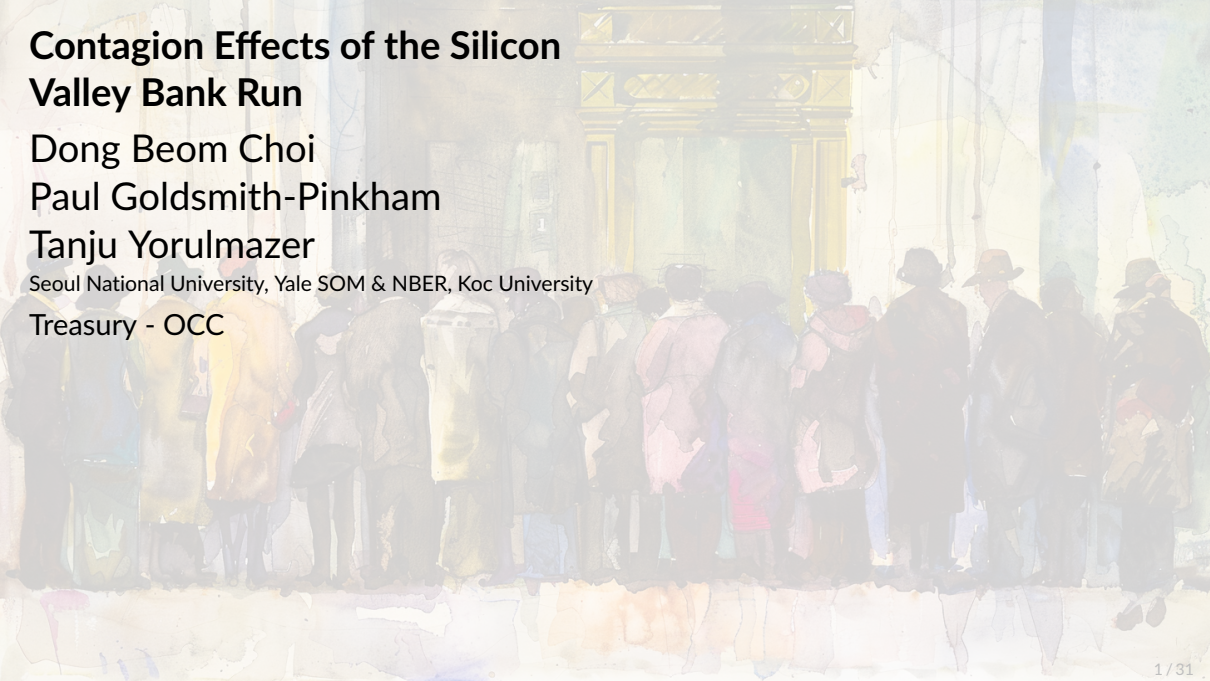
Contagion Effects of the Silicon Valley Bank Run

Dong Beom Choi
Paul Goldsmith-Pinkham
Tanju Yorulmazer

Seoul National University, Yale SOM & NBER, Koc University

Treasury - OCC

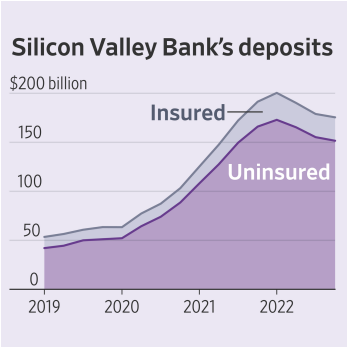


Silicon Valley Bank failure

- SVB failed on March 10th 2023 after a bank run
  - 16th largest bank with $209 billion in assets
  - Largest bank failure since the GFC at the time
  - Second largest failure in US history after Washington Mutual
- Systemic risk exception invoked with blanket deposit guarantee

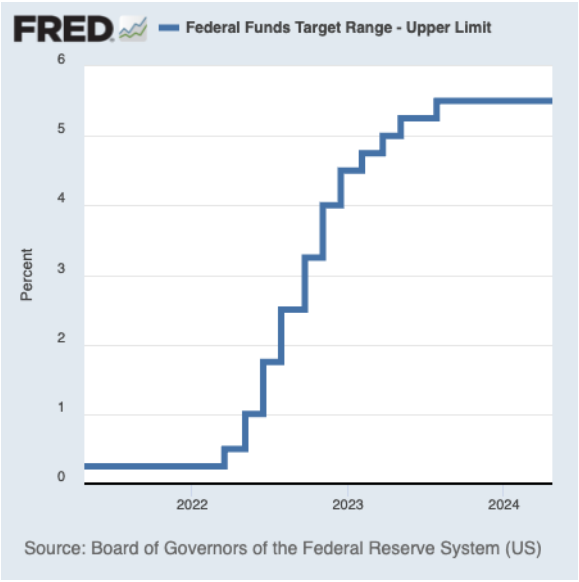
Expansion and build-up to failure

- SVB founded in 1983 with a focus on startups
  - Significant growth, serving 65% of startups in 2015
  - Deposits and assets tripled between 2019-2021
  - 90% of deposits uninsured
- Increase investments in highly-rated bonds to $120 billion
  - $91 billion in fixed-rate mortgages



