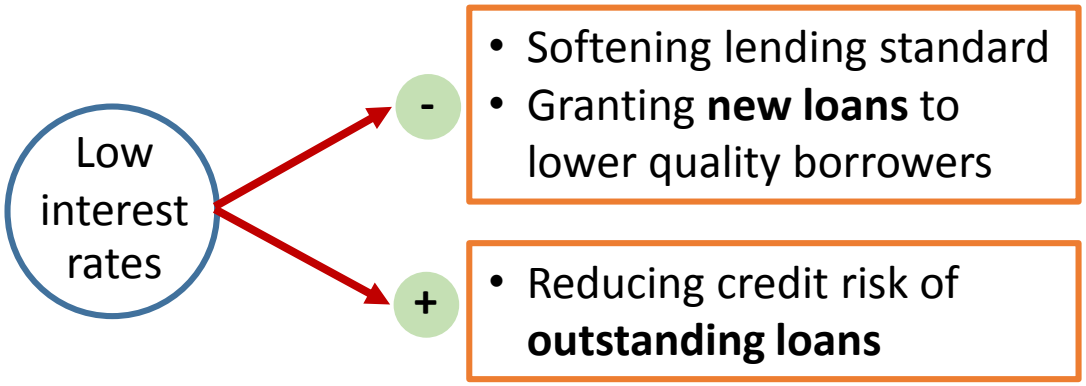
Interest rates and bank profitability



Altavilla, Boucinha, and Peydró (2017)
Alessandri and Nelson (2015)
Borio, Gambacorta, and Hofmann (2017)
Claessens, Coleman, and Donnelly (2017)

- The effect of interest rates on ROA become insignificant when taking into account macroeconomic and financial conditions (Altavilla et al., 2017)
- Larger effect of interest rates on bank profitability when the rates are low (Borio et al., 2017; Claessens et al., 2017)

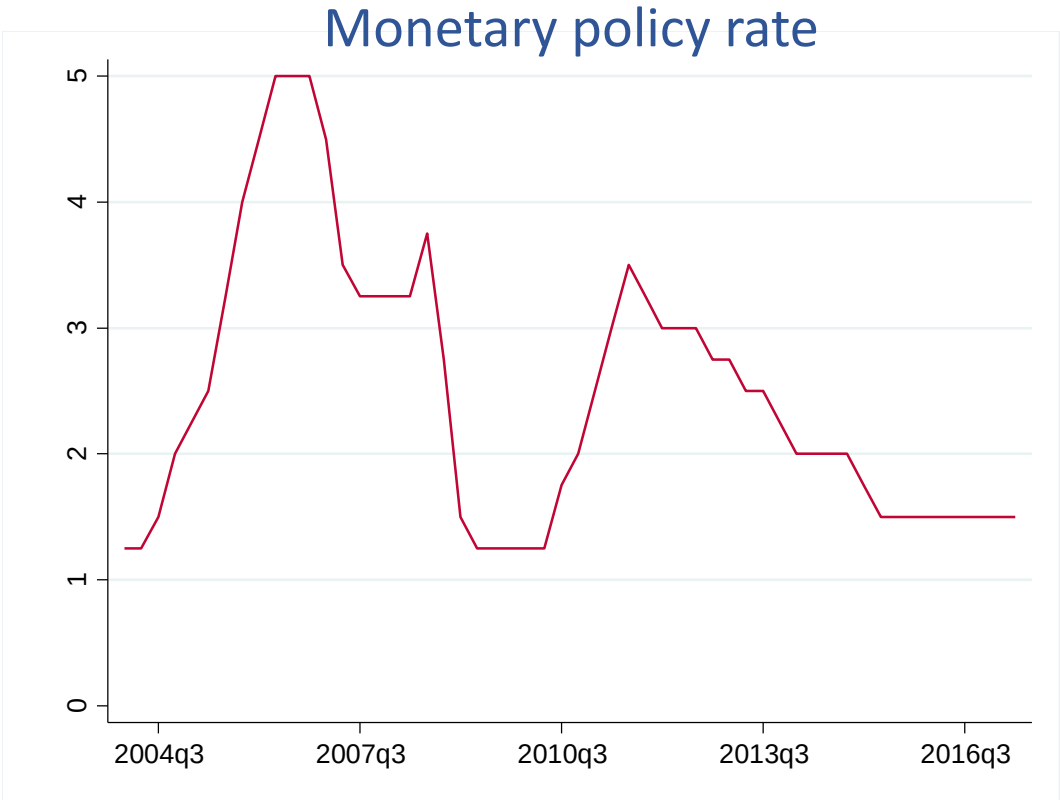
Interest rates and bank risk-taking



Ioannidou et al. (2015)
Jiménez et al. (2012, 2014)
Dell'Ariccia et al. (2017)
De Nicolò et al. (2010)
Delis & Kouretas (2011)
Abuka et al. (2015)

- Bank-level measures: non-performing loans (NPL), risk-weighted assets (RWA), expected default frequency (EDF), bank Z-score
- Loan-level measures: time to default, loan granting, risk rating, past delinquency, ex-post default, uncollateralized loans
- Small banks, and banks having more liquid assets and lower capital tend to take more risks (Ioannidou et al., 2015; Jimenez et al., 2014)

Low interest rates in Thailand



- stays at 1.5% for 12 consecutive quarters
- has not been raised since 2011Q3

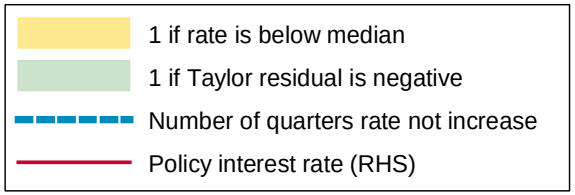
Indicators of low-for-long interest rates

