

Excess Reserves and Monetary Policy Tightening

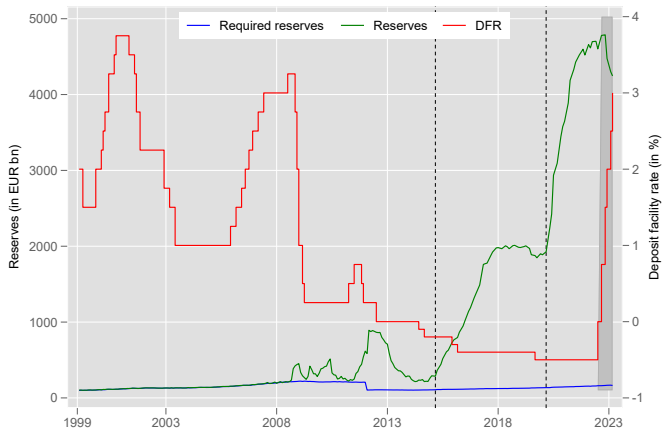
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The views presented in this paper do not necessarily reflect those of Deutsche Bundesbank or the Eurosystem.

Motivation: Abundant Reserves Meet Large Rate Hikes



Motivation

Unprecedented situation:

“The return of policy rates to positive territory would this time provide a sizeable risk free income to the banking system, and a similar loss for the Eurosystem. [...] The effect on banks’ net interest income nevertheless, if opposite in sign to the one under negative rates, could also distort the transmission of our monetary policy.”

François Villeroy de Galhau (Banque de France), August 2022, Jackson Hole

This paper:

Is the transmission via bank lending different for reserve-rich banks when reserves are well-remunerated?

Main Mechanism

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

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

Central Bank Reserves

Central bank reserves are a special type of asset:

- ▶ Most risk-free and liquid asset available
- ▶ In a floor system, reserves become a store of value
- ▶ Only banks can hold reserves
- ▶ CB sets the aggregate level of reserves, banks can only re-distribute
- ▶ Reserves are in abundant supply (reserves: 4 EUR tn, ST euro-area government bonds: 0.7 EUR tn)

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)

- **From QE to QT**

Rodnyanski and Darmouni (2017); Chakraborti et al. (2020); Acharya and Rajan (2021); Acharya et al. (2023); Lopez-Salido and Vissing-Jorgensen (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

- 483 euro area banks (71% of total assets)
- 3,315,611 firms (494,749 firms with multiple bank relationships)

- > 43 mio bank-firm level observations

Main Empirical Specification

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

- $\log(\text{Credit}_{b,f,t})$: loans outstanding (incl. off balance sheet commitment)
- RR_b : average reserve ratio (01/22-06/22); 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

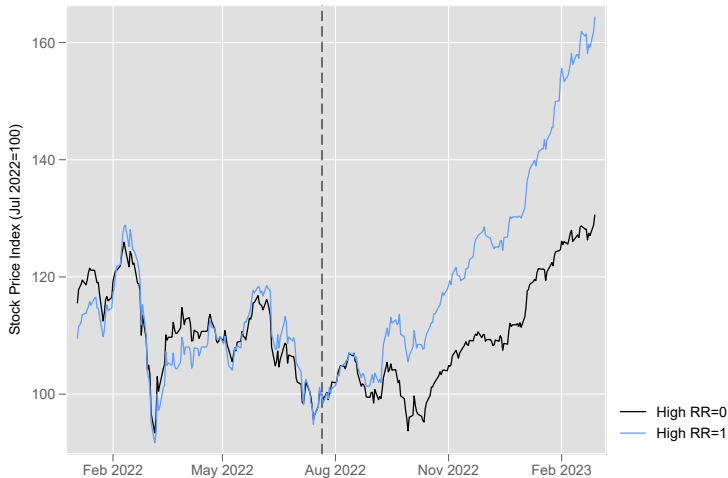
Details

$\boxed{\beta}$: 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)
	%Interest Inc.	%Interest Exp.	% Net Interest	%ROA	log(Equity)
RR x (DFR _t ≥ 0)	0.1063** (2.21)	0.0434 (1.18)	0.0629*** (2.69)	0.1236*** (3.24)	0.0200** (1.99)
adj. R2	.8183	.8433	.7847	.7913	.997
N	753	753	753	753	6,515
Controls	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes

