Internet Appendix

–Excess Reserves and Monetary Policy Tightening–

A Additional Figures and Tables

Figure IA.1: Reserve Ratio - ($DFR_t < 0$) vs. ($DFR_t \geq 0$)

Figure IA.1 shows the average bank-level reserve ratios before and after the first rate hike. Due to data confidentiality requirements, we are unable to present statistics for individual banks and therefore produced a binscatter-plot with 20 bins. The x-axis (y-axis) shows the average reserve ratio during the pre-(post-)period.

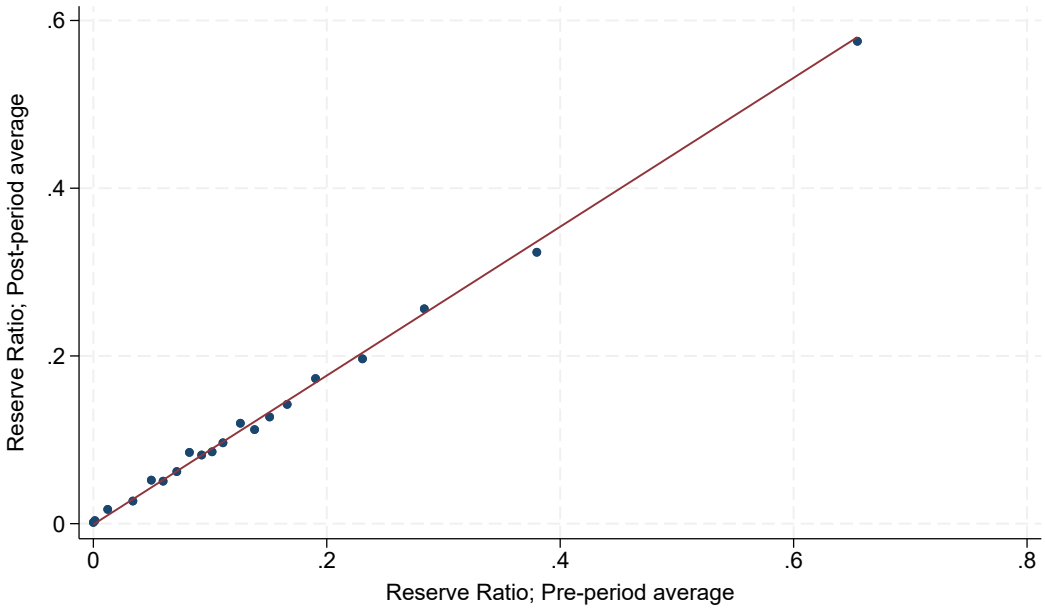

Figure IA.2: Robustness: Aggregate Credit Volumes from IBSI

Figure IA.2 shows the evolution of the aggregate credit volumes (indexed, May 2022 = 100) from IBSI for banks with reserve ratios above one standard deviation from the mean (red) and for all other banks (blue). For the sake of reference, we also show the aggregate time series across all banks (black). Note: the IBSI credit volumes include lending to private households, whereas Figure 5 in the main text is based on AnaCredit data, which only includes lending to non-financials.