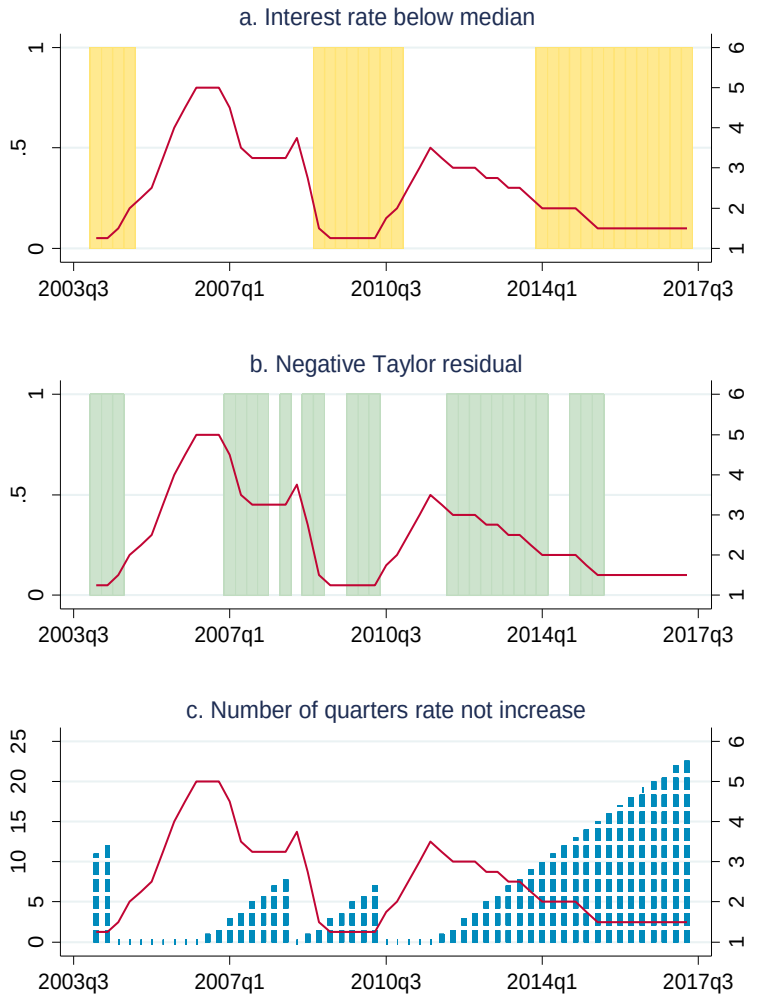
To capture the prolonged low interest rates, 3 alternative indicators are explored

a. Binary indicator that equals one when the policy rate is below sample median

b. Binary indicator that equals one when the residuals of Taylor rule are negative

c. Measure that counts the number of quarters the policy rate does not increase





Research Questions

- Does low policy rate lead to lower bank **profitability** and greater **risk-taking** by banks?
- What **types of banks** are more sensitive to the policy rate?
- What **types of firms** are more affected from bank risk-taking?

Data and Stylized Facts

Data Sources

Data	Source	Period	Frequency	Data level
Banks' financial statements	DMS	2004-2017	Quarterly	Bank level
Interest rates, macro variables and estimates	BOT	2003-2017	Quarterly	Aggregate
Loan characteristics	LAR	2003-2017	Monthly	Loan account
Collaterals	COLL	2003-2015	Monthly	Collateral
Firm characteristics	CPFS	1999-2015	Yearly	Firm level

Bank-level data

23 banks (non-entry, non-exit)

