Excess Reserves and Monetary Policy Tightening

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Banca d'Italia

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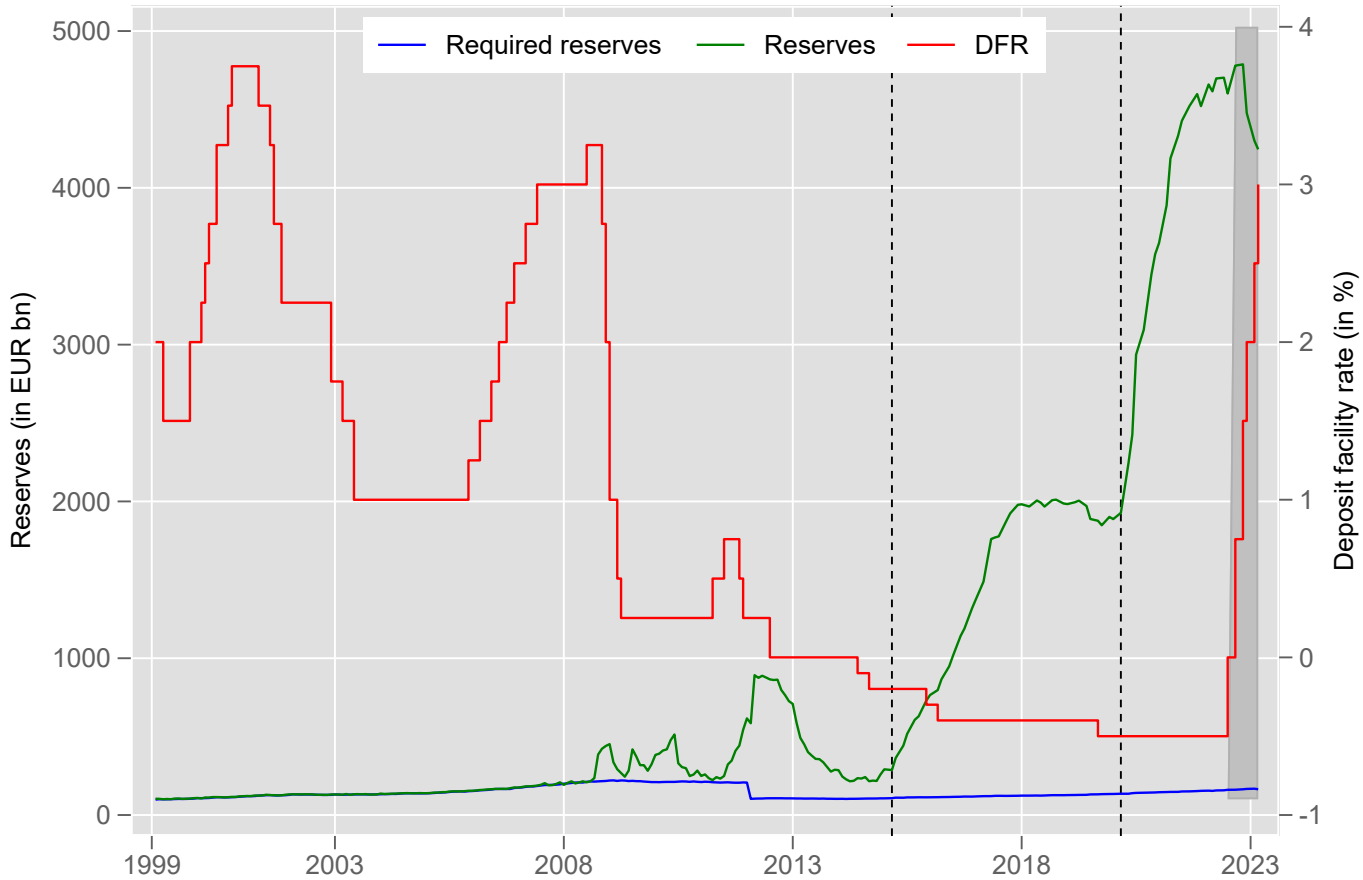
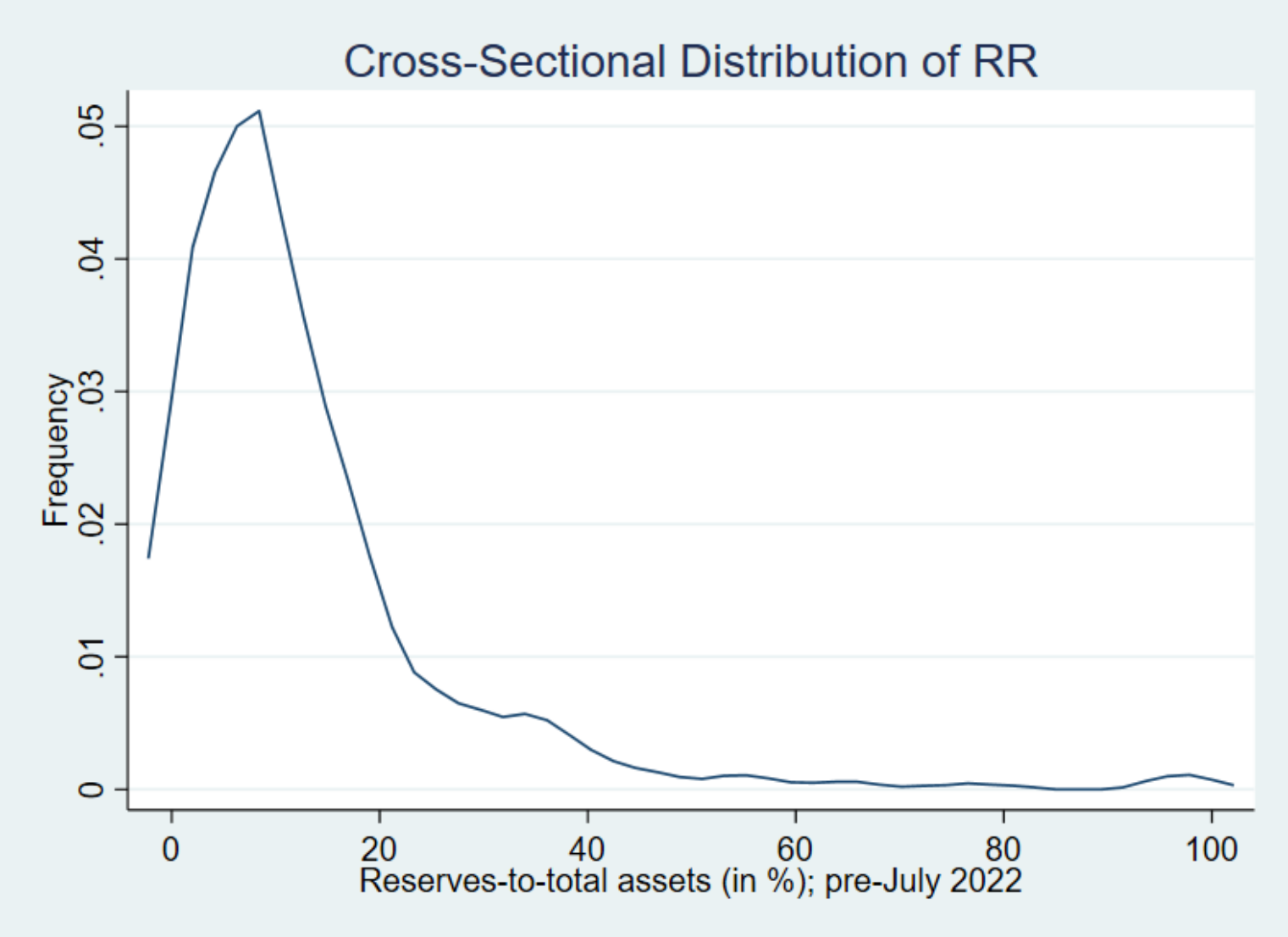
Motivation: Abundant Reserves Meet Large Rate Hikes