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

Credit Supply

Credit Supply: Main

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

	(1)	(2)	(3)	(4)
	All firms		Multiple bank firms	
RR x (DFR _t ≥ 0)	0.0049*** (5.01)	0.0050*** (5.29)	0.0079*** (5.05)	0.0084*** (5.67)
adj. R2	0.9772	0.9773	0.9744	0.9744
N	43,527,514	43,527,514	14,690,692	14,690,692
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

Credit Supply: Robustness

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

	(1)	(2)	(3)	(4)
	No Controls	RR = High RR	RR = MRR	Spec. Demand
$(DFR_t \geq 0) \times RR$	0.0049*** (3.31)	0.0139*** (4.32)	-0.0010 (-0.53)	0.0122*** (7.59)
N	14,690,692	14,690,692	14,690,692	14,690,692
Controls	Yes	Yes	Yes	Yes
Country (bank)-Time FE	Yes	Yes	Yes	Yes
Bank-Firm Fixed Effects	Yes	Yes	Yes	Yes
Firm-Time Fixed Effects	Yes	Yes	Yes	Yes

Direction of bias: [Grosse-Rueschkamp et al. \(2019\)](#)

Credit Supply: Collapsed Regressions

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

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

	(1)	(2)
	Bank-firm-level	Firm-level
RR	0.0055* (1.93)	
$\overline{\text{RR}}$		0.0052** (2.30)
Bias corrected $\overline{\text{RR}}$		0.0046
adj. R2	.03929	.01559
N	1,068,584	409,117
Controls	Yes	Yes
Firm Fixed Effects	Yes	-
Industry-Country Fixed Effects	-	Yes

Substitution effect: [Jasova et al. \(2021\)](#)

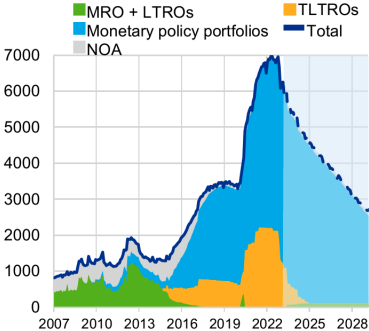
Conclusion

- 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 (policy adjustment after ECB meeting on July 27, 2023)
- Open question: Does the QE-induced abundant reserves regime come with additional side effects? Weaker overall transmission?

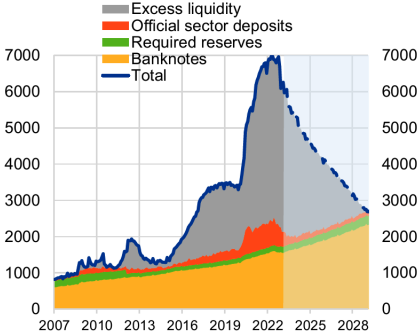
Additional Slides

ECB Balance Sheet (from Schnabel 2023)

Asset side



Liability side

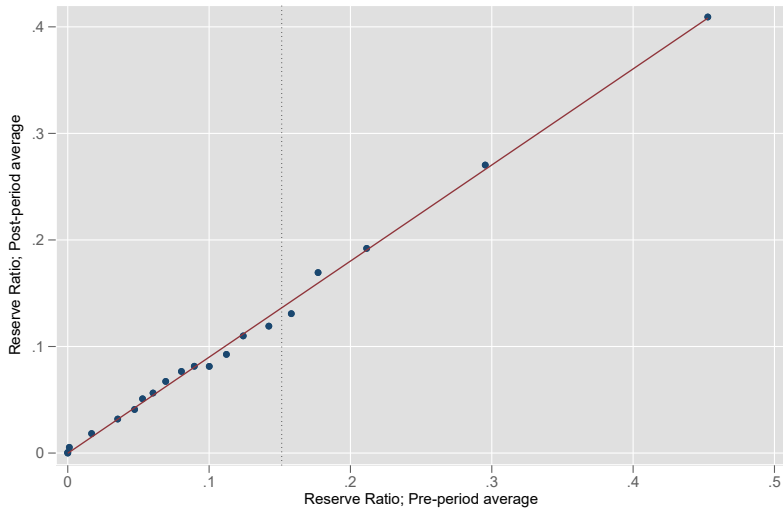


Source: ECB calculations.