Quarterly 2004Q1 – 2017Q3

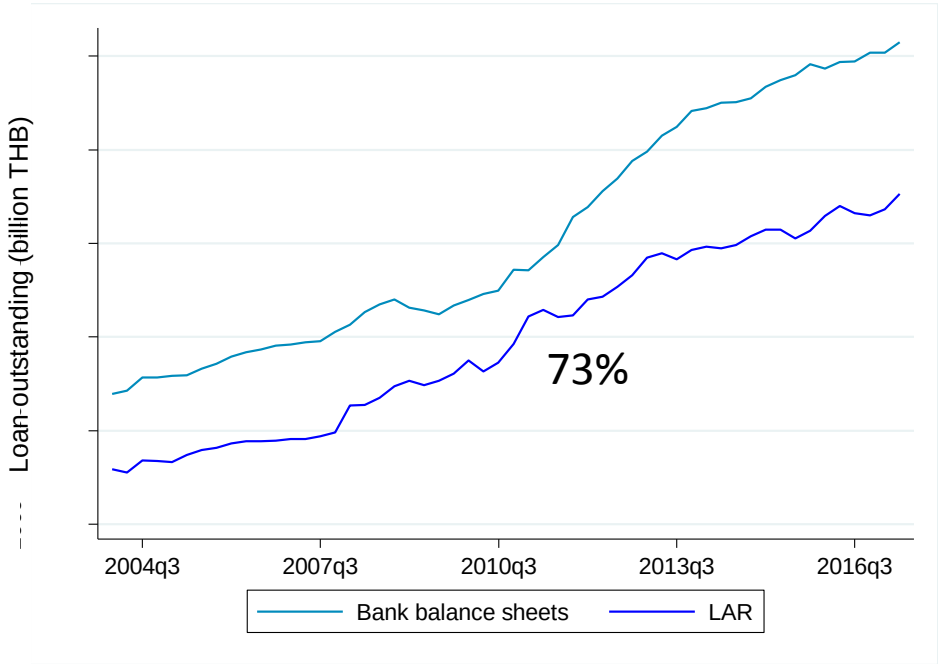
Loan-level data

10 million accounts from 39 banks

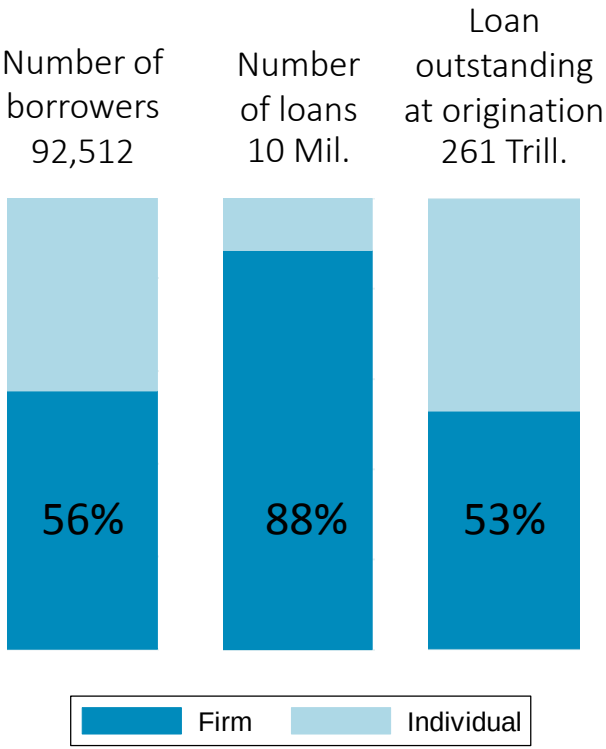
Monthly 2004M1 – 2017M9

Balance sheets, LAR, & CPFS

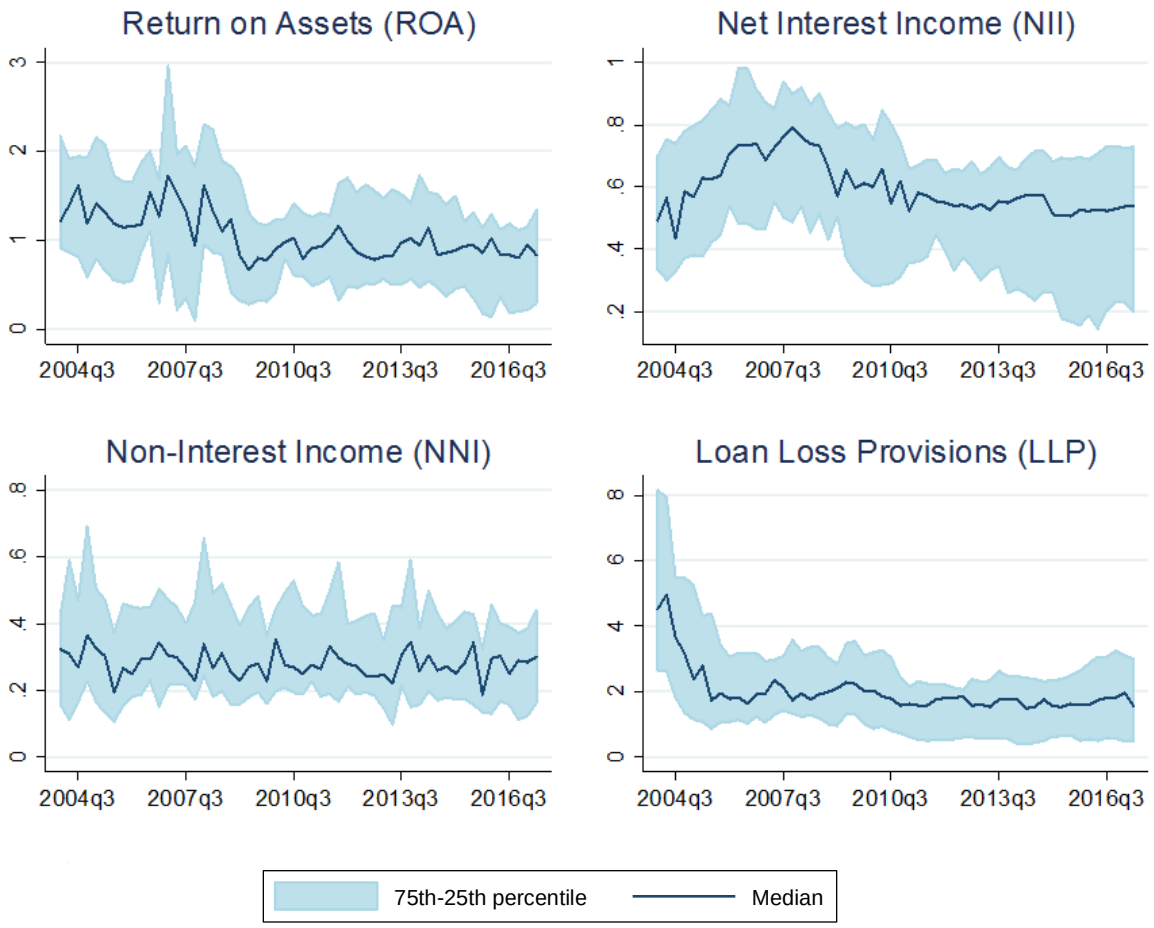
Total loan outstanding
from bank balance sheets vs. LAR



Loans to firms vs. individuals



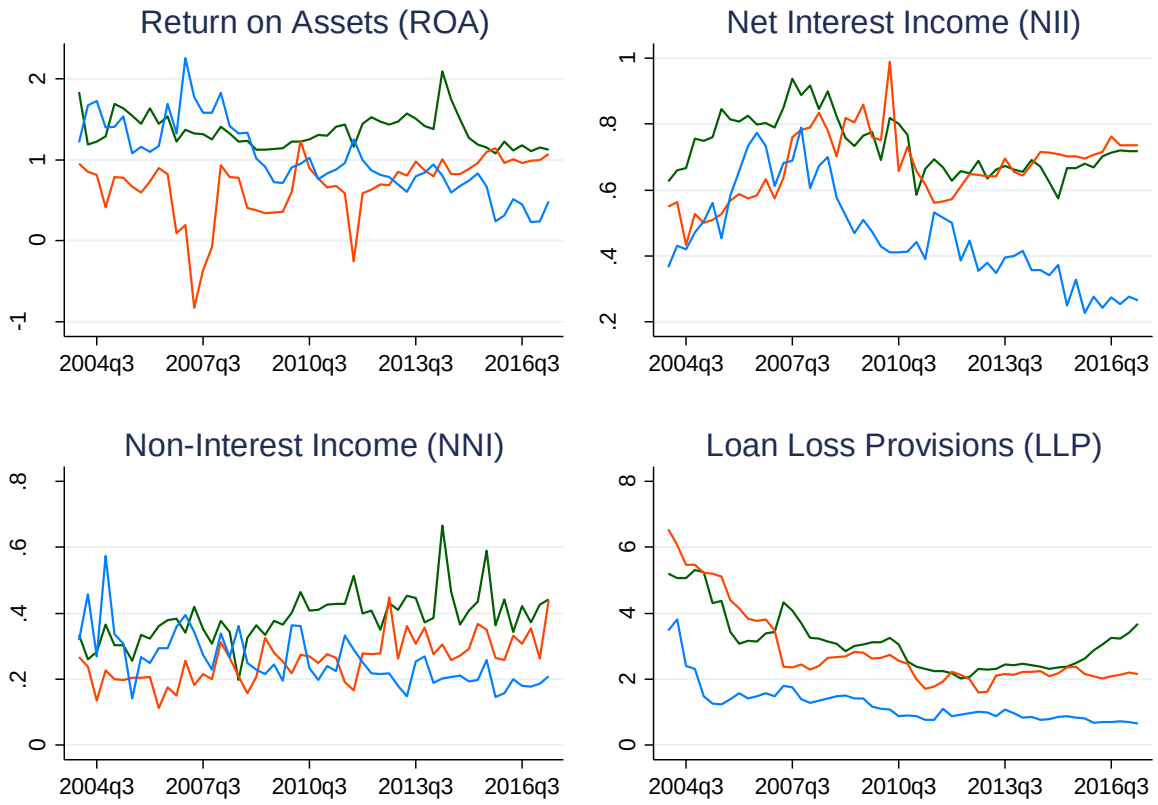
Bank profitability and its components



- No clear downward trend of profitability in recent years under the low rate environment
- But the dispersion of net interest income (NII) increases

Note: Only includes 23 non-exit, non-entry banks. All variables are ratios to total assets in percentage.

