

BANKS IN AN ENVIRONMENT OF HIGHER INTEREST RATES

ANTONIO SÁNCHEZ SERRANO
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MOTIVATION

- Research question: Do banks benefit from increases in interest rates?
- Our path to answer the question:
 1. Define a simplified balance sheet and profit and loss account.
 2. Formulation of the channels through which interest rates affect banks.
 3. Use of bank-by-bank data from 2022 EBA Transparency Exercise.
- Answer: it depends... on (i) characteristics of the bank, and (ii) what you look at.

LITERATURE REVIEW IN A NUTSHELL

- Interest rate risk in the banks:
 - Flannery (1981) → alignment of maturities of assets and liabilities.
 - Drechsler et al. (2021) → deposit franchise.
 - Jiang et al. (2023), McPhail et al. (2023) → less significant role of derivatives.
- Interest rates and bank profits:
 - Samuelson (1945), Hancock (1985), Corvoisier and Gropp (2002), Alessandri and Nelson (2015), Borio et al. (2017) → higher interest rates lead to higher net interest income.
 - Saunders and Schumacher (2000), English et al., (2018) → key role of the remuneration of deposits
 - English et al. (2018) → higher profits dissipate after one year

(SIMPLIFIED) PROFIT AND LOSS ACCOUNT OF A BANK

$$PR_t = [i_t L_t (1 - npl_t)] + i'_t DS_t - i''_t D_t - i'''_t WF_t + \Delta FV_t - OC_t - CL_t$$

The diagram illustrates the components of the profit and loss account equation. It shows six boxes below the equation, each with an arrow pointing to a specific term in the equation:

- Interest income** (pink box) points to $i_t L_t (1 - npl_t)$.
- Interest from debt securities** (white box with pink border) points to $i'_t DS_t$.
- Interest expenses** (pink box) points to $i''_t D_t$.
- Changes in fair value** (grey box) points to ΔFV_t .
- Other income / expenses** (white box with pink border) points to OC_t .
- Credit losses** (dark red box) points to CL_t .

Additionally, arrows from **Interest income** and **Interest expenses** point to a dark red box labeled **Income gap**.

Seven ways through which interest rates can impact bank profits: (i) interest income from loans at variable rates, (ii) interest income from new loans granted, in place of those maturing, (iii) interest expense of overnight deposits, (iv) interest expense of new term deposits, (v) interest expense of new wholesale funding (i.e., debt securities), (vi) increase in credit losses from deteriorated debt servicing capacity of borrowers, and (vii) revaluations of financial assets at fair value.

INCOME GAP

- Income gap is the difference between the assets automatically repricing due to a change in interest rates and the liabilities automatically repricing due to a change in interest rates.
- If there is a change in interest rates, we can look at the difference in the income and expenses from items in the income gap:

$$\begin{aligned}
 \Delta IG_t &= r_t \left[\varphi_1 \left(1 - \frac{1}{m_t} \right) \alpha \left(L_t (1 - \overline{npl}_t) - \omega L_{t-1} (1 - \overline{npl}_{t-1}) \right) + \varphi_2 \frac{1}{m_t} [L_t (1 + c_t) - \omega L_{t-1} (1 + c_{t-1})] \right. \\
 &\quad - \varphi_3 ((1 + od_t) OD_t + \omega (1 + od_{t-1}) OD_{t-1}) - \varphi_4 \frac{1}{md_t} [TD_t (1 + td_t) - \omega TD_{t-1} (1 + td_{t-1})] \\
 &\quad \left. - \varphi_5 \frac{1}{mw_t} [WF_t (1 + w_t) - \omega WF_{t-1} (1 + w_{t-1})] \right]
 \end{aligned}$$

Share of variable-rate loans Pass-through of higher interest rates to loan/deposit rates Relative change of interest rates

CHANGES IN FAIR VALUE OF ASSETS

- In principle, changes in interest rates affect the market value of bonds and equities at fair value.

$$\frac{\delta \Delta FV_t}{\delta r_t} = -(cEQ_t + c'DST_t) + \omega(cEQ_{t-1} + c'DST_{t-1})$$

Coefficients of impact of high interest rates in market prices of bonds and equities

Relative change of interest rates

CREDIT LOSSES

- Assuming the bank applies IFRS 9, credit losses would be the sum of those related to stage 1, stage 2 and stage 3. We link them to the gross disposable income of the borrower.

$$\frac{\delta CL_t}{\delta r_t} = L_t \gamma (1 - \omega) \frac{DB_{i,t}}{RGDI_{i,t} + \Delta C_{i,t} + OI_{i,t}} \left(\left(-(f + m) \sigma_1 \frac{S1}{L_t} \right) + \left(f \sigma_2 \frac{S2}{L_t} \right) + \left(m(\sigma_3 - \pi \sigma_2) \frac{(1 - S1 - S2)}{L_t} \right) \right)$$

Pass-through of higher rates to borrower (share of variable-rate loans)