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.

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



Cross-Sectional Characteristics

	(1)	(2)	(3)	(4)
Dep. var.:	RR _b		High RR _b	
	OLS	LPM	Logit	Probit
log(Total Assets)	0.0764* (1.67)	0.0685*** (2.97)	0.3656*** (3.19)	0.2182*** (3.27)
Equity Ratio	-0.1140** (-2.29)	-0.0360 (-1.51)	-0.2103 (-1.44)	-0.1201 (-1.57)
Deposit Ratio	-0.0928* (-1.82)	-0.0557*** (-2.65)	-0.3359*** (-2.74)	-0.1978*** (-2.75)
Bonds Held Ratio	-0.0176 (-0.45)	0.0007 (0.04)	-0.0033 (-0.03)	-0.0162 (-0.25)
Fixed to total loans Ratio	-0.2263*** (-4.37)	-0.0670*** (-3.28)	-0.3893*** (-3.47)	-0.2343*** (-3.59)
adj. R2	.09709	.0982		
χ^2			47.6	52.79
p-value			<0.001	<0.001
N	483	483	483	483

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Net Worth Regressions

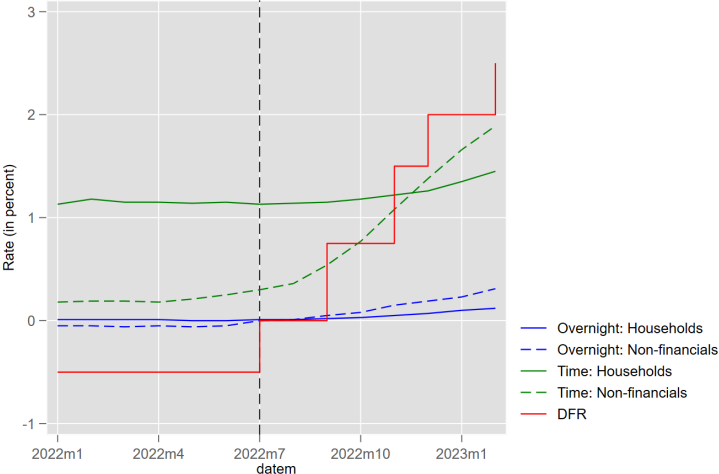
Following Altavilla et al (2022)

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

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

	(1)	(2)
	FF3	FF5
RR	0.1180*** (2.90)	0.1176*** (2.92)
N	38	38
Bank controls	Yes	Yes

Limited Deposit Passthrough



Passthrough Regressions

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

	(1)	(2)	(3)	(4)
	Overnight deposit		Time deposit	
	Non-Financials	Households	Non-Financials	Households
RR	2.1617 (0.86)	0.1252 (0.13)	-3.0610 (-1.02)	1.8435 (0.74)
Constant	9.5612*** (7.44)	5.0722*** (5.35)	48.9675*** (18.32)	21.6519*** (9.39)
N	103	103	103	103

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Deposits: Effect Not Driven by Deposit Outflows

	(1)	(2)
	Total deposits	
RR x (DFR \geq 0)	-0.0020 (-0.58)	
High RR x (DFR \geq 0)		-0.0161** (-2.28)
adj. R2	.9985	.9986
N	5,108	5,108

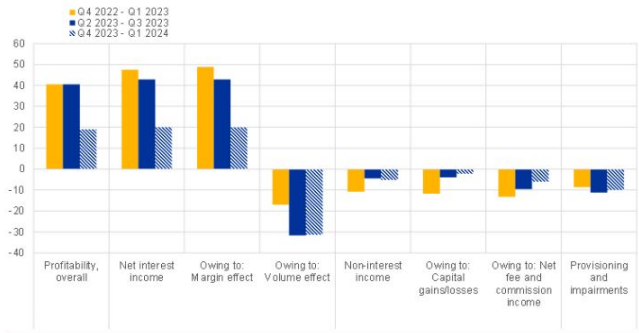
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External Validity: ECB Bank Lending Survey 2023-Q3