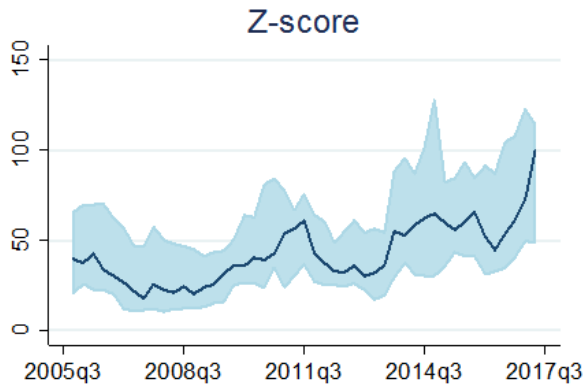
Bank profitability by bank size



- **Medium banks**: Very volatile ROA
- **Small banks**: ROA and NII decline in recent years and diverge from medium and large banks

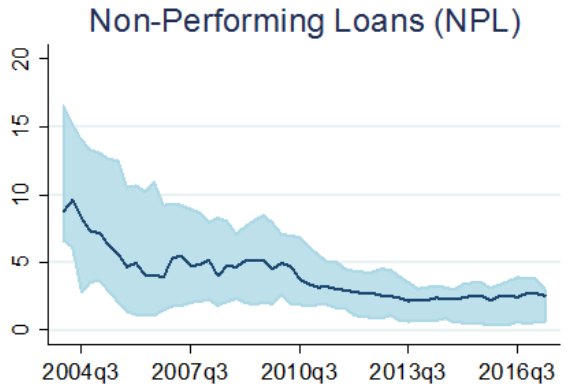
Note: Only includes 23 non-exit, non-entry banks. The lines represent median value for each group of banks.
All variables are ratios to total assets in percentage.

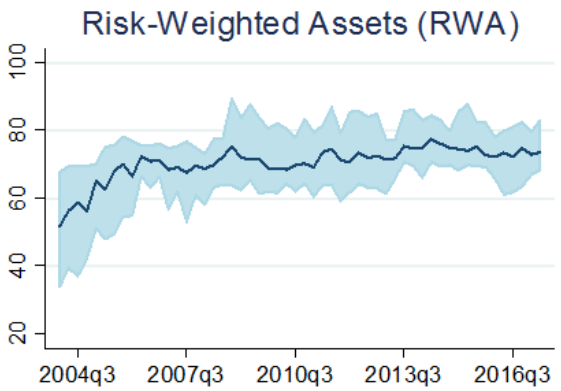
Measures of bank risk

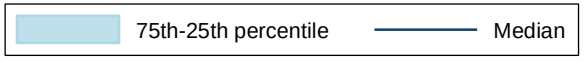


$$\text{Z-score} = \frac{ROA + Capital/asset}{ROA\_SD}$$

- over eight quarters
- The higher the better

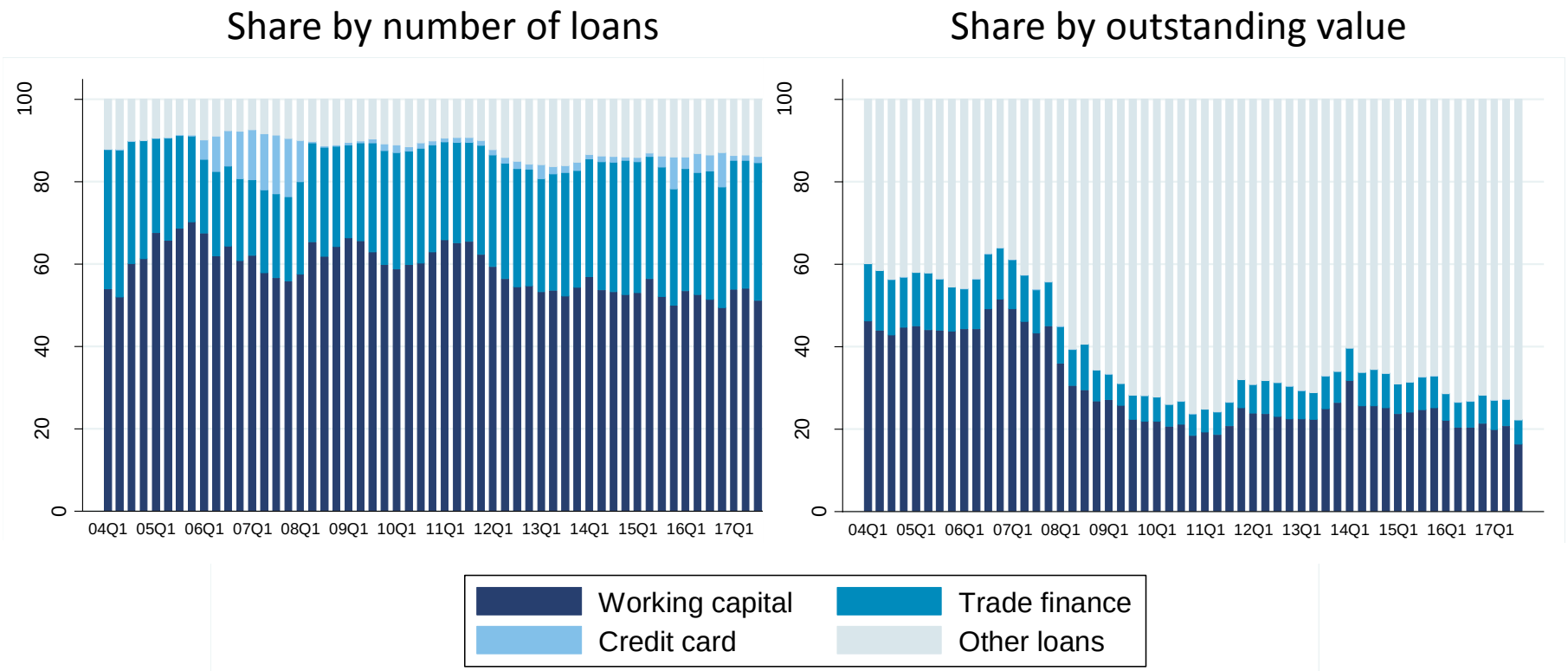






Note: Only includes 23 non-exit, non-entry banks. RWA are percentages of total assets. NPL are percentages of total loans.

Share of new loans by loan type



Note: Outstanding is at loan origination.
Trade finances = bills, notes, and loans for export and import purposes.
Working capital = overdraft, notes that are not considered trade finance, and factoring.
Other loans = short- and long- terms loans such as general business loans, leasing, hire purchase, real estate loans, and bank guarantees.