Central bank reserves: risk-free; most liquid; only held by banks; store of value in floor system; supply determined by central banks; abundant (0.75% of total assets in '08; 12% in '22).

ECB Balance Sheet

Motivation: Cross-Sectional Differences (Reserves/TotalAssets)



⟶ **This paper:** Does transmission of MP tightening via bank lending differ in the cross-section of banks?

Main Mechanism

- Bank balance-sheet channel (e.g. Bernanke, 2007):
  - Policy rate ↑
    → market value assets ↓ → net worth ↓ → credit supply ↓
- Recent hiking cycle with large reserves:
  - Policy rate ↑
    → market value non-reserve assets ↓
    → interest income ↑ → net worth ? → credit supply?

⟶ **Key finding**: Reserve-rich banks' credit supply is less sensitive to the recent MP tightening.

Related Literature

- **Bank lending channel (and minimum reserves)**
  Bernanke and Blinder (1988); Romer et al. (1990); Kashyap and Stein (1994); Bernanke and Gertler (1995); Woodford (2010)

- **Balance sheet channels of monetary policy**
  Bernanke and Gertler (1989); Kiyotaki and Moore (1997); Brunnermeier and Sannikov (2010); Drechsler et al. (2017); Gomez et al. (2021)

- **QE, QT, and central bank losses**
  Rodnyanski and Darmouni (2017); Chakraborti et al. (2020); Acharya and Rajan (2021); Acharya et al. (2023); Lopez-Salido and Vissing-Jorgensen (2023); Goncharov et al. (2023)

Data

- **AnaCredit**
  - Loan-level data (amount, loan rates, arrears)
  - Lender: Euro area banks
  - Borrower: Corporation (> 25.000 EUR)
- Bank balance sheets (**IBSI**) and bank interest rates (**iMIR**)
  - Asset and liability items; deposit interest rates
- Bank financial reporting (**FINREP**) data
  - Profit and loss accounts (significant institutions only).
- **Refinitiv-Eikon** (daily stock prices of listed banks)

- Main sample: January 2022 until February 2023
  - 472 euro area banks (71% of total assets)
  - 3,315,611 firms (494,749 firms with multiple bank relationships)
- > 42 mio bank-firm level observations

Main Empirical Specification

$$log(Credit_{b,f,t}) = \boxed{\beta} \times (RR_b) \times (DFR_t \geq 0) + \mathbf{X}'_{b,t}\gamma + \alpha_{f,t} + \alpha_{b,f} + \alpha_{c,t} + u_{b,f,t}$$

- $log(Credit_{b,f,t})$: loans outstanding (incl. off balance sheet commitment)
- RR_b: average pre-period reserve ratio; normalized (zero mean, unit std. dev.)
- $DFR_t \geq 0$: from July 2022 onwards
- $\mathbf{X}'_{b,t}$: time varying bank-level controls
- $\alpha_{f,t}, \alpha_{b,f}, \alpha_{c,t}$: fixed effects (e.g. demand controls, Khwaja and Mian 2008)