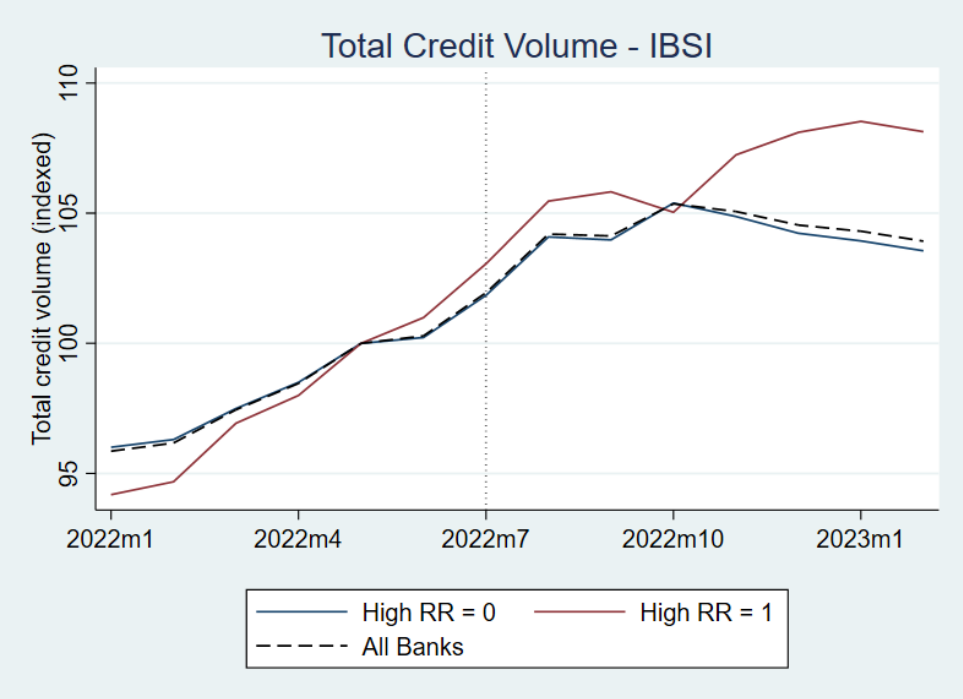

Table IA.1: Sample Composition

Table IA.1 shows details on the composition of the sample banks by country.

Country		High RR	
		$= 0$	$= 1$
AT	27	24	3
BE	12	12	0
CY	3	0	3
DE	208	188	20
EE	4	3	1
ES	21	21	0
FI	11	8	3
FR	66	53	13
GR	4	4	0
IE	12	9	3
IT	52	51	1
LT	3	2	1
LU	23	20	3
NL	11	11	0
PT	8	8	0
SK	7	7	0
Total	472	421	51

Table IA.2: Robustness: Baseline Regressions - Credit Volume (Clustering)

Table IA.2 shows the result for the fixed-effects panel regression in equation (1) executed on the bank-firm-level. We use the logarithm of credit volume to non-financial corporations f by bank b in month t as outcome variable. We focus on our main specification from Table 5, namely column (4), for the multi-bank sample. Our baseline setup is based on t-statistics for standard errors clustered at the bank-time level. Here we report results for alternative clustering approaches. $DFR_t \geq 0$ is a dummy variable for the period from the first rate hike and *RR* is the continuous bank-level reserve ratio during the pre-period, which is standardized such that the coefficient captures a one-standard deviation increase from the mean. All regressions include bank-level control variables interacted with the *DFR* dummy and country-time (both location of the bank and firm), and bank-firm fixed effects. The sample period is January 2022 to February 2023. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)
S.e. clustering	Bank-time	Bank	Time	Bank, time
($DFR_t \geq 0$) x RR	0.0128***	0.0128***	0.0128***	0.0128***
	(7.57)	(3.47)	(5.83)	(3.74)
adj. R2	.9753	.9738	.9738	.9738
N	14,062,930	14,062,930	14,062,930	14,062,930
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

Table IA.3: Cross-Sectional Characteristics - Matched Sample (High RR)

Table IA.3 shows the results of a cross-sectional regression of the continuous reserve ratio (column (1)) and the High RR dummy (columns (2)-(4)) on several normalized bank characteristics for a matched sample. The bank-level characteristics are calculated as averages during the pre-period and then normalized to have zero mean and unit standard deviation. Column (2) shows the results from a linear probability model (LPM). Columns (3) and (4) show results from Logit/Probit regressions, respectively. We report t-statistics based on robust standard errors in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)
Dep. var.:	RR_b		High RR_b	
	OLS	LPM	Logit	Probit
log(Total Assets)	-0.1149	-0.0458	-0.1862	-0.1163
	(-0.83)	(-0.75)	(-0.76)	(-0.75)
Equity Ratio	-0.0353	0.0086	0.0345	0.0215
	(-0.38)	(0.21)	(0.21)	(0.21)
Deposit Ratio	-0.0250	0.0690	0.2816	0.1721
	(-0.14)	(0.84)	(0.84)	(0.86)
Bonds Held Ratio	-0.1137	-0.0542	-0.2208	-0.1348
	(-0.60)	(-0.62)	(-0.63)	(-0.63)
Fixed to total loans Ratio	-0.1089	0.0024	0.0090	0.0069
	(-0.61)	(0.04)	(0.04)	(0.05)
adj. R2	-.04465	-.04597		
χ^2			1.253	1.301
p-value			>.90	>.90
N	84	84	84	84