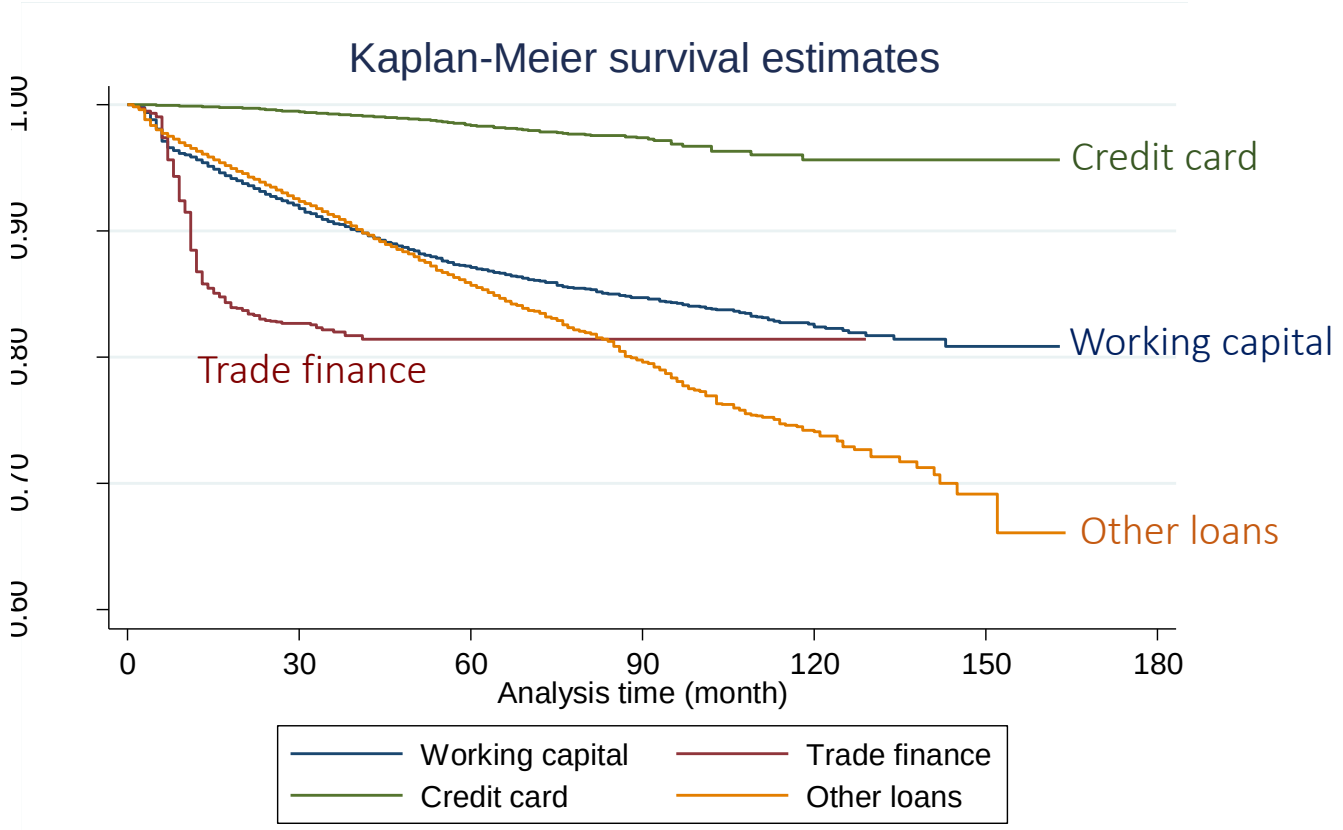
Loan characteristics by loan type

		Working capital	Trade finance	Credit card	Other loans	
					Short-term	Long-term
Size of loans *(thousand)*	Median	1,800	1,650	3	7,657	4,154
	Mean	11,436	7,194	13	168,223	40,589
Maturity *(months)*	Median	2.0	3.0	1.0	2.0	60.0
	Mean	4.3	4.3	15.1	2.5	86.3
Share of corporate loans		85.4%	98.6%	92.3%	82.4%	65.4%
Share of collateralized loans		25.4%	22.4%	1.9%	19.4%	53.0%
Share of defaulted loans		1.6%	1.1%	0.2%	3.1%	7.2%
Share of SM and defaulted loans		4.0%	4.9%	2.1%	5.4%	17.3%

Note: Maturity is an optional field in LAR and it is replaced with the actual duration of the loan when maturity is missing or inconsistent. Short- and long-term loans refer to loans with adjusted maturity not more than one year, and more than one year respectively.

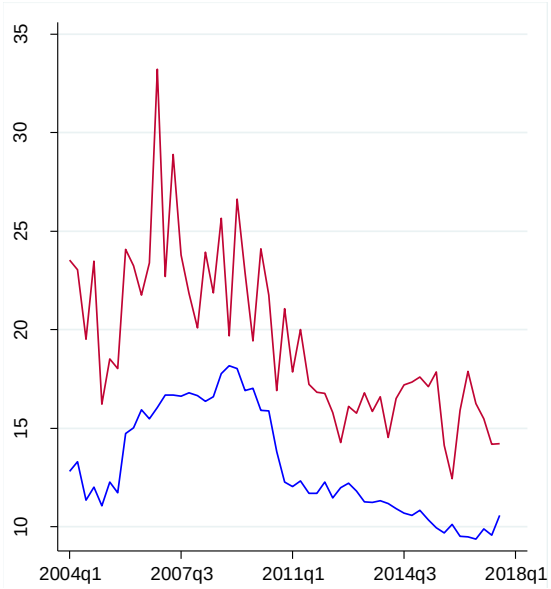
Measures of bank risk at loan level (1)

- Duration = time to loan default or repayment

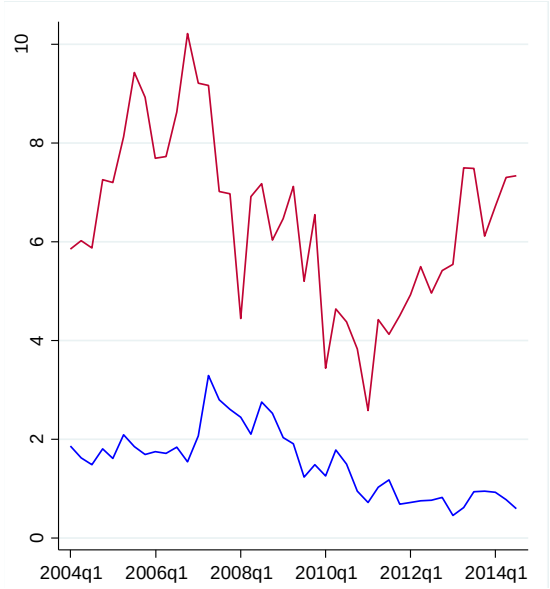


Measures of bank risk at loan level (2)