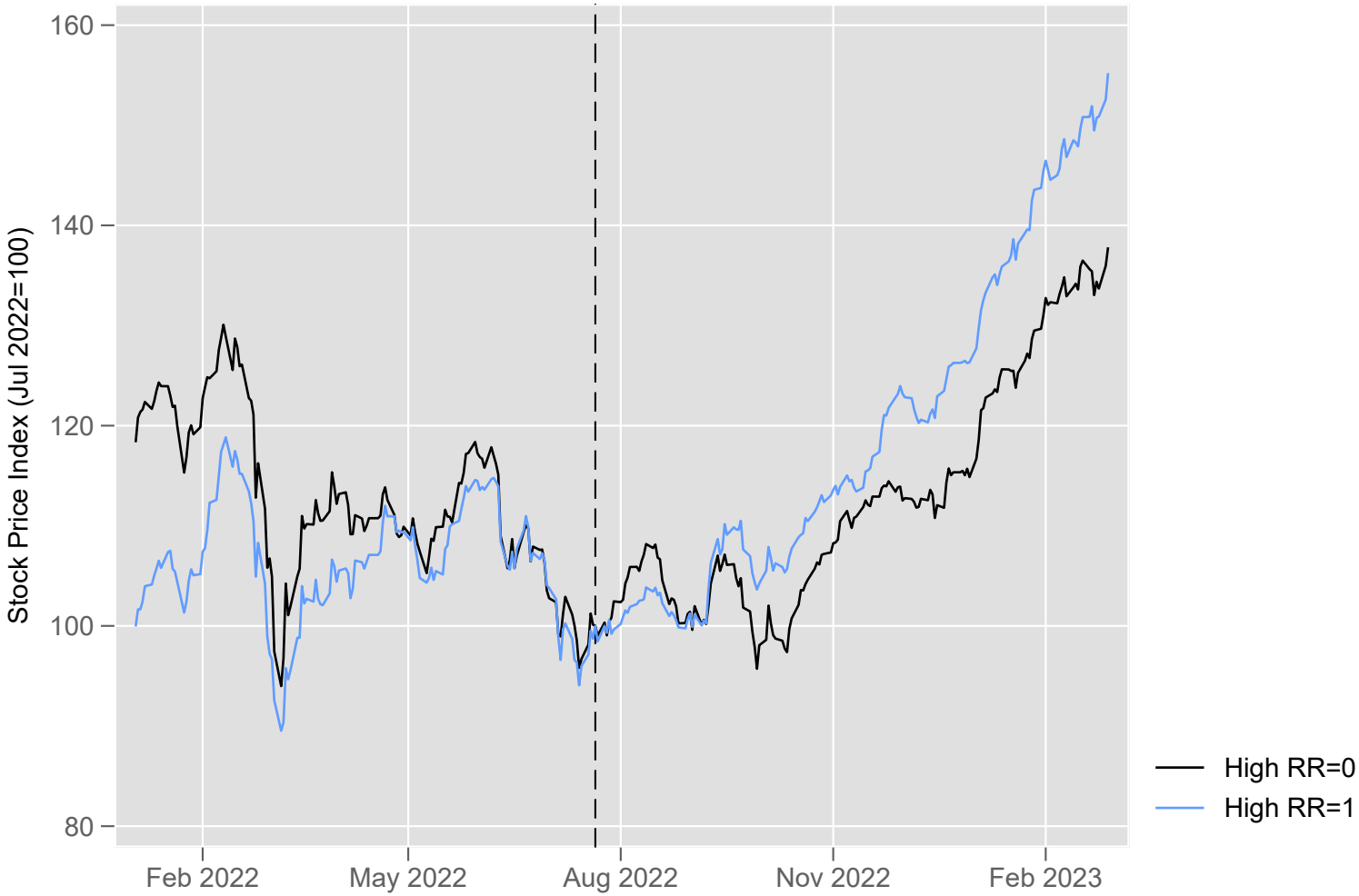
RR Characteristics

$\boxed{\beta}$: difference in credit supply after the ECB's MP tightening when increasing RR by one std. dev. from the mean.

Main Hypothesis: $\beta > 0$ (credit supply less sensitive)

Net Worth

Net Worth: Stock Prices



Regression

Net Worth: (Net) Interest Income and Profits

$$y_{b,t} = \theta \times (RR_b) \times (DFR_t \geq 0) + \mathbf{X}'_{b,t}\gamma + \alpha_b + \alpha_t + u_{b,t}$$

	(1)	(2)	(3)	(4)	(5)
	%Int. Inc. Ratio	%Int. Exp. Ratio	%Net	%ROA	log(Equity)
$(DFR_t \geq 0) \times RR_b$	0.0877*	0.0276	0.0506*	0.0801*	0.0138*
	(1.78)	(1.07)	(1.74)	(1.96)	(1.70)
adj. R2	.8536	.8801	.8393	.8275	.9962
N	736	736	736	736	6388
Controls	Yes	Yes	Yes	Yes	Yes
Country-Time FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes

[Mean(Net Interest): 0.93%. Mean(ROA): 1.58%.]

[Reserve remuneration: 7% of banks' int. income (median: 6%; top 25: 12%)]

Limited Deposit Passthrough | Bank Lending Survey

Credit Supply

Credit Supply: Main

$$log(Credit_{b,f,t}) = \beta \times (RR_b) \times (DFR_t \geq 0) + \mathbf{X}'_{b,t}\gamma + \alpha_{f,t} + \alpha_{b,f} + \alpha_{c,t} + u_{b,f,t}$$

	(1)	(2)	(3)	(4)
	All firms		Multiple bank firms	
$(DFR_t \geq 0) \times RR_b$	0.0071***	0.0074***	0.0106***	0.0128***
	(6.78)	(7.36)	(6.25)	(7.57)
adj. R2	.9782	.9784	.9749	.9753
N	42,580,697	42,580,697	14,062,930	14,062,930
Controls	Yes	Yes	Yes	Yes
Country (bank)-Time FE	Yes	Yes	Yes	Yes
Country (firm)-Time FE	Yes	–	Yes	–
Bank-Firm Fixed Effects	Yes	Yes	Yes	Yes
Industry-Country-Size-Time FE	No	Yes	No	–
Firm-Time Fixed Effects	No	No	No	Yes

[Economic magnitude: 0.25% of 2022 euro area GDP.]

Timing | Bank Heterogeneity | Firm Heterogeneity | External Validity | Aggregate Effects

Credit Supply: Robustness

$$log(Credit_{b,f,t}) = \beta \times (RR_b) \times (DFR_t \geq 0) + \mathbf{X}'_{b,t}\gamma + \alpha_{f,t} + \alpha_{b,f} + \alpha_{c,t} + u_{b,f,t}$$

	(1)	(2)	(3)
	No Controls	RR = High RR	$RR_b = MRR_b$
$RR_b \times (DFR_t \geq 0)$	0.0103***	0.0093***	0.0002
	(5.36)	(3.32)	(0.16)
N	14,062,930	14,062,930	14,062,930
Controls	No	Yes	Yes
Country (bank)-Time FE	Yes	Yes	Yes
Bank-Firm Fixed Effects	Yes	Yes	Yes
Firm-Time Fixed Effects	Yes	Yes	Yes

Bias: Grosse-Rueschkamp et al. (2019)

Credit Supply: Collapsed Regressions

$$\Delta log(Credit_{b,f}) = \beta \times (RR_b) + \mathbf{X}_b' \gamma + \alpha_f + u_{b,f} \quad (1)$$

$$\Delta log(Credit_f) = \delta \times (\overline{RR_f}) + \alpha_1 \times \overline{B}_f + \alpha_2 \times F_f + u_f \quad (2)$$

	(1)	(2)
	Bank-firm-level	Firm-level
RR_b	0.0109**	
	(2.91)	
$\overline{RR}$		0.0068***
		(2.92)
Bias corrected $\overline{RR}$		0.0042
adj. R2	.04256	.01962
N	1,015,495	373,845
Controls	Yes	Yes
Firm Fixed Effects	Yes	-
Industry-Country Fixed Effects	-	Yes