Debt burden of borrowers as share of disposable income

Coefficients on the impact of gross disposable income on credit losses

Coverage of loans in stages 1, 2 and 3

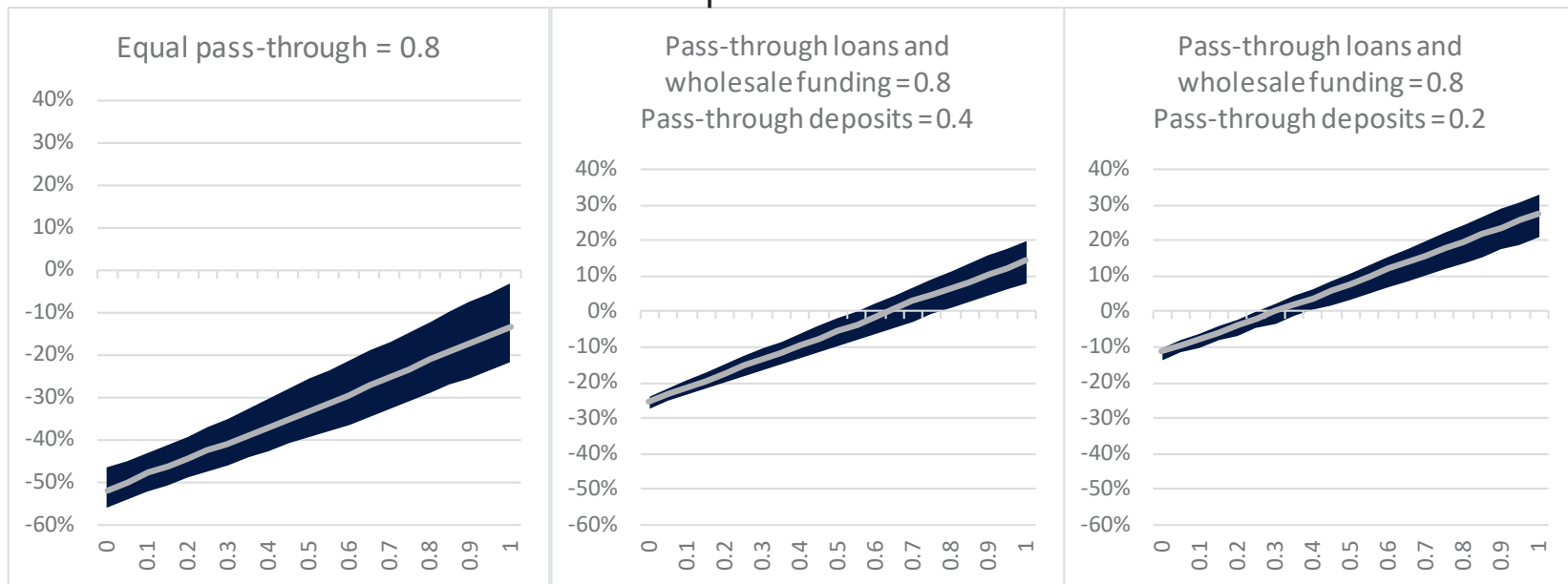
Loans in stages 1, 2 and 3

Share of loans in stages 3 already classified in stage 2

MIND THE (INCOME) GAP

- With equal pass-through of loans and deposits, the income gap is always negative.
- Deposit franchise is necessary for the business model of banks.

Income gap, as a share of total assets, under different assumptions on the share of variable-rate loans and the pass-through rates of loans and deposits



Sources: 2022 EBA Transparency Exercise and author's calculations.
Notes: the x-axis shows different values of the share of variable-rate loans over total loans (from 0 to 1) and the y-axis shows the related change in income gap as a share of total assets. Each panel makes a different assumption about the pass-through of official interest rates to the interest rate of loans, wholesale funding and deposits.

A LOOK AT THE LAST MONETARY POLICY TIGHTENING CYCLE IN THE EURO AREA

- We use a sample of 103 banks in the 2022 EBA Transparency Exercise; for each one of them, a simplified balance sheet is built.
- The table below shows the interest rate of the marginal lending facility of the ECB.

	Interest rate at the end of the quarter	Previous interest rate	Relative change in interest rates (ω)
Q3-2022	1.50%	0.25%	0.17
Q4-2022	2.75%	1.50%	0.54
Q1-2023	3.75%	2.75%	0.73
Q2-2023	4.25%	3.75%	0.88
Q3-2023	4.75%	4.25%	0.89

NET INTEREST INCOME

- Inverted U-shaped curve, with the median of accumulated profits being almost at 2% of total assets over five quarters.

Change in net interest income as a share of total assets in the current monetary policy tightening cycle in the euro area