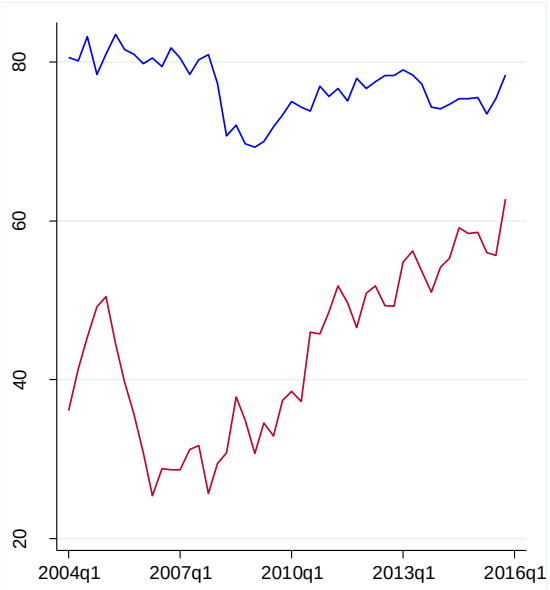
Share of new loans to past default borrowers (%)



Share of new loans that later default within 3 years (%)



Share of new loans without collaterals (%)



Other long-term loans
Working capital and other short-term loans

Methodology

Empirical strategy

	Data	Main analysis	Robustness check	Dependent variables
Profitability	Bank level	Fixed-effects panel regression	Dynamic panel regression	ROA, NII/TA, NNI/TA, LLP/TA
Risk taking	Bank level	Fixed-effects panel regression	Dynamic panel regression	Z-score, RWA/TA, NPL/TL
	Loan level	Survival analysis	Probit regression	• Hazard rate • Past default, future default, loans with collaterals

$$Measure_{i,t} = \alpha_i + \delta Measure_{i,t-1} + \beta_1 MP_t + \beta_2 YieldSpread_t + \Phi MacroControls_t + \Omega BankCharacteristics_{i,t-1} + \varepsilon_{i,t}$$

$$\lambda(t, X, \beta) = \lambda_0(t)\exp(\beta' X)$$

Explanatory variables

Main variable:	Monetary policy rate (MP)
Interest rate variables:	Yield spread, low-for-long indicators
Macroeconomic controls:	GDP growth, CPI growth, crisis dummy, expected GDP growth, expected inflation, Herfindahl Hirschman Index (HHI)
Bank characteristics:	Capital ratio, liquidicy ratio, total assets, funding composition, efficiency ratio, ROA, loans/total assets, NPL, bank size
Loan characteristics:	Type of loans, loan size, collateralization
Borrower characteristics:	Past default, number of bank relationships
Firm characteristics:	Firm age, size, ROA

Main Results

(Preliminary)

Bank Profitability

Dependent variable	ROA	NII/TA	NNI/TA	LLP/TA	ROA	ROA
Lagged dependent	0.383***	0.716***	0.163***	0.832***	0.374***	0.369***
	(4.074)	(9.626)	(6.906)	(19.916)	(4.118)	(4.026)
Policy rate (MP)	0.067	**0.022*** **	-0.016	**0.075** **	0.010	**-0.192** **
	(0.958)	**(2.964)**	(-0.993)	**(2.721)**	(0.160)	**(-2.597)**
Yield spread	0.062	**0.022*** **	-0.016	**0.112** **	0.066	0.050
	(0.748)	**(2.912)**	(-1.030)	**(2.616)**	(0.804)	(0.651)
Capital ratio $_{t-1}$ (CR_{t-1})	0.012	-0.001	**0.004** **	-0.000	0.010	**-0.020** **
	(1.702)	(-1.042)	**(2.526)**	(-0.038)	(1.432)	**(-2.181)**
Liquidity ratio $_{t-1}$ (LR_{t-1})	-0.003	**-0.001***	-0.003	0.001	-0.003	**-0.024*** **
	(-0.738)	**(-1.964)**	(-1.709)	(0.389)	(-0.704)	**(-3.863)**
Loans/total assets $_{t-1}$	**0.006***	0.000	**0.004*** **	-0.001	0.005	0.006*
	(1.809)	(0.564)	**(2.896)**	(-0.579)	(1.603)	(1.730)
bank_Medium x MP					**-0.172*** **	
					(-3.229)	
bank_Small x MP					**0.130*** **	
					(2.989)	
CR_{t-1} x MP						**0.011*** **
						(4.561)
LR_{t-1} x MP						**0.008*** **
						(4.314)
Observations	1,197	1,197	1,197	1,197	1,197	1,197
R-squared	0.249	0.676	0.068	0.821	0.261	0.267

Robust t-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Only 23 non-entry non-exit banks. The bank fixed effect is included. The standard errors are clustered at the bank level. Explanatory variables omitted to preserve space are GDP growth, CPI growth, log bank total assets, bank funding composition, bank efficiency ratio, and crisis dummy.