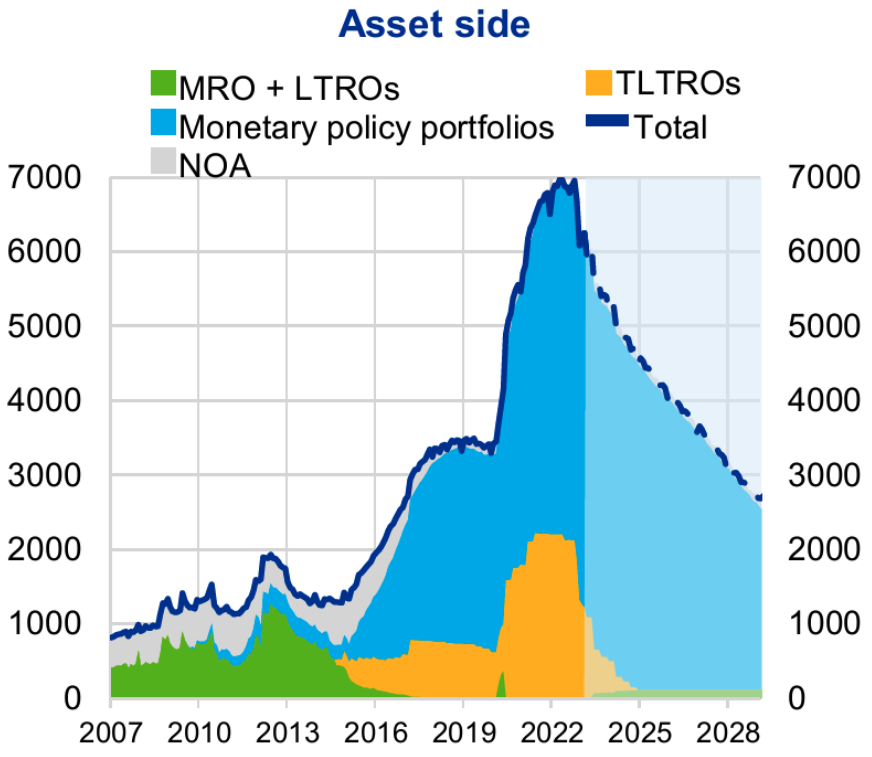
Substitution effect: e.g., Jimenez et al. (2020)

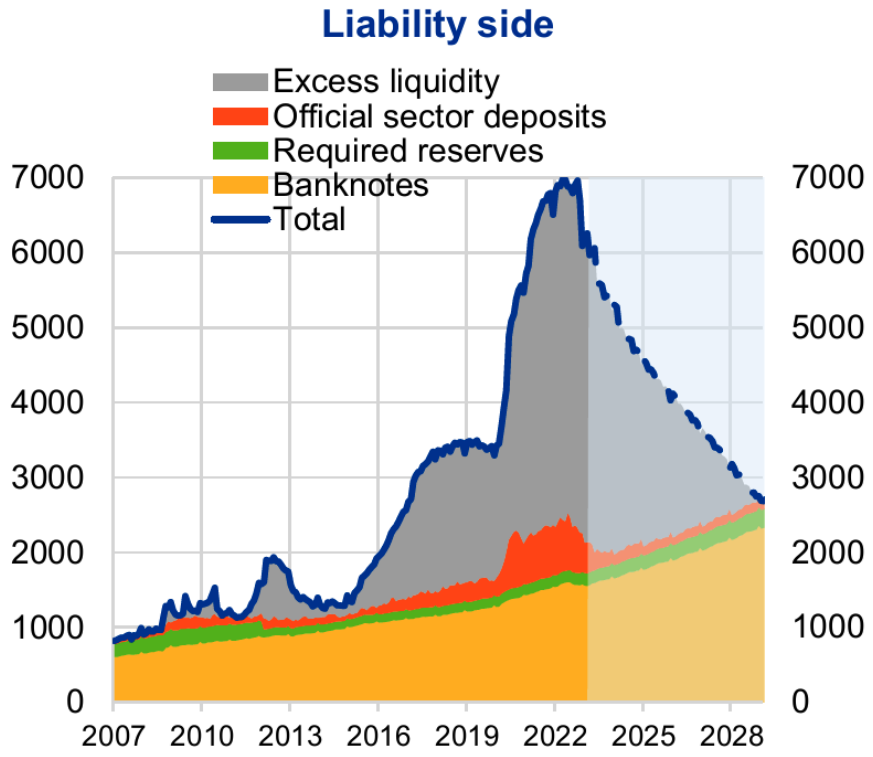
Conclusion

- Reserve-rich banks' credit supply less sensitive to MP tightening
  - Positive net worth effect
  - (Credit supply effect stronger for *small and worse capitalized* banks)
  - (Directed towards *smaller* firms with *higher credit quality*)
  - Results binding at the firm-level → indication of real effects
- Ongoing policy discussions on reserve remuneration
  (MRR adjustment after ECB meeting on July 27, 2023)
- QE/QT and central bank profits?
- Open question: Weaker overall transmission when reserves are abundant?

Additional Slides

ECB Balance Sheet (from Schnabel 2023)





Source: ECB calculations.
Note: The future path of the monetary policy portfolio is based on the median expectations by analysts as reported in the March SMA survey. Government deposits are assumed to be remunerated at a ceiling of €STR-20bps as of May 2023. The projections of banknotes are based on an ECB internal model. NOA stands for net other assets.
Last observation: February 2023.

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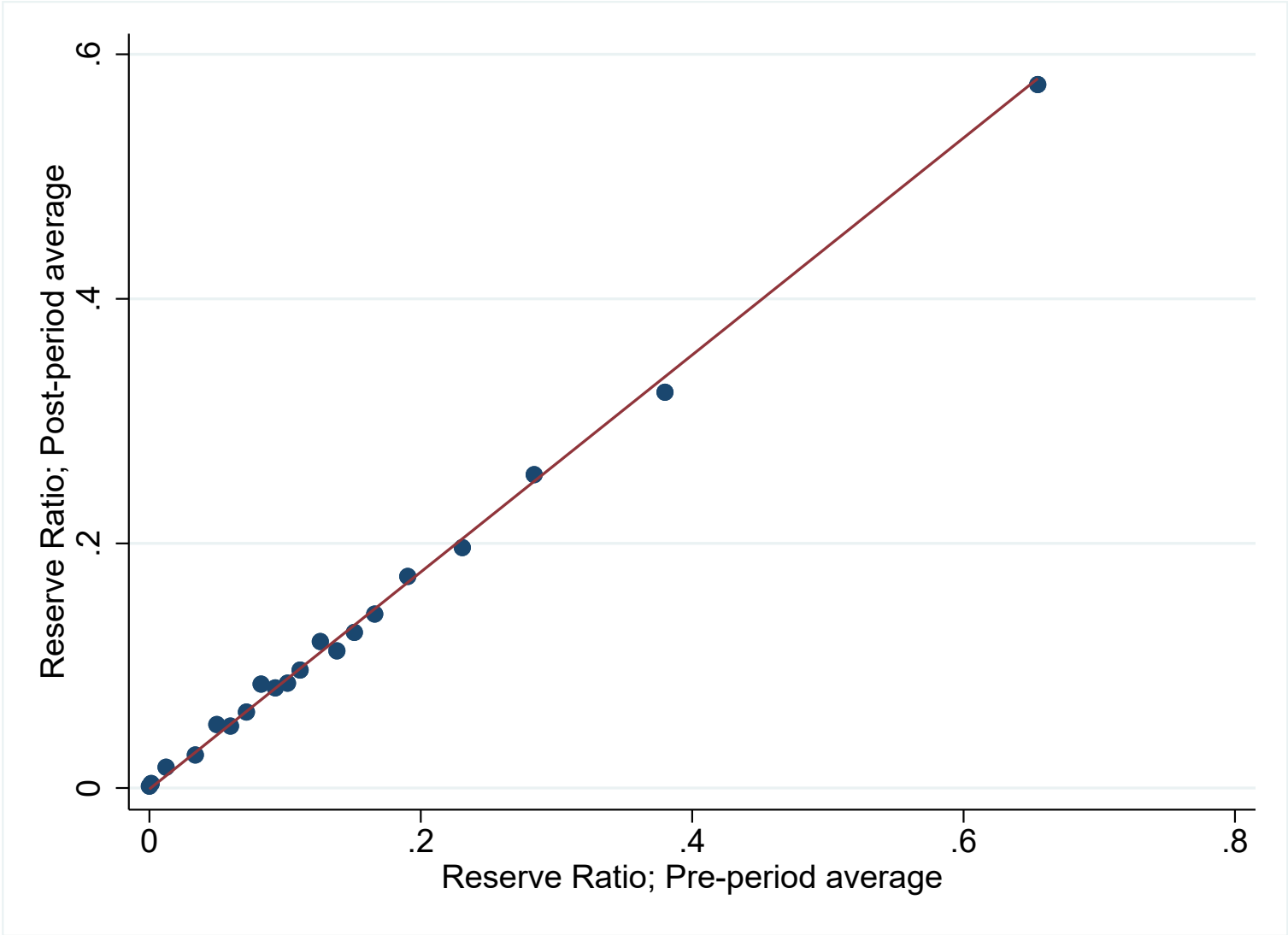
Reserve Ratio - $(DFR_t < 0)$ vs. $(DFR_t \geq 0)$