Table IA.4: Matched Sample (High RR) - Credit Volume

Table IA.4 shows the result for the fixed-effects panel regression in equation (1), but using the much smaller matched bank sample from Table IA.3. All regressions include bank-level control variables interacted with the *DFR* dummy and country-time (both location of the bank and firm), and bank-firm fixed effects. The sample period is January 2022 to February 2023. We report t-statistics based on standard errors clustered at the bank-time level in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)
$(DFR_t \geq 0)$ x RR	0.0131***	0.0172***
	(5.69)	(6.94)
adj. R2	.9808	.9826
N	616,994	616,994
Controls	Yes	Yes
Country (bank)-Time FE	Yes	Yes
Country (firm)-Time FE	Yes	-
Bank-Firm Fixed Effects	Yes	Yes
Firm-Time Fixed Effects	No	Yes

Table IA.5: Deposits

Table IA.5 shows the result for the fixed-effects panel regression executed on the bank-level panel dataset. We use the total deposits (in logs) of bank b in month t as the outcome variable. *RR* is the continuous bank-level reserve ratio during the pre-period and standardized such that the coefficient captures a one-standard deviation increase from the mean. All regressions include bank-level control variables interacted with the *DFR* dummy, country-time fixed effects and bank fixed effects. The sample period is January 2022 to February 2023. We report t-statistics based on standard errors clustered at the bank level in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)
	log(Total Deposits)	
($DFR_t \geq 0$) x RR	0.0047	
	(0.46)	
($DFR_t \geq 0$) x High RR		0.0567
		(1.21)
adj. R2	.9953	.9953
N	5,179	5,179
Controls	Yes	Yes
Country-Time FE	Yes	Yes
Bank FE	Yes	Yes

Table IA.6: Borrower Quality - Triple Interaction

Table IA.6 shows the result for the fixed-effects panel regression executed on the bank-firm-level. e use the logarithm of credit volume to non-financial corporations f by bank b in month t as outcome variable. *RR* is the continuous bank-level reserve ratio during the pre-period and standardized such that the coefficient captures a one-standard deviation increase from the mean. The reported regressions correspond to Panel C of Table 9 and include triple interaction terms for High PD firms (column 1) and firms with credit in arrears (column 2, respectively. All regressions include bank-level control variables interacted with the *DFR* dummy, country-time, bank-firm fixed effects, and firm-time fixed effects. The sample period is January 2022 to February 2023. We report t-statistics based on standard errors clustered at the bank-time level in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

	(1) PD	(2) Arrears
($DFR_t \geq 0$) x RR	0.0141***	0.0136***
	(7.98)	(8.19)
($DFR_t \geq 0$) x RR x High PD	-0.0116***	
	(-6.19)	
($DFR_t \geq 0$) x RR x Arrears		-0.0055***
		(-2.68)
adj. R2	.9747	.9752
N	14,062,930	14,062,930
Controls	Yes	Yes
Country-Time Fixed Effects	Yes	Yes
Bank-Firm Fixed Effects	Yes	Yes
Firm-Time Fixed Effects	Yes	Yes

Table IA.7: Loan Rates

Table IA.7 shows the result for the fixed-effects panel regression executed on the bank-firm-level, using the value-weighted loan rates of bank b with firm f in month t as the outcome variable. *RR* is the continuous bank-level reserve ratio during the pre-period and standardized such that the coefficient captures a one-standard deviation increase from the mean. Column (1) shows the results for the full sample, columns (2) and (3) differentiate between firms with High and Low PDs (as in Table 9), respectively. Column (4) is based on the full sample and includes a triple interaction term with the High PD dummy. All regressions include bank-level control variables interacted with the *DFR* dummy, country-time, bank-firm fixed effects, and firm-time fixed effects. The sample period is January 2022 to February 2023. We report t-statistics based on standard errors clustered at the bank-time level in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)
	Loan rate (in percent)			
	Baseline	High PD	Low PD	Interaction
$(\text{DFR}_t \geq 0)$ x RR	0.0337*	0.0636***	0.0328*	0.0342*
	(1.84)	(2.88)	(1.80)	(1.87)
$(\text{DFR}_t \geq 0)$ x RR x High PD				0.0119*
				(1.93)
adj. R2	.8976	.9087	.8875	.8919
N	14,062,930	1,218,148	12,844,782	14,062,930
Controls	Yes	Yes	Yes	Yes
Country-Time Fixed Effects	Yes	Yes	Yes	Yes
Bank-Firm Fixed Effects	Yes	Yes	Yes	Yes
Firm-Time Fixed Effects	Yes	Yes	Yes	Yes

B Deposit Passthrough in the Cross-Section

Figure 3 in the main text indicates that euro area banks did not fully pass on the rate hikes to their depositors. Here we present supplementary evidence that the deposit passthrough does not appear to be a function of banks' reserve ratios.