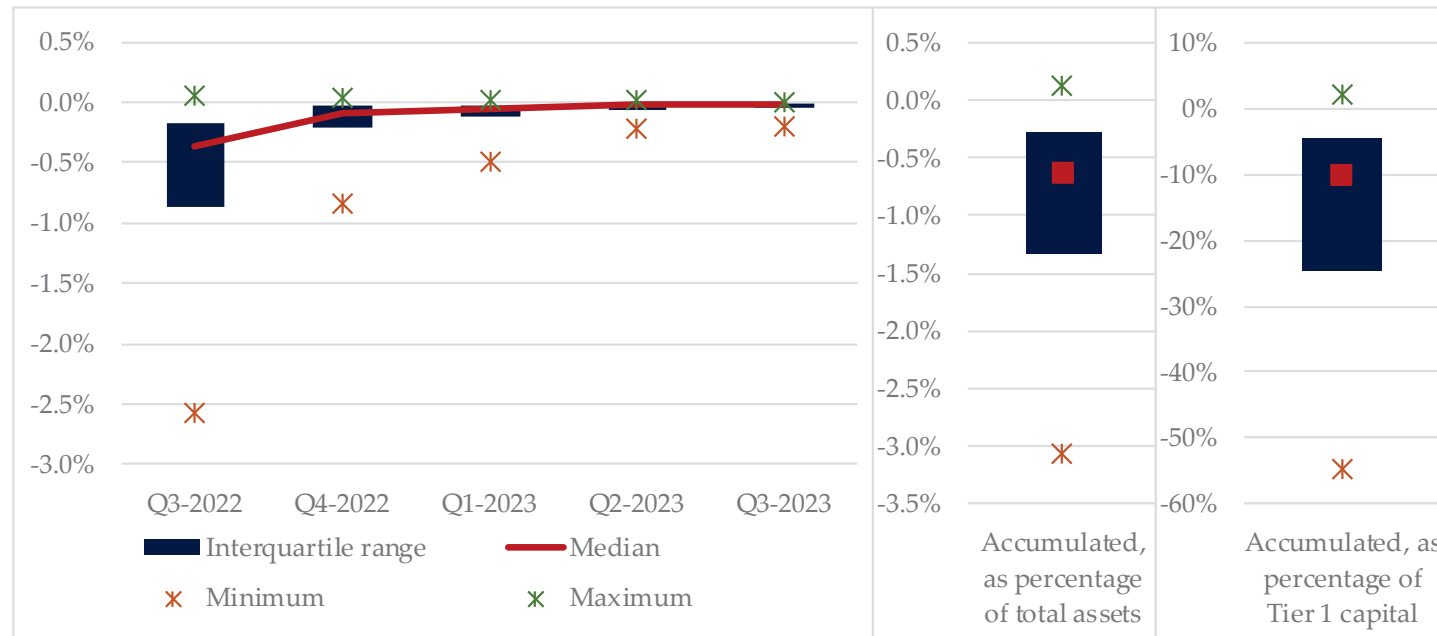


Sources: 2022 EBA Transparency Exercise, European Central Bank and author's calculations. Notes: the y-axis shows the change of the net interest income as a share of total assets (or of Tier 1 capital in the right-hand side panel). In the left-hand side panel, the x-axis represents one quarter (Q3-2022, Q4-2022, Q1-2023, Q2-2023 and Q3-2023). The blue boxes represent the interquartile range and the red lines (or squares) the median. A green and orange star represent the maximum and the minimum, respectively.

CHANGES IN FAIR VALUE

- Losses concentrated in the first period (Q3-2022), which showed the largest relative change in interest rates.

Change in the fair value of debt securities and equities as a share of total assets in the current monetary policy tightening cycle in the euro area



Sources: 2022 EBA Transparency Exercise, European Central Bank and author's calculations. Notes: the y-axis shows the related fair value gains or losses as a share of total assets (or of Tier I capital in the right-hand side panel. In the left-hand side panel, the x-axis represents one quarter (Q3-2022, Q4-2022, Q1-2023, Q2-2023 and Q3-2023). The blue boxes represent the interquartile range and the red lines (or squares) the median. A green and orange star represent the maximum and the minimum, respectively.

UNREALISED LOSSES FROM BONDS

- They can be significant for some banks, but why would they be in this situation?

Unrealised losses in debt securities at amortised cost, as a share of total assets in the current monetary policy tightening cycle in the euro area

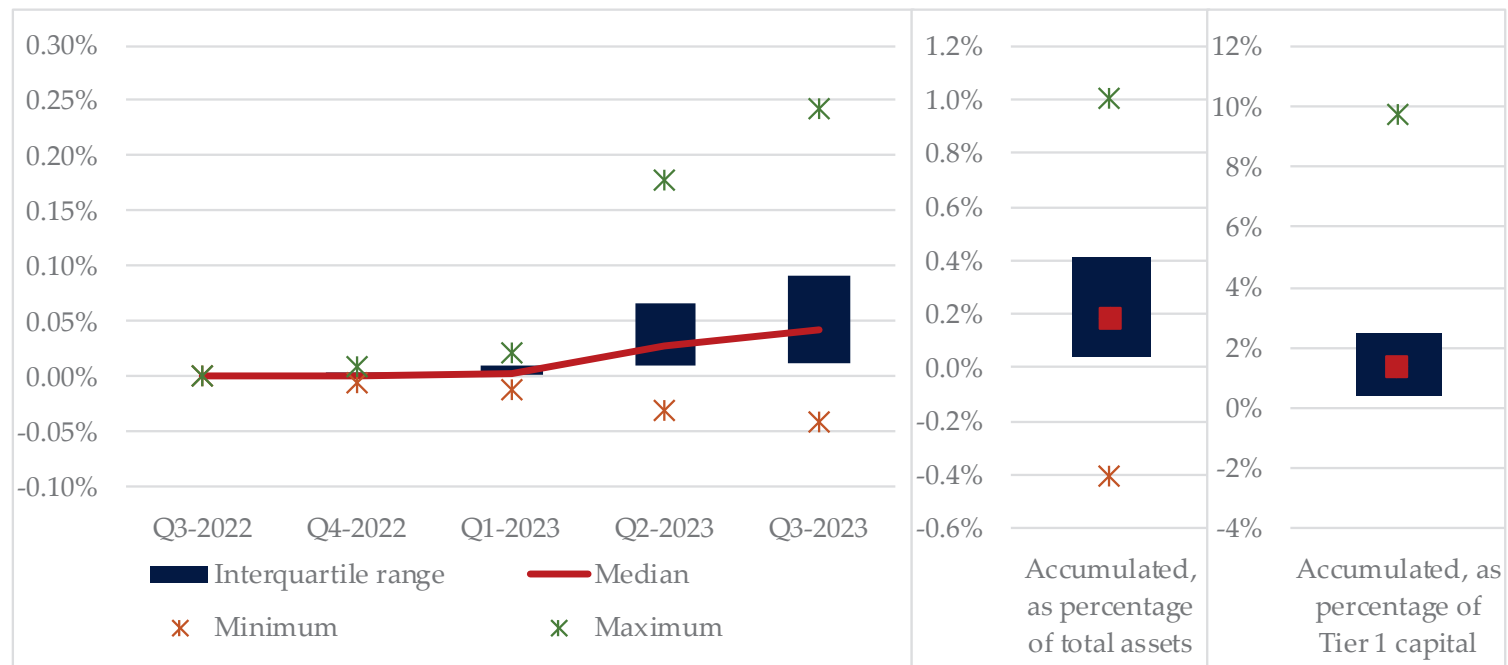


Sources: 2022 EBA Transparency Exercise, European Central Bank and author's calculations. Notes: the y-axis shows the unrealised losses from debt securities at amortised cost as a share of total assets (left-hand side panel) or of Tier 1 capital (right-hand side panel) if banks are forced to sell them at the end of Q3-2023. The blue boxes represent the interquartile range and the red squares the median. A green and orange star represent the maximum and the minimum, respectively.