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Cross-Sectional Characteristics

	(1)	(2)	(3)	(4)
Dep. var.:	RR_b		High RR_b	
	OLS	LPM	Logit	Probit
log(Total Assets)	-0.0771	0.0134	0.1023	0.0658
	(-1.49)	(0.58)	(0.88)	(0.96)
Equity Ratio	-0.1305**	-0.0344	-0.1708	-0.1017
	(-2.18)	(-1.33)	(-1.18)	(-1.33)
Deposit Ratio	-0.2333***	-0.0929***	-0.5250***	-0.3137***
	(-4.28)	(-4.13)	(-4.11)	(-4.20)
Bonds Held Ratio	-0.0864**	-0.0364**	-0.2435*	-0.1487*
	(-2.25)	(-2.04)	(-1.75)	(-1.95)
Fixed to total loans Ratio	-0.1683***	-0.0355	-0.2113*	-0.1307*
	(-3.35)	(-1.61)	(-1.72)	(-1.85)
adj. R2	.1389	.09137		
χ^2			52.71	55.71
p-value			<0.001	<0.001
N	472	472	472	472

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Net Worth Regressions

Following Altavilla et al (2022)

$$(R_{b,t} - r_t^F) = \alpha_b + \mathbf{F}_t' \gamma_b + \lambda_b \times (DFR_t \geq 0) + \varepsilon_{b,t},$$

$$\lambda_b = \alpha + \beta \times RR_b + X_b' \gamma + u_b.$$

	(1)	(2)	(3)	(4)	(4)	(5)
	Raw returns		FF3		FF5	
RR_b	0.1533***	0.1399***	0.1639***	0.1510***	0.1631***	0.1506***
	(3.20)	(2.95)	(3.06)	(2.86)	(3.08)	(2.88)
adj. R2	.1299	.5822	.2158	.4476	.2122	.4509
N	38	38	38	38	38	38
Bank controls	No	Yes	No	Yes	No	Yes

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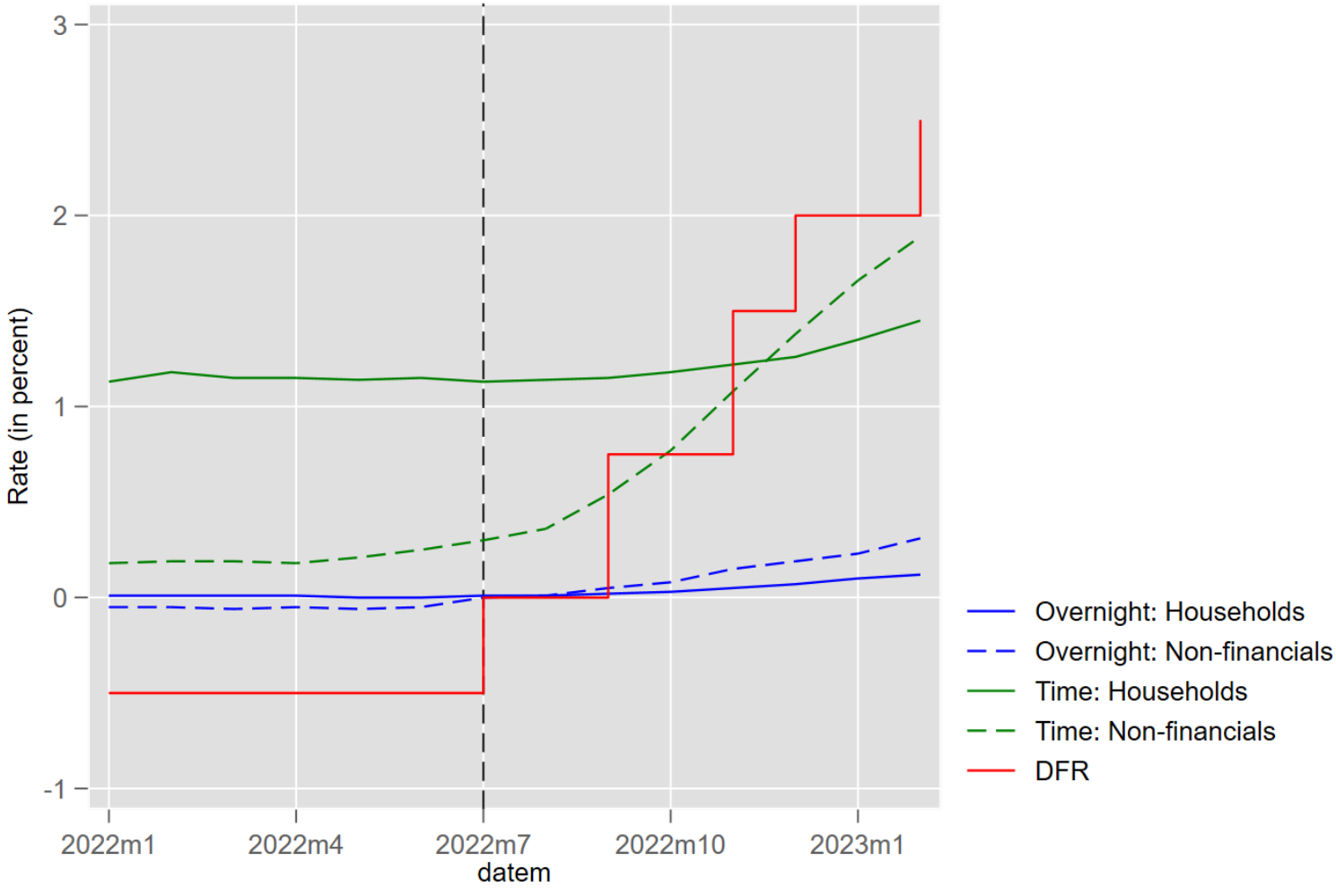
Limited Deposit Passthrough