Overall, **no effect** of interest rate on ROA

Net interest income increases with policy rate +

But **loan loss provision** also increases with rate −

Small banks more sensitive to policy rate, while **medium banks** less sensitive

Banks with higher **capital ratio** and **liquidity ratio** are more responsive

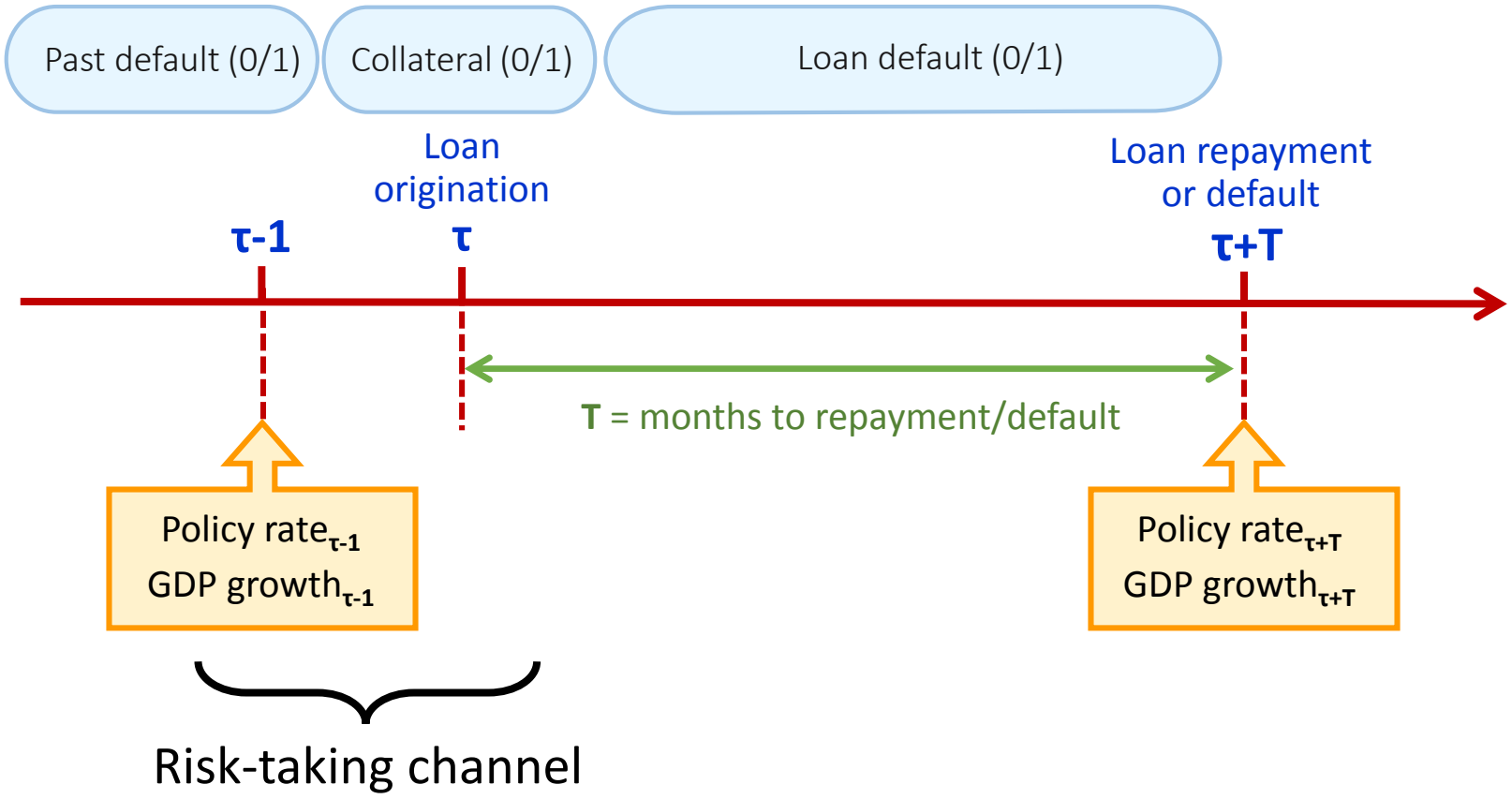
Bank Risk Taking

Dependent variable	Z-score	RWA/TA	NPL/TL
Lagged dependent variable	0.797***	0.827***	0.765***
	(44.076)	(34.259)	(10.994)
Policy rate (MP)	**-2.445***	0.147	**0.358***
	(-1.873)	(0.305)	**(1.746)**
Yield spread	4.381	-0.139	0.568
	(1.689)	(-0.233)	(1.618)
Capital ratio $_{t-1}$ (CR_{t-1})	**0.449***	0.003	-0.019
	(1.993)	(0.043)	(-0.737)
Liquidity ratio $_{t-1}$ (LR_{t-1})	-0.043	0.020	-0.016
	(-0.876)	(0.332)	(-0.875)
Efficiency $_{t-1}$	**-0.022****	**-0.019*****	0.007
	(-2.697)	**(-3.079)**	(1.294)
Observations	1,038	1,197	1,197
R-squared	0.690	0.723	0.731

Weak evidence of the effect of interest rate on bank risk-taking at the bank level

Robust t-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Only 23 non-entry non-exit banks. The bank fixed effect is included. The standard errors are clustered at the bank level. Explanatory variables omitted to preserve space are GDP growth, CPI growth, log bank total assets, bank funding composition, bank loans to total assets, and crisis dummy.

Duration Analysis and Timing of Variables



Loan Duration Model by Loan Type

Dependent variable: Hazard rate

	All loans	Working capital	Trade finance	Credit card	Other short-term loans	Other long-term loans
Past default (0/1)	**1.176*** **	**1.217*** **	**1.414*** **	**1.287*** **	**1.527*** **	**0.680*** **
	(120.465)	**(79.005)**	**(63.050)**	**(10.440)**	**(49.819)**	**(33.878)**
Collateralized (0/1)	**-0.360*** **	**-0.271*** **	**-0.368*** **	0.158	**-0.201*** **	**-0.420*** **
	(-32.673)	**(-15.597)**	**(-13.763)**	(0.930)	**(-5.865)**	**(-20.760)**
Bank relationship	**-0.989*** **	**-1.221*** **	**-0.768*** **	**-1.858*** **	**-1.171*** **	**-0.527*** **
	(-79.116)	**(-61.218)**	**(-30.274)**	**(-15.161)**	**(-25.753)**	**(-17.215)**
$MP_{\tau-1}$	-0.014	**0.366*** **	**-0.080*** **	**0.312*** **	0.047	**-0.357*** **
	(-1.337)	**(21.469)**	**(-2.720)**	**(2.837)**	(1.258)	**(-17.651)**
$MP_{\tau+T}$	**0.276*** **	**0.154*** **	**-0.121*** **	**1.295*** **	**0.072*** **	**0.795*** **
	(45.331)	**(15.265)**	**(-6.363)**	**(16.314)**	**(2.822)**	**(57.108)**
$GDP\ growth_{\tau-1}$	**-0.006*** **	0.001	**0.007***	**-0.027** **	**-0.046*** **	**-0.011*** **
	(-4.370)	(0.495)	**(1.893)**	**(-2.312)**	**(-9.152)**	**(-4.465)**
$GDP\ growth_{\tau+T}$	**-0.004*** **	**-0.011*** **	**0.018*** **	**-0.100*** **	**0.014*** **	**-0.043*** **
	(-2.865)	**(-4.587)**	**(5.154)**	**(-7.044)**	**(2.844)**	**(-12.079)**
Observations	5,040,315	2,894,626	1,443,752	91,893	431,771	178,273
Pseudo-R	0.0235	0.0235	0.0235	0.0235	0.0235	0.0235
log likelihood	-143037	-143037	-143037	-143037	-143037	-143037

The estimates are based on ML estimation of cox proportional hazards model. τ is the month the loan was granted. T is the time to default or repayment of the loan. Bank relationship is log of number of banks used. Explanatory variables omitted to preserve space are loan size, yield spread, HHI, log bank total assets, bank ROA, bank capital ratio, bank liquidity ratio, NPL to total loans, and loans to total assets. z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Expected signs on **loan characteristics**

For **full sample**, no effect of interest rate on loan hazard rate

But, low rate leads to higher hazard rate for **other long-term loans**

Higher interest rate at end of duration, higher default risk

Higher GDP growth, lower default risk

Duration Model – Bank Characteristics

	Hazard rate
$MP_{\tau-1}$	**-0.248*** **
	(-8.799)
$MP_{\tau+T}$	**0.277*** **
	(45.337)
Bank total assets $_{\tau-1}$	**0.193*** **
	(19.669)
Bank ROA $_{\tau-1}$	**-0.093*** **
	(-17.338)
Bank CR $_{\tau-1}$	0.001
	(0.190)
Bank LR $_{\tau-1}$	**-0.074*** **
	(-18.597)
Bank NPL/TL $_{\tau-1}$	**0.040*** **
	(32.727)
Bank loan/TA $_{\tau-1}$	**0.003*** **
	(3.573)
Bank size	**-0.289*** **
	(-13.690)
Bank size x $MP_{\tau-1}$	**0.041*** **
	(6.672)
$CR_{\tau-1}$ x $MP_{\tau-1}$	0.003
	(1.574)
$LR_{\tau-1}$ x $MP_{\tau-1}$	**0.017*** **
	(12.409)
Observations	5,040,315
Pseudo-R	0.0259
log likelihood	-629918