CREDIT LOSSES

- Growing share of credit losses in the last quarters as we consider only stage 2 loans in the first three quarters.

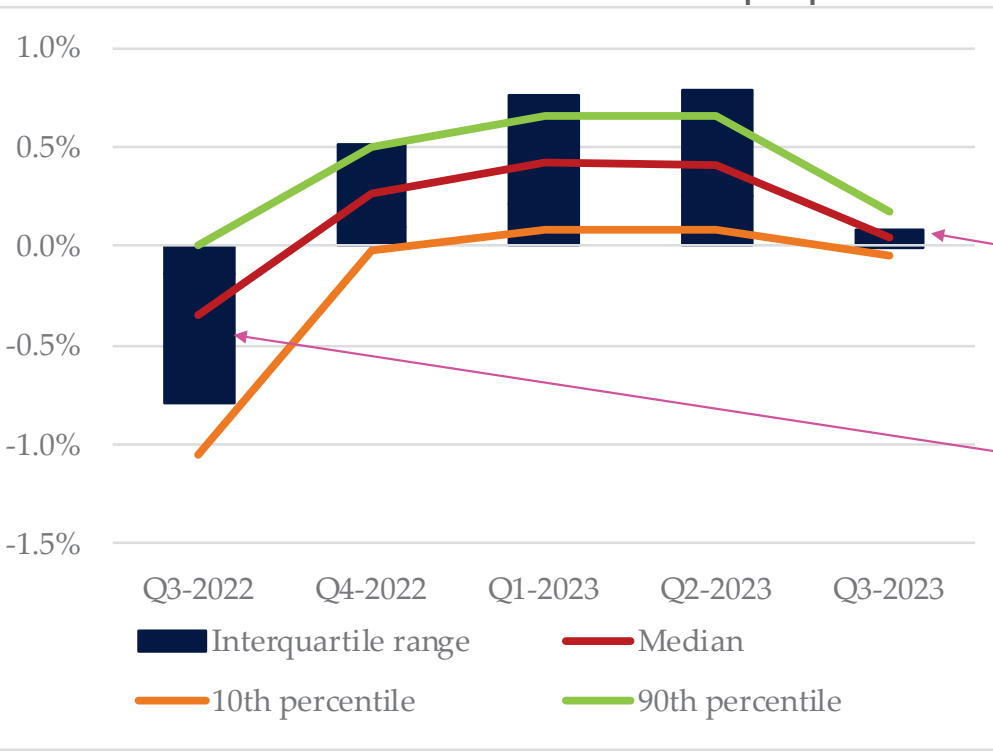
Credit losses as a share of total assets in the current monetary policy tightening cycle in the euro area



Sources: 2022 EBA Transparency Exercise, European Central Bank and author's calculations. Notes: the y-axis shows the related credit losses as a share of total assets (or of Tier 1 capital in the right-hand side panel). In the left-hand side panel, the x-axis represents one quarter (Q3-2022, Q4-2022, Q1-2023, Q2-2023 and Q3-2023). The blue boxes represent the interquartile range and the red lines (or squares) the median. A green and orange star represent the maximum and the minimum, respectively.

TOTAL PROFITS

- Overall, positive impact of high interest rates on bank profits, with lower profits reported at the start and at the end of the sample period for most banks.



Estimated total impact of higher interest rates on profits as a share of total assets in the current monetary policy tightening cycle in the euro area

Reduced net interest income and higher credit losses

Large relative change in interest rates affecting bond prices and still limited pass-through of higher interest rates to loans

Sources: 2022 EBA Transparency Exercise, European Central Bank and author's calculations. Notes: the y-axis shows the sum of (i) the change in net interest income, (ii) fair value gains and losses and (iii) credit losses as a share of total assets. The x-axis represents one quarter quarter (Q3-2022, Q4-2022, Q1-2023, Q2-2023 and Q3-2023). The blue boxes represent the interquartile range and the red lines (or squares) the median. A green and orange lines represent the 90th and the 10th percentiles, respectively.

MARKET VALUE OF EQUITY

- Changes in interest rates also affect the market value of bank assets and liabilities.
- We can compute the market value of the equity of a bank (V_t) as:

$$V_t = A_t e^{-t_A r_A} - LI_t e^{-t_{LI} r_{LI}}$$

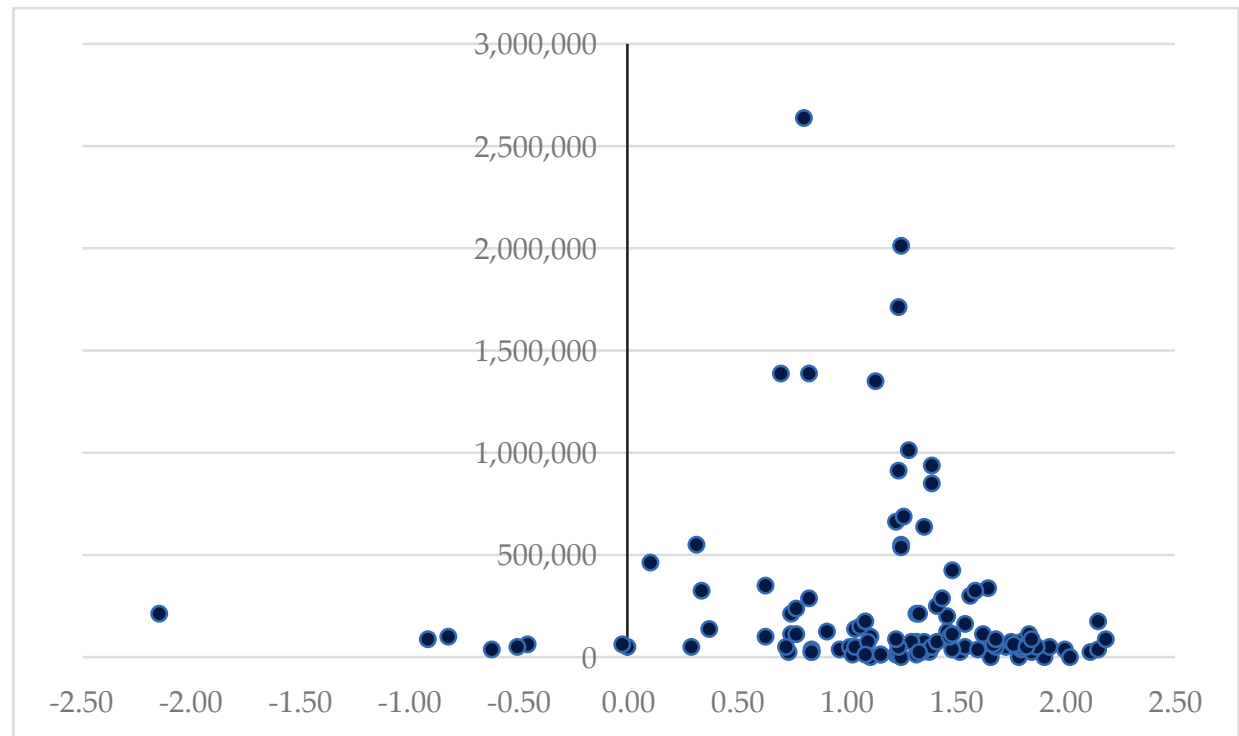
where A_t are assets, LI_t are liabilities, r_A (r_{LI}) is the yield of a risk-free bond with maturity t_A (t_{LI}), being the latter the duration of assets and liabilities of the bank.

- We use durations from confidential data from the EBA and the US Treasuries yield curve for risk-free bonds.
- In these circumstances, assuming longer duration of assets than of liabilities (i.e., positive duration gap), higher (lower) interest rates decrease (increase) the market value of equity of banks. When the duration gap between assets and liabilities is negative, the opposite relationship with interest rates holds.

DURATION GAP

- Most banks in the EU, including the largest ones, have positive duration gap, so increases in interest rates should be negatively affecting their market value of equity.

Estimated duration gap of EU banks, Q2-2022

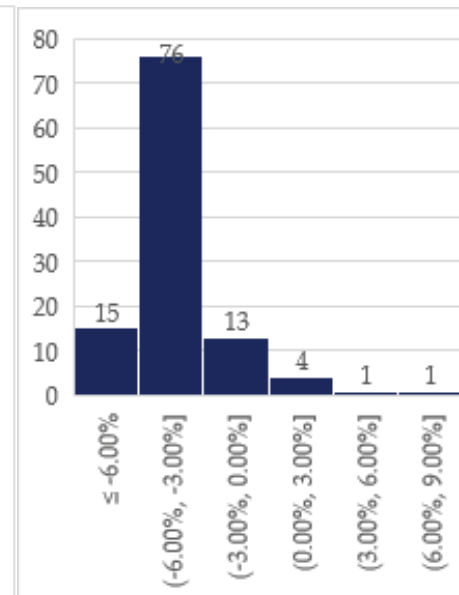
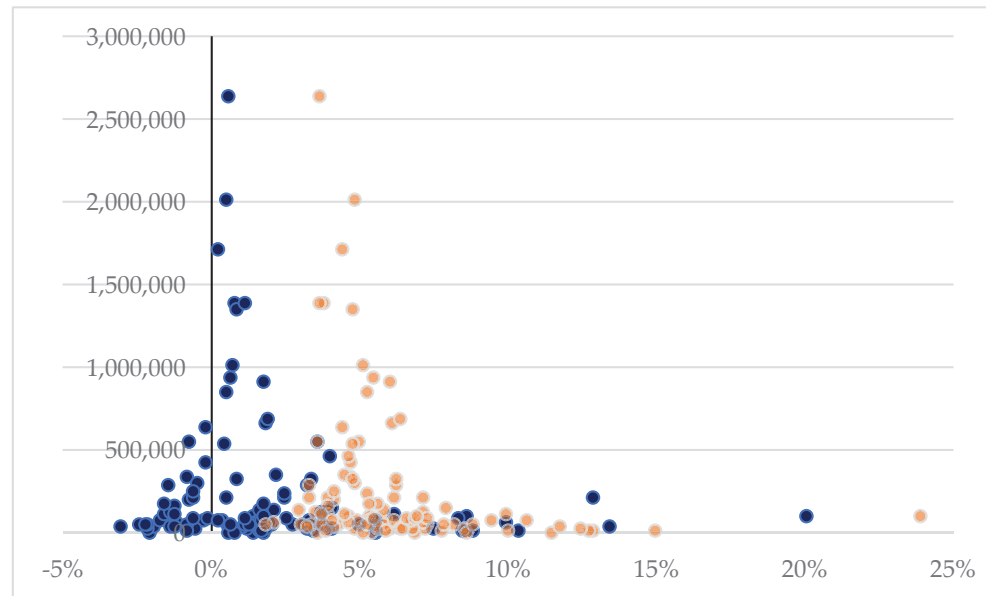


Sources: 2022 EBA Transparency Exercise, EBA report on IRRBB and author's calculations. Notes: the x-axis shows the duration gap of banks participating in the 2022 EBA Transparency Exercise, based on the durations reported in the EBA report on IRRBB and the y-axis shows the amount of total assets in Q2-2022. Each dot represents a bank.