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Passthrough Regressions

$$\text{Deposit } \beta_b = 100 \times \frac{\Delta Rate_b^k}{\Delta DFR}$$

	(1)	(2)	(3)	(4)	(5)
	Total deposits	Overnight deposits		Time deposits	
		Non-Financials	Households	Non-Financials	Households
RR_b	2.0125	2.8987	1.0190	-4.9080	1.8435
	(0.97)	(1.26)	(0.67)	(-1.33)	(0.61)
Constant	14.5521***	11.0227***	6.5829***	45.6957***	20.6141***
	(10.12)	(8.00)	(6.08)	(18.97)	(10.73)
adj. R2	.0057	.01235	.0026	.01267	.00293
N	138	138	138	138	138

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Deposits: Effect Not Driven by Deposit Outflows (DSS)

	(1)	(2)
	log(Total Deposits)	
$(DFR_t \geq 0) \times RR_b$	0.0047	
	(0.46)	
$(DFR_t \geq 0) \times$ High RR_b		0.0074
		(0.51)
adj. R2	.9953	.9954
N	5,179	5,179
Controls	Yes	Yes
Country-Time FE	Yes	Yes
Bank FE	Yes	Yes

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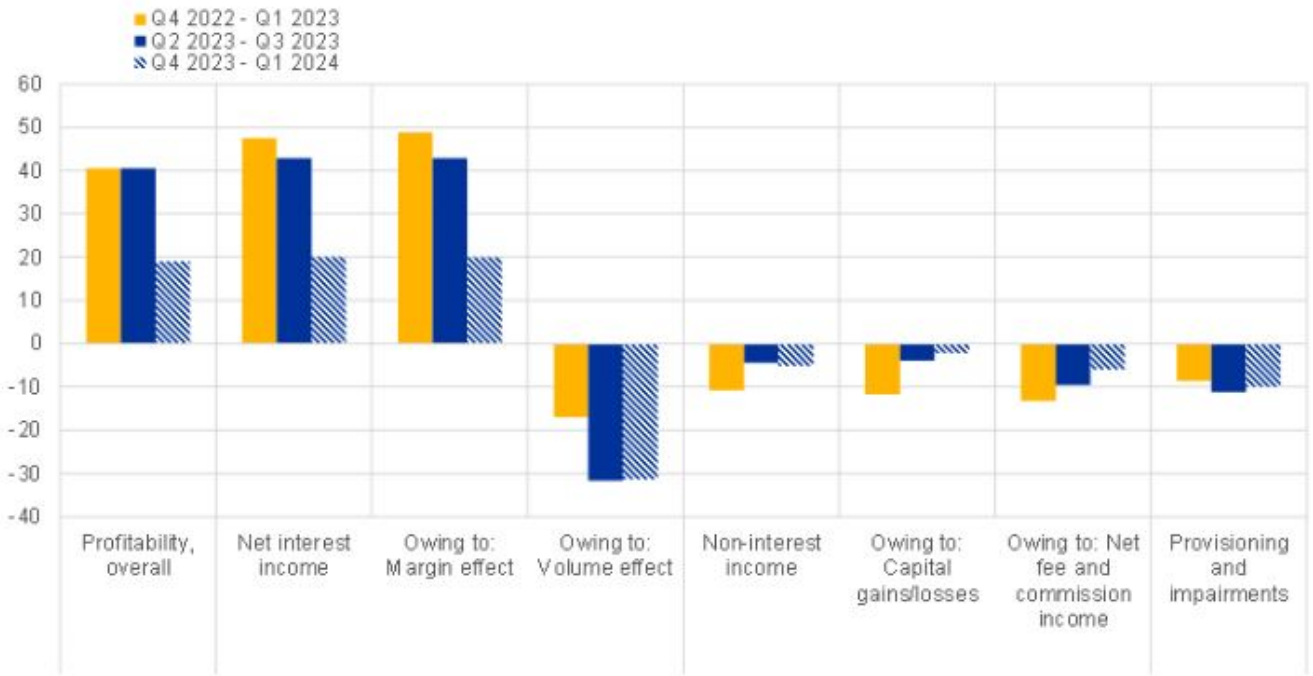
External Validity: ECB Bank Lending Survey 2023-Q3

Chart 21

Impact of ECB interest rate decisions on euro area bank profitability

(net percentages of banks; over the past six months and the next six months)



Notes: The net percentages refer to the difference between the sum of the percentages of banks responding "increased considerably" and "increased somewhat" and the sum of the percentages of banks responding "decreased somewhat" and "decreased considerably". The dashed bars denote expectations indicated by banks in the current round.