Expected results of **interest rates** on loan hazard rate

Loans issued by **larger banks** tend to have lower hazard rate

Large banks are less responsive to policy rate in terms of loan risk-taking

And banks with **higher liquidity** are slightly less responsive

The dependent variable is the hazard rate. The estimates are based on ML estimation of cox proportional hazards model. τ is the month the loan was granted. T is the time to default or repayment of the loan. Explanatory variables omitted to preserve space are past default, collateralized, loan size, bank relationship, yield spread, beginning GDP growth, ending GDP growth, and HHI. z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Duration Model – Firm Characteristics

	I	II
$MP_{\tau-1}$	**-0.099*** **	**-0.147*** **
	(-6.516)	**(-7.374)**
$MP_{\tau+T}$	**0.291*** **	**0.311*** **
	(35.484)	**(37.486)**
GDP $growth_{\tau-1}$	**-0.006*** **	**-0.007*** **
	(-3.217)	**(-3.607)**
GDP $growth_{\tau+T}$	**-0.005*** **	**-0.007*** **
	(-2.911)	**(-3.416)**
Firm size (0/1)		**-1.029*** **
		(-29.291)
Firm size x $MP_{\tau-1}$		**0.075*** **
		(6.750)
Firm age		**-0.065*** **
		(-3.594)
Firm age x $MP_{\tau-1}$		-0.005
		(-0.831)
Firm ROA		**-0.822*** **
		(-20.182)
Firm ROA x $MP_{\tau-1}$		0.017
		(1.316)
Observations	4,072,616	4,072,616
Pseudo-R	0.0420	0.0420
log likelihood	-293266	-293266

Main results remain robust

Larger, older, and **more profitable firms** tend to be associated with low hazard rate

Large firms' default risks are less sensitive to interest rates
- Less affected by bank risk taking

The dependent variable is the hazard rate. The estimates are based on ML estimation of cox proportional hazards model. τ is the month the loan was granted. T is the time to default or repayment of the loan. Explanatory variables omitted to preserve space are past default, collateralized, loan size, bank relationship, yield spread, HHI, log bank total assets, bank ROA, bank capital ratio, bank liquidity ratio, NPL to total loans, and loans to total assets. z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Duration Model – Low-for-long

	Base	I	II	III
$MP_{\tau-1}$	-0.014	0.012		
	(-1.337)	(1.143)		
$MP_{\tau+T}$	**0.276*** **	**0.225*** **		
	(45.331)	**(32.941)**		
No. quarters rate not increase $_{\tau-1}$		**0.268*** **		
		(40.472)		
No. quarters rate not increase $_{\tau+T}$		**-0.238*** **		
		(-38.163)		
Rate below median$_{\tau-1}$ (0/1)			-0.004	
			(-0.295)	
Rate below median$_{\tau+T}$ (0/1)			**-0.496*** **	
			(-43.087)	
Negative Taylor residual$_{\tau-1}$ (0/1)				**0.118*** **
				(11.507)
Negative Taylor residual$_{\tau+T}$ (0/1)				**0.392*** **
				(40.499)
Observations	5,040,315	5,040,315	5,040,315	5,040,315
Pseudo-R	0.0235	0.0253	0.0253	0.0253
log likelihood	-143037	-630289	-630289	-630289

The dependent variable is the hazard rate. The estimates are based on ML estimation of cox proportional hazards model. τ is the month the loan was granted. T is the time to default or repayment of the loan. Explanatory variables omitted to preserve space are loan characteristics, macroeconomic controls, and bank characteristics. z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1

'Low for longer' leads to an increase in bank risk-taking in **new loans**

… but helps lower the default risk for **existing loans**

Other alternative measures of low interest rates do not show consistent results

Loan Risk – Probit Model

Dependent variable	**Past default**	**Future default**	**Collateralized**
Loan size	-0.003***	-0.001***	0.087***
	(-20.887)	(-4.682)	(517.312)
Bank relationship	0.405***	-0.336***	-0.312***
	(395.870)	(-132.284)	(-279.086)
$MP_{\tau-1}$	**-0.062*** **	**-0.056*** **	**-0.534*** **
	(-58.044)	**(-26.293)**	**(-464.369)**
Yield $spread_{\tau-1}$	-0.065***	-0.100***	-0.655***
	(-44.953)	(-35.060)	(-417.760)
GDP $growth_{\tau-1}$	-0.006***	-0.017***	-0.022***
	(-37.980)	(-47.524)	(-148.071)
$HHI_{\tau-1}$	-17.809***	-24.440***	-16.572***
	(-119.740)	(-81.089)	(-124.187)
Bank total $assets_{\tau-1}$	0.023***	0.032***	-0.546***
	(32.135)	(21.270)	(-727.582)
Bank $ROA_{\tau-1}$	-0.031***	-0.035***	-0.049***
	(-56.978)	(-42.437)	(-89.997)
Bank $CR_{\tau-1}$	-0.041***	-0.036***	-0.189***
	(-144.711)	(-57.877)	(-619.746)
Bank $LR_{\tau-1}$	-0.006***	0.003***	0.009***
	(-41.779)	(10.676)	(62.385)
Bank $NPL/TL_{\tau-1}$	0.019***	0.051***	-0.001***
	(117.296)	(181.595)	(-8.748)
Bank $loan/TA_{\tau-1}$	0.003***	0.008***	0.023***
	(46.074)	(50.977)	(365.296)
Observations	9,978,690	9,978,690	8,248,799
Pseudo-R	0.103	0.0902	0.169
log likelihood	-456533	-2.649e+06	-2.955e+06

z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Low interest rates increase the likelihood of:

- granting new loans to borrowers with **past default**
- granting new loans that **eventually default**
- granting new loans with **collateral** (??)

Summary of results

- Low interest rates adversely affect banks' **interest income** but at the same time also lower banks' cost through a reduction in **loan loss provision**
  - These offsetting effects result in a muted overall impact on **bank profitability**
- Do not detect bank risk-taking behavior at the **bank level** based on standard balance sheet measures of risk
- Some evidence of bank risk-taking at the **loan level** due to low policy rates
  - particularly for **general long-term loans** and **corporate loans**
- **Small banks** appear to be more sensitive—in terms of profitability and risk taking—to changes in the policy rate
- Banks with **higher capital and liquidity** ratios tend to be more sensitive to policy rate in terms of profitability, but not in risk-taking
- **Small firms** are more likely to be affected by bank risk-taking behavior

Thank you