MARKET VALUE OF EQUITY

- In a comparison with the market value under low interest rates (19 January 2021), the market value of equity has decline for most EU banks, becoming negative for many of them.

Estimated market value of equity of EU banks, Q2-2022

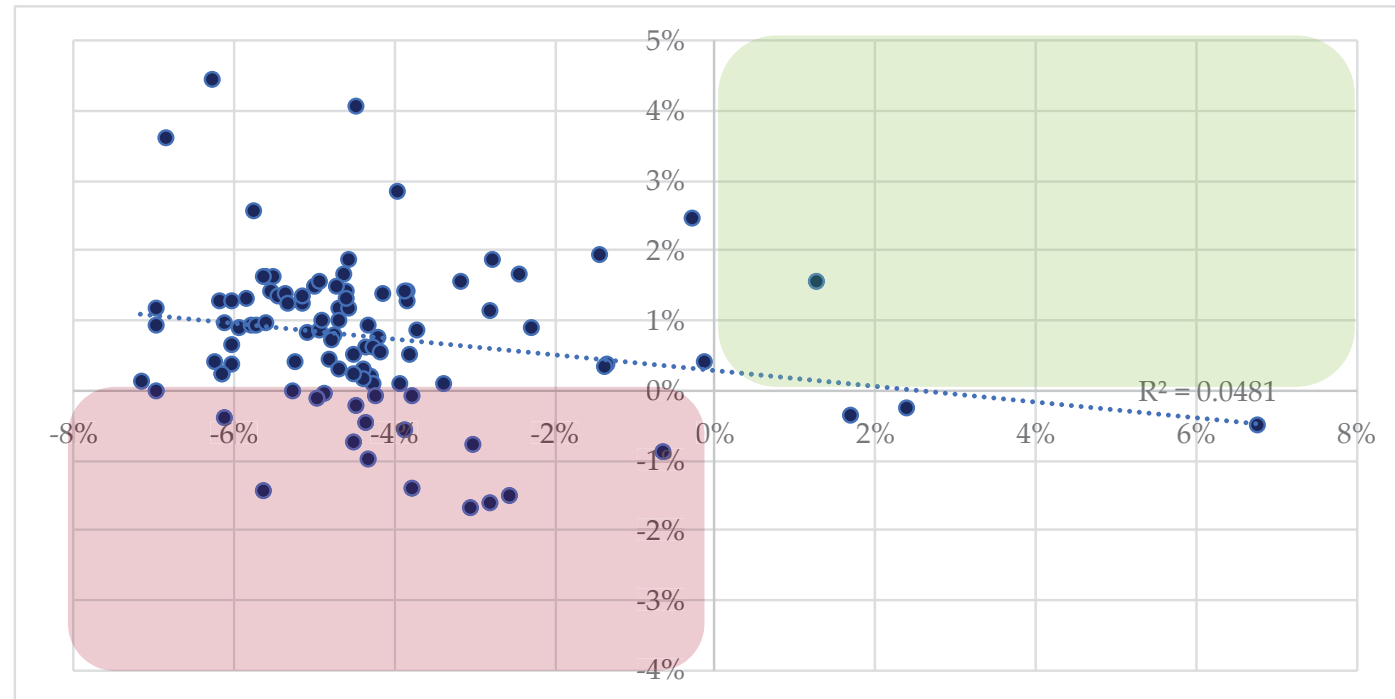


Sources: 2022 EBA Transparency Exercise, EBA report on IRRBB, Haver Analytics and author's calculations. Notes: in the left-hand side panel, the x-axis shows the market value of equity as a share of total assets (blue and orange dots) of banks participating in the 2022 EBA Transparency Exercise, based on the durations reported in the EBA report on IRRBB and the yield curve of US Treasuries as of 19 January 2024 and of 19 January 2021, respectively. The y-axis shows the amount of total assets in Q2-2022. The right-hand side panel shows the histogram of the difference between the market value of equity as a share of total assets, computed according to the yield curve of US Treasuries in 19 January 2024 and 19 January 2021.

PROFITS AND MARKET VALUE OF EQUITY

- As expected, most banks are in the top left-hand side quadrant (more profits, less market value of equity). But 24 banks showing less profits and less market value of equity (!) due to changes in fair value of bonds and credit losses.