Chart 21

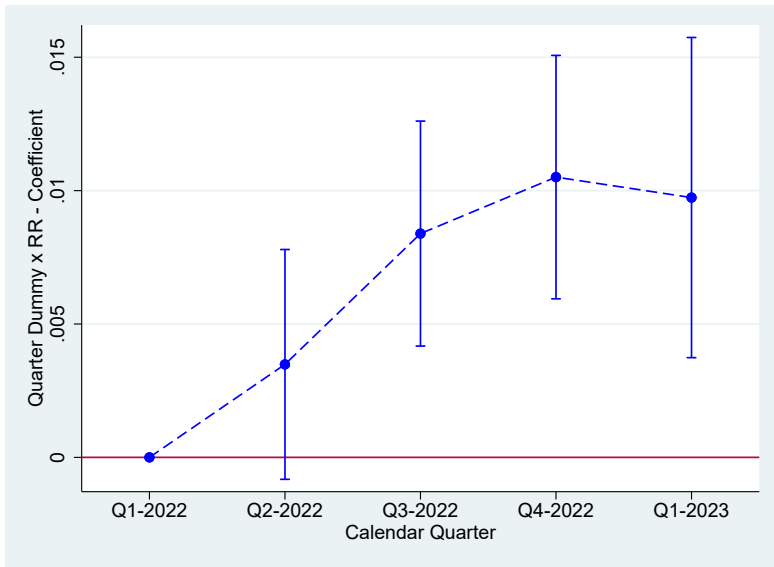
Impact of ECB interest rate decisions on euro area bank profitability

(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.

Timing of Effect



Bank Heterogeneity

	(1)	(2)	(3)
	Bank Size	Bank Equity	Loan Fixation
$(DFR_t \geq 0) \times RR$	0.0132*** (9.60)	0.0068** (2.44)	0.0068*** (3.74)
$(DFR_t \geq 0) \times \text{Large bank}$	0.0400*** (7.54)		
$(DFR_t \geq 0) \times RR \times \text{Large bank}$	-0.0317*** (-4.26)		
$(DFR_t \geq 0) \times \text{Low Equity}$		-0.0179*** (-4.34)	
$(DFR_t \geq 0) \times RR \times \text{Low Equity}$		0.0062* (1.72)	
$(DFR_t \geq 0) \times \text{Low Fixed-to-total}$			0.0001 (0.21)
$(DFR_t \geq 0) \times RR \times \text{Low Fixed-to-total}$			0.0108*** (3.38)
adj. R2	0.9745	0.9744	0.9744
N	14,690,692	14,690,692	14,690,692

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Firm Heterogeneity: Borrower Quality

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

	(1)	(2)	(3)	(4)
	PD		Arrears	
	High	Low	Yes	No
$(DFR_t \geq 0) \times RR$	0.0045** (2.38)	0.0099*** (6.72)	0.0060*** (2.71)	0.0100*** (7.15)
adj. R2	0.9767	0.9735	0.9766	0.9732
N	1,382,086	13,062,496	2,810,622	11,633,960
Controls	Yes	Yes	Yes	Yes
Country-Time Fixed Effects	Yes	Yes	Yes	Yes
Bank-Firm Fixed Effects	Yes	Yes	Yes	Yes
Firm-Fixed Effects	Yes	Yes	Yes	Yes

Firm Heterogeneity: Size

	(1)	(2)	(3)	(4)
	Micro	Small	Medium	Large
$(DFR_t \geq 0) \times RR$	0.0069*** (3.88)	0.035*** (6.00)	0.0092*** (4.48)	0.0051*** (3.74)
adj. R2	0.9733	0.9568	0.9602	0.9745
N	1,286,892	2,099,177	4,737,797	5,521,891
Controls	Yes	Yes	Yes	Yes
Country-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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