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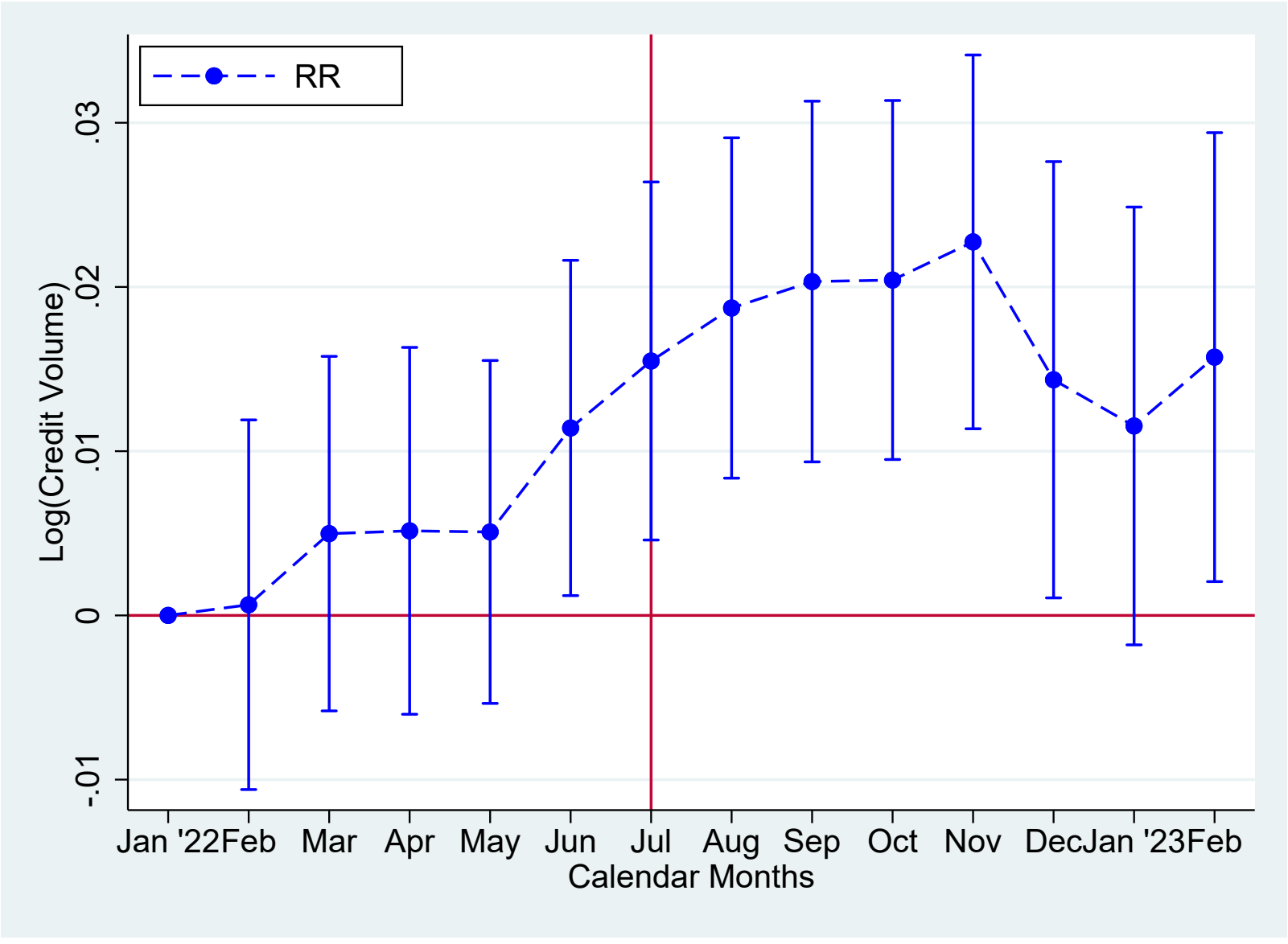
Timing of Effect



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Bank Heterogeneity

	(1) Baseline	(2) Bank Size	(3) Equity	(4) Fixed-to-total
$(DFR_t \geq 0)$ x RR	0.0128*** (7.57)	0.0185*** (11.19)	0.0135*** (5.52)	0.0095*** (4.69)
$(DFR_t \geq 0)$ x Large bank		-0.2250*** (-3.02)		
$(DFR_t \geq 0)$ x RR x Large bank		-0.0578*** (-5.10)		
$(DFR_t \geq 0)$ x Low Equity			-0.0050 (-0.20)	
$(DFR_t \geq 0)$ x RR x Low Equity			0.0111** (2.55)	
$(DFR_t \geq 0)$ x Low Fixed-to-total Loans				-0.0196 (-0.70)
$(DFR_t \geq 0)$ x RR x Low Fixed-to-total Loans				0.0175*** (4.55)
adj. R2	.9753	.9753	.9753	.9753
N	14,062,930	14,062,930	14,062,930	14,062,930

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Firm Heterogeneity: Borrower Quality

$$log(Credit_{b,f,t}) = \beta \times (RR_b) \times (DFR_t \geq 0) + \mathbf{X}'_{b,t}\gamma + \alpha_{f,t} + \alpha_{b,f} + \alpha_{c,t} + u_{b,f,t}$$

	(1)	(2)	(3)	(4)
	Probability of Default (PD)		Arrears	
	High	Low	Yes	No
$(DFR_t \geq 0) \times RR$	0.0025	0.0141***	0.0081***	0.0136***
	(1.12)	(7.98)	(3.22)	(8.15)
adj. R2	.9782	.9743	.9801	.9742
N	1,218,148	12,844,782	2,043,266	12,019,664
Controls	Yes	Yes	Yes	Yes
Country (bank)-Time Fixed Effects	Yes	Yes	Yes	Yes
Bank-Firm Fixed Effects	Yes	Yes	Yes	Yes
Firm-Time Fixed Effects	Yes	Yes	Yes	Yes

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Firm Heterogeneity: Size

	(1)	(2)	(3)	(4)
	Micro	Small	Medium	Large
$(DFR_t \geq 0) \times RR$	0.0073***	0.0206***	0.0186***	0.0099***
	(3.23)	(8.18)	(7.57)	(6.68)
adj. R2	.973	.9567	.9607	.9756
N	1,298,483	2,063,478	4,744,448	5,412,478
Controls	Yes	Yes	Yes	Yes
Country (bank)-Time Fixed Effects	Yes	Yes	Yes	Yes
Bank-Firm Fixed Effects	Yes	Yes	Yes	Yes
Firm-Fixed Effects	Yes	Yes	Yes	Yes