Estimated market value of equity of EU banks and changes in profits

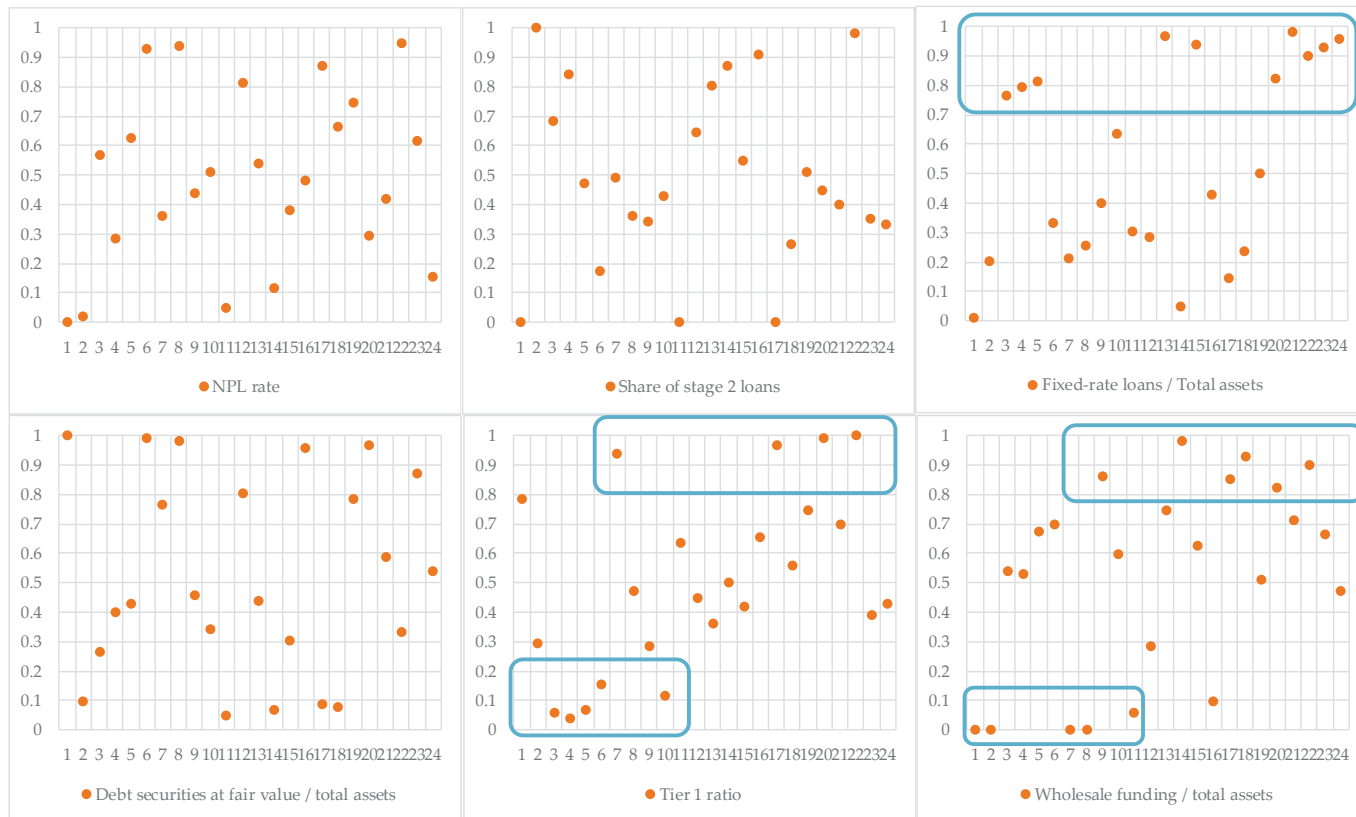


Sources: 2022 EBA Transparency Exercise, ECB, EBA report on IRRBB, Haver Analytics and author's calculations. Notes: the x-axis shows the difference between the market value of equity when using interest rates of the US Treasuries as of 19 January 2024 and 19 January 2021, as a share of total assets, while the y-axis shows the impact of higher interest rates on profits.

LOOKING DEEPER INTO BANKS IN THE RED ZONE (I)

- Several banks with losses in our empirical analysis tend to have a relatively high share of fixed-rate loans over total assets.
- Not easy to find a common pattern beyond that...

Percentile of the six ratios to explain the structure of banks' balance sheet



Sources: 2022 EBA Transparency Exercise, ECB and author's calculations. Notes: the x-axis represent a bank showing a loss from higher interest rates according to our empirical analysis. The y-axis shows the quantile over the whole sample of 103 banks where the value for each bank is.

LOOKING DEEPER INTO BANKS IN THE RED ZONE (2)

- We consider the following regression equation:

$$Profits_i = c + \beta X_i$$

where $Profits_i$ are the profits of bank i computed according to our analysis, c is the intercept, and β are the coefficients associated with the vector of independent variables X_i .

- Purposedly, we consider only bank-specific variables as we are interested in identifying bank-specific factors in the cross-section.
- Under robust least squares, debt securities at fair value and the share of fixed-rate loans are statistically significant.

Dependent variable: profits / total assets						
	(I)	(II)	(III)	(IV)	(V)	(VI)
	Ordinary least squares	Quantile regression (tau = 0.2)	Robust least squares (M)	Robust least squares (M)	Robust least squares (MM)	Robust least squares (MM)
Constant	0.0137*** (0.0041)	-0.0050 (0.0065)	0.0167*** (0.0032)	0.0205*** (0.0018)	0.0175*** (0.0031)	0.0173*** (0.0016)
Debt securities at fair value	-0.1173*** (0.0226)	-0.0970*** (0.0305)	-0.1116*** (0.0177)	-0.1033*** (0.0137)	-0.1111*** (0.0171)	-0.1073*** (0.0153)
Fixed-rate loans	-0.0229** (0.0095)	-0.0027 (0.0090)	-0.0237*** (0.0075)	-0.0296*** (0.0060)	-0.0252*** (0.0072)	-0.0234*** (0.0065)
Rate of non-performing loans	0.0597 (0.1094)	0.3273*** (0.1057)	-0.0872 (0.0858)	-0.1174* (0.0647)	-0.0935 (0.0830)	
Share of stage 2 loans	-0.0329** (0.0137)	-0.0304*** (0.0105)	0.0162 (0.0107)		0.0139 (0.0104)	
Tier 1 ratio	0.0489 (0.0402)	-0.0104 (0.0371)	-0.0200 (0.0316)		-0.0172 (0.0305)	
Wholesale funding	-0.0011 (0.0056)	0.0001 (0.0063)	0.0002 (0.0044)		0.0008 (0.0043)	
Country dummy	0.0175 (0.0151)	0.0600** (0.0232)	0.0122 (0.0118)		0.0101 (0.0114)	
Number of observations	103	103	103	103	103	103
(Pseudo) R-squared	0.2804	0.1360	0.1849	0.2005	0.1889	0.1777
Adjusted R-squared		0.0724	0.4477	0.5248	0.4741	0.4479
Durbin-Watson	0.5095					
Sum of squared residuals	0.0101		0.0121	0.0118	0.0121	0.0113
F-statistic	5.2875					
Prob (F-statistic)	0.0000					
Quasi LR statistic		16.8247				
Prob (Quasi LR-statistic)		0.0186				
Rn-squared statistic			57.7563	78.4570	61.9889	60.0529
Prob			0.0000	0.0000	0.0000	0.0000