Tight monetary policy

- Federal Reserve began to increase rates on March 17, 2022
- Rate hikes benefit banks by allowing higher interest margins (Dreschsler et al. (2017)) but...
- Vulnerabilities associated with duration risk for fixed-rate assets



SVB and interest rate risk

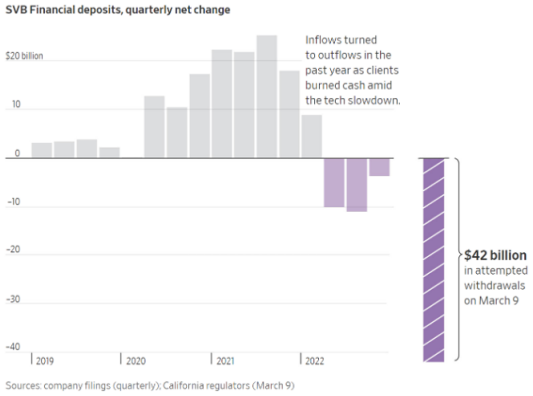
- Highly-rated government bonds with long maturities
- By the end of 2022 bond portfolio had:
  - $91.3 billion in held-to-maturity (HTM) securities
  - $26.1 billion in available-for sale (AFS) securities
- Unrealized losses for HTM securities exceeding $15 billion

Timeline of run on SVB and failure

- Deposits dropped for four straight quarters
  - Intensified in February and March 2023
- Liquidate HTM assets, loss of $1.8 billion, announced to raise capital of $2.25 billion in the week of failure

End Game

1. Downgrade by Moody's on **March 8th**
2. Run on SVB, withdrawals of $42 billion on **March 9th**
3. Receivership by FDIC on **March 10th**
4. Blanket guarantee on all deposits on **March 12th**



Motivation and research question

- Financial contagion can lead to spillovers from SVB onto other banks
  - Direct exposures, information contagion, disorderly liquidations...
- Analyze spillover effects using stock market response
  - Goldsmith-Pinkham & Yorulmazer (2010) for Northern Rock
- Examine stock price reactions of banks
  - Following the switch to tight monetary policy
  - Failure of SVB
- Assess bank characteristics (“vulnerability factors”) that played a role in spillovers

Main results

1. Significant but heterogenous spillover effects
2. Returns in 2022 were highly predictive of 2023 declines
3. Important factors:
   - Uninsured deposits
   - Implied HTM losses
   - Capitalization
   - Size
   - Cash
4. Less important factors:
   - Liquid securities
   - Non-performing loans
5. Anticipated 2022 returns came from uninsured depsoits and cash

   → not anticipating HTM losses or capitalization

Literature

- Vast literature on bank runs
  - Diamond & Dybvig (1983), Gorton (1988), Calomiris &Kahn (1991), Allen & Gale (1998), Goldstein & Pauzner (2005)...
- Vast literature on contagion
  - Allen & Gale (2000), Chen (1999), Acharya & Yorulmazer (2008), Diamond and Rajan (2001), Gorton and Huang (2004)...
- Interest rate risk
  - Flannery and James (1984), Dreschler et al. (2017)...
- Recent papers on SVB
  - Acharya et al. (2023), Jiang et al. (2023), Caglio et al. (2023), Luck et al. (2023), Flannery& Sorescu (2023), Haddad et al. (2023), Metrick (2024)...