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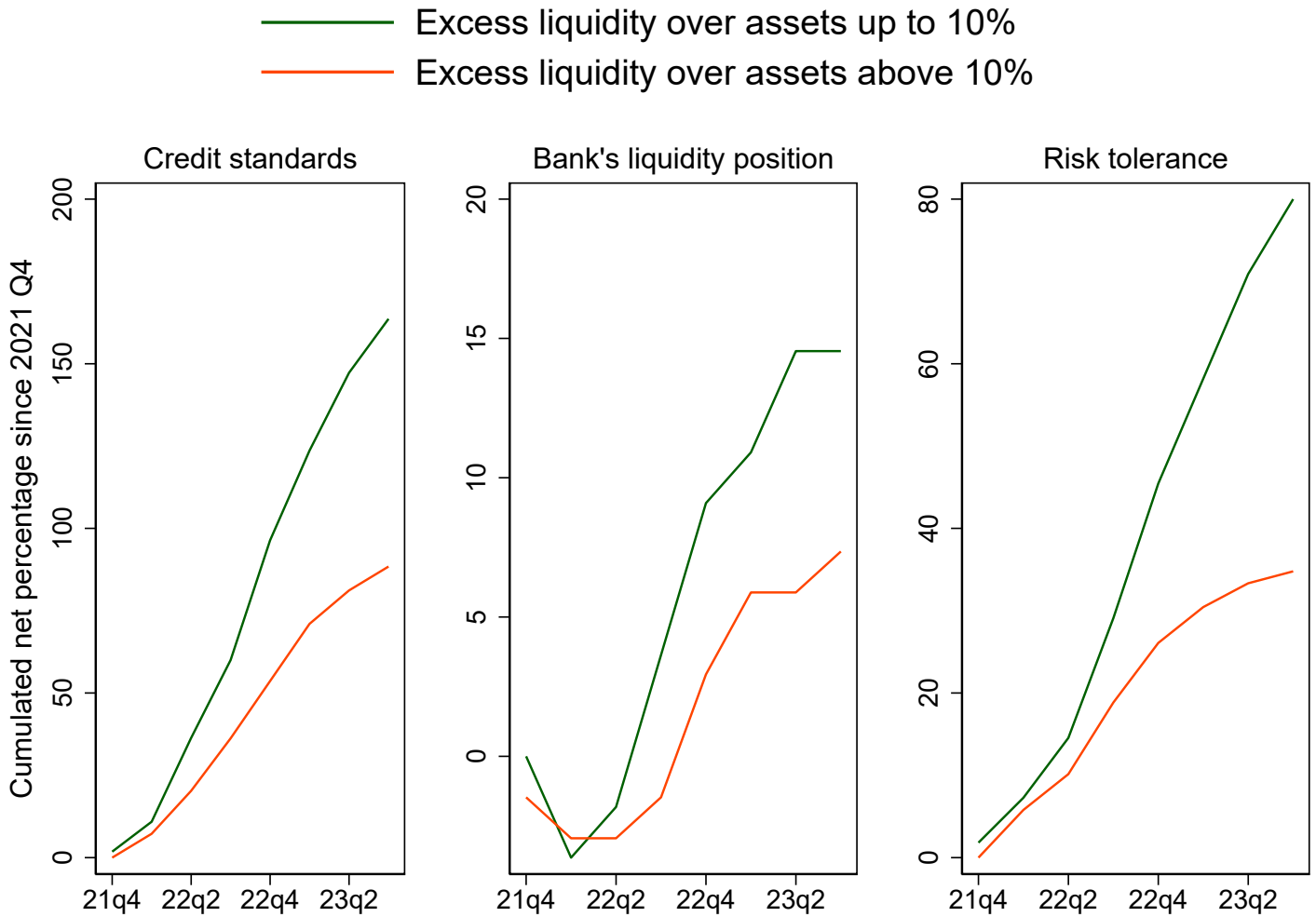
Credit Supply: External Validity (BLS)

Survey-Based Evidence from Huennekes (2023)



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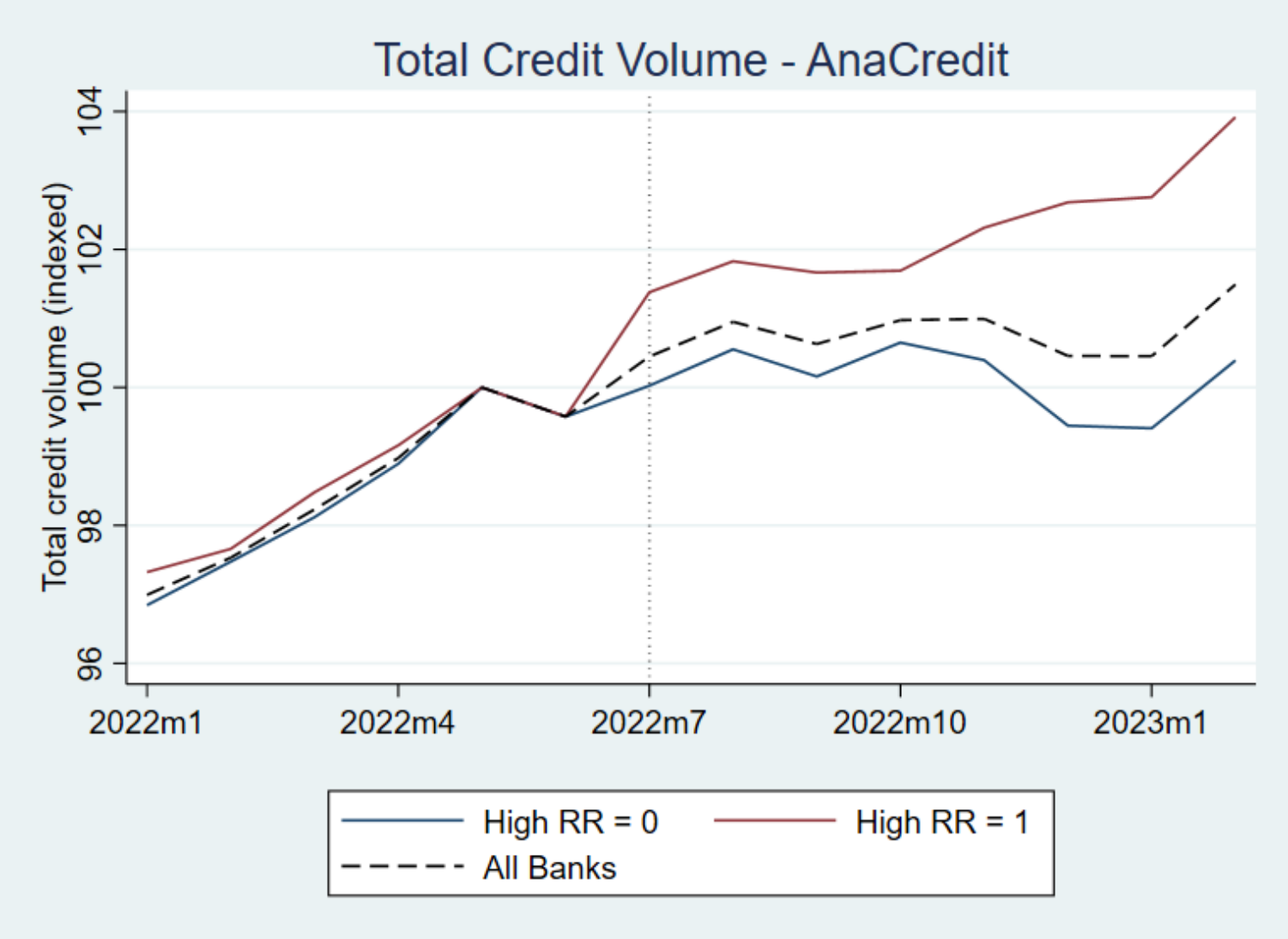
Total Credit Volumes



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