Underwater: Strategic Trading and Risk Management in Bank Securities Portfolios

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Introduction

- Banks hold large portfolios of investment securities
 - At start of recent tightening cycle: \$6.2tr in bonds, making up 26% of total assets
 - (Unrealized) securities losses key factor underlying March 2023 banking turmoil
- In principle, securities portfolio is a key tool for *managing* risk
 - Interest rate risk: can quickly sell or hedge risky bonds to limit risk (given that loans are illiquid)
 - *Liquidity:* can sell or repo securities to raise cash (in response to deposit outflows or other shocks)
- Q: how do banks manage risk in bond portfolio in practice? *Focus*: 2022-23 tightening
 - 1. Do banks rebalance after "risk shock"? How? (sell high-risk bonds? hedge? buy low risk? etc.)
 - 2. Are there financial and/or regulatory frictions that limit active portfolio management?
 - i. Aversion to selling risky bonds with unrealized losses
 - ii. Frictions in obtaining / employing hedge accounting

Data

- Primary data: FR Y-14 security-level data linked by CUSIP to bond characteristics
 - Quarterly portfolio snapshot for BHCs with >\$100bn in assets subject to stress testing
 - Bond characteristics from IDC and MSCI (e.g., duration, convexity, maturity, callability)
 - <u>Key point</u>: stated maturity is a poor proxy for duration for many/most bank securities
- Novel methodology to identify securities sales:
 - Identify cases where bond exits from bank portfolio but does not mature, is not called, etc.
 - Cross-validate against aggregate realized gains/losses reported in Y-9C
- Supplement Y-14 with public bank regulatory data (Call / Y-9C) + bank 10-Ks

Interest rate risk (IRR): key concepts

Interest rate risk: Risk that a shift in interest rates will reduce bank value or earnings

Measurement:

- *Duration* of an asset measures rate of change of value to a change in rates
 - E.g., duration of $5 \rightarrow 1$ bp increase in interest rates will reduce bond value by 5 bp
- For bank as whole: interest rate sensitivity of *economic value of equity (EVE)*
 - EVE = difference between the net present value of bank assets and liabilities
 - Banks compute %∆ EVE for various yield curve shocks, and check against risk limits
 - EVE may differ significantly from regulatory capital (based mostly on book values)
 - Aside: valuing deposit franchise key challenge for measuring EVE (e.g., shifts in deposit "beta")
- Banks also estimate sensitivity of *net interest income* to interest rate shocks

Evolution of bank interest rate risk in 2022-23

- Sharp upward shift in yield curve. Also higher interest rate volatility
 - 10y Tsy +250bp; 30y mortgage +350bp; implied IR vol x4 (Sarisoy 2023). \$700bn unrealized losses on bank securities.
- Also a shift in bank interest rate risk post-2022:
 - Bank models: EVE more exposed to positive rate shocks (right)
 - Bank stocks fall more after positive rate shocks (Emin et al., 2024)
 - Supervisory downgrades related to IRR (Gopalan-Granja 2025)
- One driver: large bank holdings of bonds that extended in duration; esp. agency mortgage-backed securities (MBS)
 - When rates rise, mortgage borrower becomes less likely to prepay
 - As a result, bond now effectively longer term / more rate-sensitive
 - MBS + other "callable" bonds > 60% of large bank portfolios, but lots of cross-bank variation. (Also whole mortgages.)



Effect of +300bp rate change on bank EVE (%)

Fuster et al. (2024); derived from OCC aggregation of bank IRR measures

Higher risk; greater cross-bank dispersion as rates increased



Duration: Callable vs noncallable bonds

Portfolio duration across banking organizations

- Regressions: high share of callable bonds (e.g., MBS) \rightarrow larger rise in duration in 2022-23
- Matters for bank as a whole: high share of callable bonds \rightarrow larger total fair value losses in 22-23

How do banks manage portfolio following "risk shock"?



How did banks adjust to risk shock in 2022-23?

- 1. Low outright sales of risky bonds in fact sales *fell* in 2022-23 (below left)
- 2. Little increase in qualified hedging (below right)
- 3. Banks with more callable bonds (most affected by "risk shock") did not sell/hedge more
- 4. But banks did indeed shift new purchases to lower duration bonds [link]



Securities duration: gross and net of hedging



Limited response of securities portfolio to deposit outflows

Asymmetric response:

- Banks buy bonds when deposits flow in
- But limited response if deposits flow out

Consistent with high-frequency evidence studying deposit flows around March 2023:

- Cipriani, Eisenbach and Kovner (2024)
- Glancy, Ionescu, Klee, Kotodis, Siemer and Zlate (2024)

Deposit growth vs securities growth: 2022-23 [binned scatter plot; quarterly frequency]



Federal Reserve Bank of Philadelphia Source: Author calculations based on Call reports