Data

- Daily stock price for banks from Yahoo! Finance
  - Feb 1, 2022 to May 25, 2023
- If regulated by FDIC, collect deposits data using FDIC's BankSuite
- Balance sheet data using FR Y-9C data and Call Reports
  - Total assets, cash, securities, HTM and AFS securities, mark-to-market losses on HTM securities, Tier 1 capital, non-performing loans...
- 224 sample banks

Excess returns

- Each bank's daily return is used to calculate the cumulative return:

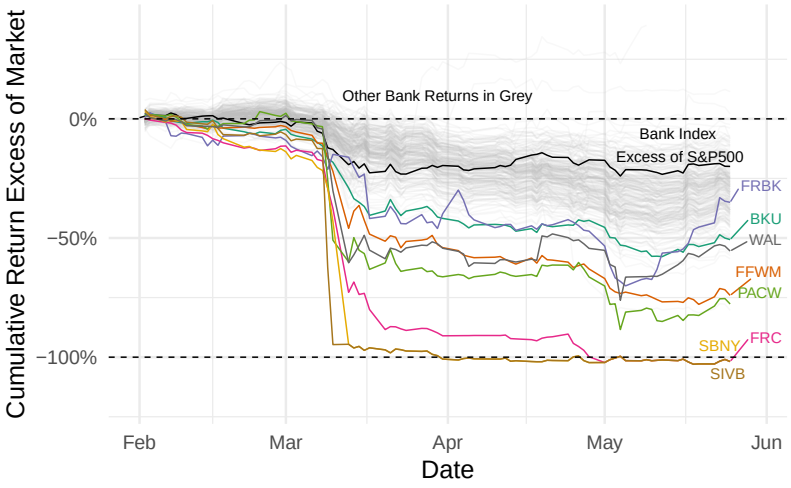
$$R_{it} = \prod_t (1 + r_{it}) - 1$$

- R_m cumulative return of S&P 500 for the same period.
- Excess return for bank i over S&P 500 $R_{it} - R_m$ over three periods:
  - **Early returns:** Feb 1, 2023 to Mar 17, 2023 (one week after SVB failure)
  - **Late returns:** Feb 1, 2023 to May 25, 2023
  - **2022 returns:** (Feb 1, 2022 to Jan 31, 2023) used to analyze whether effects were anticipated
- We calculate excess returns and analyze the bank characteristics that explain them
- Implied losses of SVB were publicly available in January 2023

Overall trends: banks vs. S&P

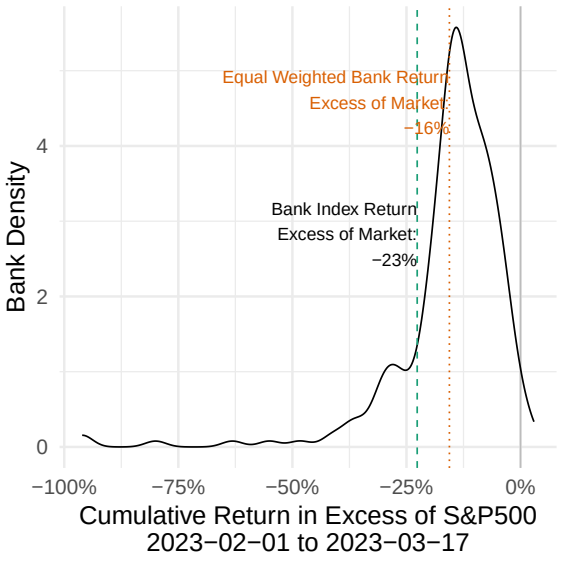
- Before SVB, banks did not particularly underperform despite the rate hikes
  - initially weaker performance, but recovering by early 2023
- Following SVB, significant underperformance

Overall trends: bank cross-section post-SVB



- Noticeable increase in cross-sectional variation (i.e., differential spillovers)
- 8 banks with the largest declines as of March 17th highlighted
- Question: Which factors contributed to the scale of spillovers?

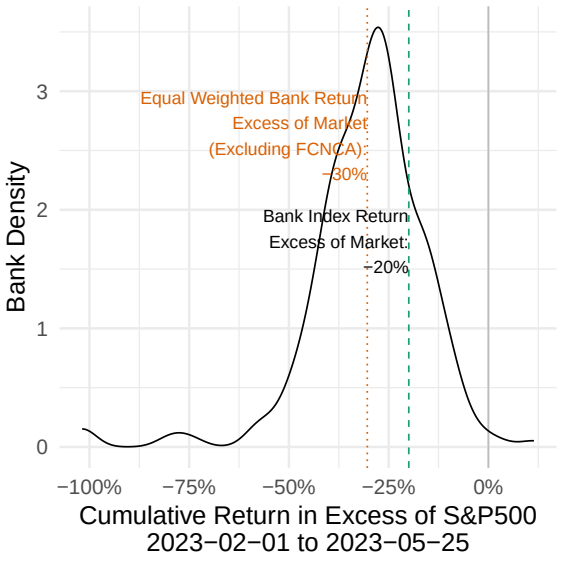
Overall trends: differential spillovers



Similar shape, but...