To analyse the deposit rate passthrough in the cross-section of banks, we draw on bank-level deposit rates for the subsample of banks reporting to iMIR.[1] Focusing on the different deposit rates from Figure 3, now at the bank-time level, we compute:

$$\text{Deposit } \beta_b = 100 \times \frac{\Delta DepositRate_b}{\Delta DFR}, \tag{IA.1}$$

where Δ denotes the total change between June 2022 and February 2023. (The results are robust to using shorter windows, e.g., up until December 2022 or January 2023.) The deposit β in Eq. (IA.1) quantifies how much of the change in the DFR is reflected in changes in different deposit rates. A complete passthrough would correspond to a value of 100%.

Table IA.8 shows the results from a simple cross-sectional regression of Deposit β_b on the continuous reserve ratio (Panel A) and on the High RR dummy (Panel B), with t-statistics based on heteroscedasticity robust standard errors in parentheses. In this setup, the intercept shows the average passthrough across the different deposit rates for banks with a reserve ratio equal to the sample mean and the coefficients on the RR or the High RR dummy display the differential in the passthrough across banks with different reserve ratios. Column (1) shows that, when we look at banks' aggregate (overnight and time) deposits from both households and non-financials, there is no significant difference in the deposit β along banks' reserve ratios. Columns (2) to (4) further separate between the different categories and, in line with the aggregate statistics in Figure 3, we find that the passthrough is stronger (i) for time deposits compared to overnight deposits[2] and (ii) for deposits of non-financials compared to households. Regarding our main variable of interest, however, we find no evidence that the passthrough is a function of banks' reserve ratios, since all coefficients on RR are insignificant in Panel A. Only

[1] More information is available in guideline (EU) 2017/148. The iMIR-subsample covers roughly 82% of our sample banks' total assets.

[2] As noted in the Introduction, the positive income effect could be offset via the deposit channel of monetary policy. In this case, we would expect that the weak deposit passthrough would induce depositors to switch to alternative money-like instruments (e.g., short-term bonds or money market funds). The empirical evidence, however, does not suggest that euro area banks faced large deposit outflows due to the rate hike (ECB SDW). Rather, in line with their stronger passthrough, there was a shift from overnight to time deposits.

for High RR banks we find a weaker passthrough for non-financial time deposits, but this effect is not large enough to significantly affect the total deposit β in the cross-section. Overall, the fact that deposit betas are generally far from 100 percent leaves room for the increased reserve remuneration being a relevant feature for reserve-rich banks' net worth.

Table IA.8: Deposit Passthrough

Table IA.8 shows the results of a simple cross-sectional regression of the deposit β in Eq. (IA.1) on the continuous reserve ratio (Panel A) and on the High RR dummy (Panel B). *RR* is the continuous bank-level reserve ratio during the pre-period, which is standardized such that the coefficient captures a one-standard deviation increase from the mean. The High RR dummy takes a value of 1 for banks with reserve ratios above one standard deviation from the mean during the pre-period. The deposit β quantifies how much of the change in the DFR is reflected in changes in different deposit rates, where the Δ is the total change between June 2022 and February 2023. A complete passthrough would correspond to a value of 100%. We report t-statistics based on robust standard errors in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Panel A: RR	(1)	(2)	(3)	(4)	(5)
	Total deposits	Overnight deposits		Time deposits	
		Non-Financials	Households	Non-Financials	Households
RR	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

Panel B: High RR	(1)	(2)	(3)	(4)	(5)
	Total deposits	Overnight deposits		Time deposits	
		Non-Financials	Households	Non-Financials	Households
High RR	-3.1058	0.0257	-0.5841	-19.2561**	-2.7311
	(-0.84)	(0.01)	(-0.16)	(-2.41)	(-0.46)
Constant	15.1056***	11.3636***	6.7629***	47.0677***	21.1096***
	(9.44)	(7.45)	(5.75)	(18.82)	(10.50)
adj. R2	.0029	0.000	.0001	.04217	.00139
N	138	138	138	138	138