Taking stock

- In principle, securities portfolio key risk management tool. But in practice, little active management in 2022-23 – instead "sticky" portfolios
 - Result: Higher risk / losses for banks with bonds that extended in duration as rates rose (esp MBS)
 - Did banks just *want* to take more risk? Not complete explanation [link]
- Next: what factors limit active portfolio management? (e.g., regulatory, accounting frictions)
- First question: are banks averse to selling bonds with unrealized losses. If so, why?
 - One motivation: managing *regulatory* capital.
 - Unrealized securities losses not included in reg. capital for most banks ("AOCI filter"). [link]
 - Implication: hit to regulatory capital if bonds are sold at a loss
 - Exception: Largest BHCs (Cat I/II; e.g., >\$700bn) may not use filter; some others opt out.
 - Also: (i) selling underwater bonds reduces net income; (ii) may draw attention to losses (e.g., SVB)

Evidence: Banks avoid selling bonds with unrealized losses

- "Underwater" bonds (fair value < book value) are much less likely to be sold
 - See chart at right binned scatter plot
- 2. Statistical analysis:
 - Magnitude: 3-4x more likely to sell bond at par; 8-9x more likely to sell bond at premium (vs underwater)
 - Not driven by bank or other security characteristics (robust to fine controls; bank x time fixed effects) [link]

Probability of security sale vs unrealized gain/loss [Binned scatter plot]



Drivers of strategic trading: capital regulation; market pressure

Aversion to selling underwater bonds varies by bank – sheds light on banks' motivations:

- 1. Regulatory capital management:
 - Banks more willing to sell underwater bonds if *unrealized* securities losses already recognized in regulatory capital (no "AOCI filter")
 - Accounts for about half of banks' aversion to realizing losses
- 2. Stock market pressure:
 - Greater aversion to realizing losses if stock market values bank below book value (possible interpretation: poor future prospects)



Frictions in hedging interest rate risk

- Banks use "hedge accounting" when hedging int. rate risk using derivatives
 - Aligns accounting treatment of hedge and underlying risk (avoid misleading volatility)
 - Not costless to set up: E.g., must document high correlation with underlying risk
- We find evidence that fixed costs limit qualified hedge activity:
 - 1. Hedging = 0 for 52% of bank quarters, even for our sample of largest BHCs (>\$100bn)
 - 2. High persistence of hedging vs non-hedging status over time (95%)
 - 3. Participation in qualified hedging is tightly positively correlated with size
- Further issue: No qualified hedging for "held-to-maturity bonds": binds for some banks
 - Also evidence that it is easier to elect hedge accounting for Treasuries than other bonds (some banks "max out" hedging of available-for-sale Treasury bonds)

Summary

- 1. Significant shift in interest rate *risk* for many banks in 2022-23. One driver: large holdings of agency MBS and other assets that extended in duration
 - As rates started rising, banks progressively more exposed to *further* interest rate changes
- 2. But relatively little active management of bond portfolio to rebalance risk "sticky" portfolios
 - Affected banks did not sell or hedge risky bonds in significant quantities to dial back risk
 - Limited response of securities portfolio to deposit outflows
- 3. Financial, regulatory and accounting frictions discourage active management
 - Banks unwilling to realize unrealized losses by selling, particularly if results in lower regulatory capital
 - Frictions in obtaining "hedge accounting" constrain interest rate hedging for some banks
- 4. Broader context: (i) purpose of bank bond portfolios; (i) risks of callable assets like MBS

Additional slides

Preview of key takeaway points

- 1. Significant shift in interest rate *risk* for many banks in 2022-23. One driver: assets that extended in maturity, esp. agency mortgage-backed securities (MBS)
- 2. But relatively little active management of securities portfolio in response "sticky" portfolios
 - Also: limited response of securities portfolio to deposit outflows
- 3. Financial, regulatory and accounting frictions discourage active management
 - Banks averse to realizing losses on risky underwater bonds. In part: managing *regulatory* capital.
 - Frictions in obtaining "hedge accounting" constrain interest rate hedging for some banks
- 4. Broader context: (i) purpose of bank bond portfolios; (i) risks of MBS; other "callable" assets

Maturity structure: Bank Treasury/agency purchases



[Link back]

Source: FR Y-14, IDC

Alternative explanation: bank risk-taking

- Did duration rise simply because banks just *wanted* to take more risk? (e.g., risk-shifting)
- Certainly may be part of the story, but doesn't explain several key features of the data; e.g.,:
 - 1. Why was the increase in duration was so correlated with ex ante asset mix?
 - 2. Why then were banks actively reducing the duration of new Treasury purchases?
 - **3**. Why did banks shift large volume of securities to HTM classification?
- Instead inertia in bank portfolios can explain these features