CONCLUDING REMARKS

- No ground-breaking results: broadly in line with existing evidence (and also the BCBS standard on interest rate risk in the banking book).
- We document a large positive effect of higher interest rates on bank profits, through net interest income:
 - Important role played by the share of variable-rate loans and the “deposit franchise”.
 - Our computation of changes in fair value of financial instruments reports a large loss in the first period.
 - Results depend on when credit losses start to increase (we have assumed a delay of one year).
 - Banks reporting losses due to large share of fixed-income loans or a particular business model.
- At the same time, there is a negative effect of higher interest rates through the market value of equity.
- While the increase in profits tends to dominate in the short-term, the decrease in the market value of equity could have more lasting effects.

MANY THANKS FOR YOUR ATTENTION



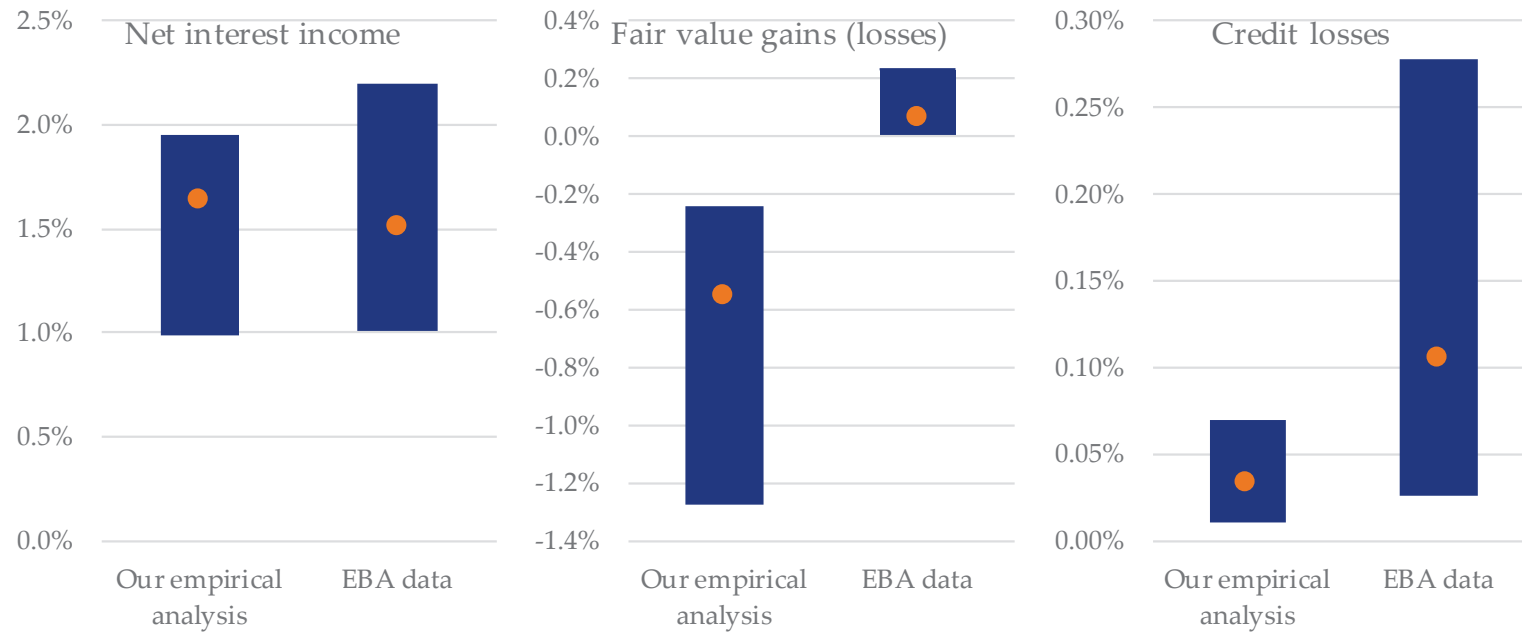
BACKGROUND SLIDES

SIMPLIFIED BALANCE SHEET OF A BANK

Assets	Liabilities
Loans (L) =	Equity (E) =
Performing loans (PL) +	Capital (C) +
Non-performing loans (NPL)	Loan Loss Provisions (LLP)
Equities (EQ)	Wholesale funding (WF)
Debt securities (DS) =	Deposits (D) =
Debt securities held-for-trading (DST) +	Insured deposits (ID) +
Available-for-sale debt securities (DSA)+	Uninsured deposits (UD)
Debt securities held-to-maturity (DSM)	
Liquid assets (LA)	

REALITY CHECK: A COMPARISON WITH THE 2023 EBA TRANSPARENCY EXERCISE

Changes in net interest income, in the fair value of financial assets and in credit losses, in our empirical analysis and in the 2023 EBA Transparency Exercise



Sources: 2022 and 2023 EBA Transparency Exercises, ECB and author's calculations. Notes: the left-hand side panel shows the accumulated profits from net interest income as a share of total assets between Q3-2022 and Q2-2023 in terms of median (orange dots) and interquartile range (blue bars). The middle panel shows the accumulated gains or losses from financial assets measured at fair value as a share of total assets between Q3-2022 and Q2-2023 in terms of median (orange dots) and interquartile range (blue bars). It does not consider unrealised losses from financial assets at amortised cost. The right-hand side panel shows the accumulated credit losses as a share of total assets between Q3-2022 and Q2-2023 in terms of median (orange dots) and interquartile range (blue bars).