Accounting treatment: investment securities

- "Available for sale" (AFS):
 - Gains/losses reported on balance sheet, but do not affect net income or retained earnings
 - Instead, recorded in separate component of equity: "accumulated other comprehensive income" (AOCI)
 - For most banks, AOCI is not counted towards regulatory capital. (Exceptions: very largest + "opt out" banking organizations)
- "Held to maturity" (HTM):
 - Accounting is similar to a balance sheet loan
 - Gains/losses still publicly reported, however
 - Cannot easily sell or reclassify bonds classified as HTM ("tainting" rule)

	Available for sale (AFS)	Held to maturity (HTM)		
Recorded on balance sheet at:	Market value	Amortized cost		
Unrealized gains / losses are a	reflected in:			
Net income?	No	No		
Book equity?	Yes, recorded in AOCI	No		
Regulatory capital?	Only for largest banks (e.g., >\$700bn) + "opt out" banks	No		
Realization of gains / losses t	hrough sale affects:			
Net income?	Yes	Yes		
Book equity?	No	Yes		
Regulatory capital?	Yes, except for largest banks + "opt out" banks	Yes		
Sale / reclassification permitted by accounting regulations?	Yes	Generally no: "tainting" rule		
Interest rate hedges may qualify for hedge accounting	Yes	No		

Accounting classification of bank securities: "available for sale" (AFS) vs "held to maturity" (HTM)

% securities classified as HTM

Duration: AFS vs HTM



Source: Y-14; IDC

Strategic trading

[Outcome variable = 1 if security was sold; = 0 otherwise]

	(1)	(2)	(3)	(4)	(5)	(6)
FV/AC ∈ [.99-1.01]	0.034***	0.030***	0.032***	0.030***	0.025***	0.021*
	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)	(0.012)
FV/AC > 1.01	0.035***	0.079***	0.085***	0.077***	0.072***	0.102**
	(0.010)	(0.018)	(0.019)	(0.017)	(0.017)	(0.043)
Obs.	467,728	467,728	467,728	467,728	467,728	69,563
Fixed effects	No	No	Time	Bank x Time	Bank x Time	Bank x Time
						Cusip x Time
Controls	No	No	No	No	Yes	No
Weights	No	Yes	Yes	Yes	Yes	Yes
P(sale) for $FV/AC < 0.99$.015	.012	.012	.012	.012	.0083

A. Linear probability model (OLS)

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	(1)	(2)	(3)	(4)
FV/AC ∈ [.99-1.01]	3.650***	3.843***	3.269***	3.329***
	[2.3,5.9]	[2.4,6.2]	[2.0,5.4]	[2.2,5.1]
FV/AC > 1.01	8.425***	9.735***	7.370***	8.340***
	[4.9,14.5]	[5.4,17.5]	[4.0,13.4]	[4.9,14.1]
Obs.	467,728	467,728	467,025	467,025
Fixed effects	No	Time	Bank, Time	Bank, Time
Controls	No	No	No	Yes
Weights	Yes	Yes	Yes	Yes
P(sale) for $FV/AC < 0.99$.012	.012	.012	.012

Determinants of bank aversion to sale of securities at a loss

[Outcome variable = 1 if security was sold; = 0 otherwise]

	(1)	(2)	(3)	(4)	(5)	(6)
FV/AC > 0.99	2.129**	1.727**	4.293***	1.764**	3.672***	2.079*
	[1.1,4.1]	[1.0,2.9]	[1.9,9.8]	[1.1,2.9]	[2.0,6.7]	[0.9,4.6]
FV/AC > 0.99	2.824***	3.765***	2.406**	1.562	2.295**	3.202**
\times AOCI not in capital	[1.4,5.8]	[1.8,8.0]	[1.1,5.3]	[0.6,4.1]	[1.0,5.2]	[1.3,8.2]
FV/AC > 0.99	1.610					1.200
\times CET1 Buffer $<$ Median	[0.8,3.4]					[0.5,2.8]
FV/AC > 0.99		3.973***				3.182***
imes PB Ratio $<$ Median		[1.7,9.1]				[1.5,6.8]
FV/AC > 0.99			0.646			0.529
\times YoY Stock Ret < Median			[0.3,1.6]			[0.2,1.4]
FV/AC > 0.99				3.588***		1.975
\times Reserves/Securities < Median				[1.4,9.3]		[0.7,5.5]
FV/AC > 0.99					0.750	0.798
\times Uninsured Deposits/Deposits > Median					[0.3,1.7]	[0.4,1.8]
Obs.	467,025	467,025	467,025	467,025	467,025	467,025
Fixed effects	Bank, Time					
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Weights	Yes	Yes	Yes	Yes	Yes	Yes
P(sale) for $FV/AC < 0.99$.012	.012	.012	.012	.012	.012