- “early” returns: value-weighted return lower than equal-weighted return

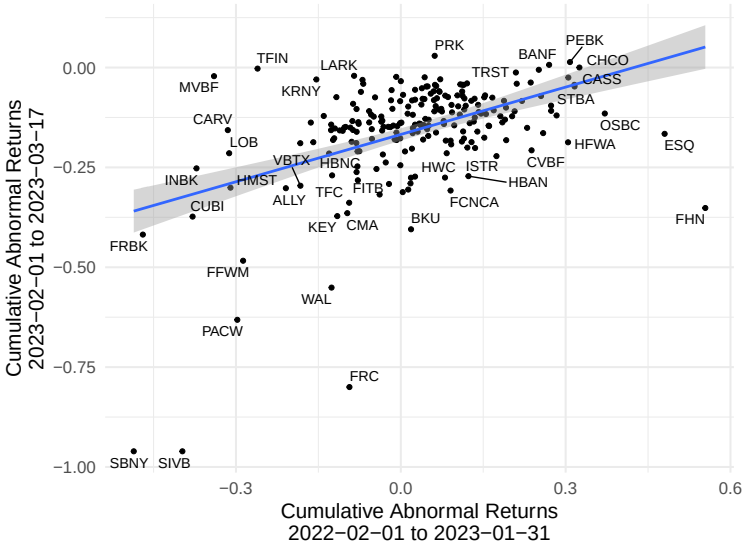
Overall trends: differential spillovers



Similar shape, but...

- “early” returns: value-weighted return lower than equal-weighted return
- “late” returns: value-weighted return greater than equal-weighted return
- Larger banks underperformed at the beginning but performing better later on

SVB spillover effects vs. 2022 performance



- Market participants (at least partially) factored in the risks associated with the 2023 crisis ahead of time?
  - Significant positive association ($t = 4.5$)

What are the driving factors behind the spillover effects?

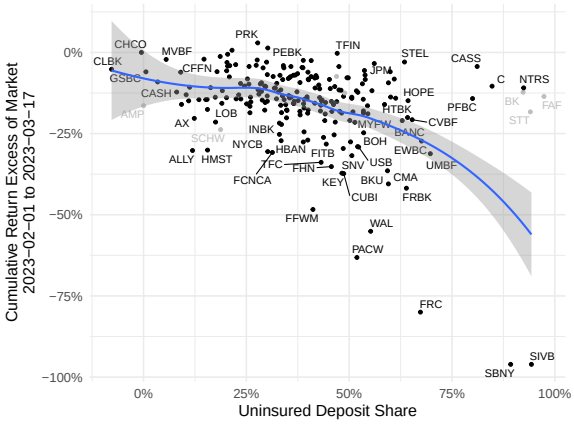
- Spillover effects were significant but heterogeneous
- Factors that had a unique role in this episode:
  - Uninsured deposits
  - Unrealized losses on securities
- More conventional factors:
  - Asset liquidity
  - Leverage
  - Asset quality
  - Size

Unique factors: uninsured deposits and HTM losses

- Implied losses in HTM securities
  - → Gets realized only when bank needs to sell assets
- Losses in securities prompted concerns
  - → inducing uninsured depositors withdrawal
- Uninsured depositors withdrawals lead to sales of assets

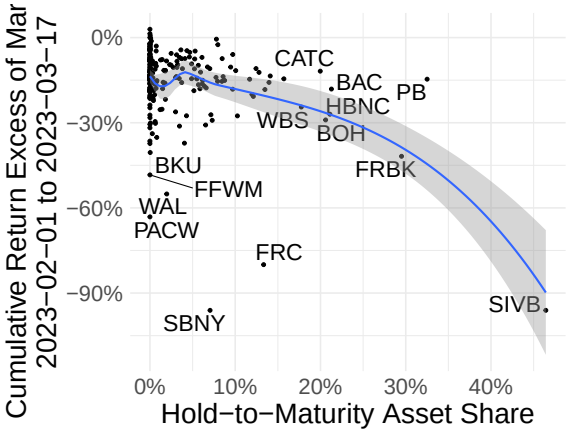
Against the conventional wisdom...

- Deposits (even uninsured) were typically considered as a reliable source of funding
  - Ivashina and Scharfstein (2010), Hanson et al. (2015), and Bai et al. (2018)
  - LCR adopts relatively low run-off rates than other market funding sources
- Most of the HTM securities were “highly liquid”
  - “High Quality Liquid Assets” under the Liquidity Coverage Ratio assumptions



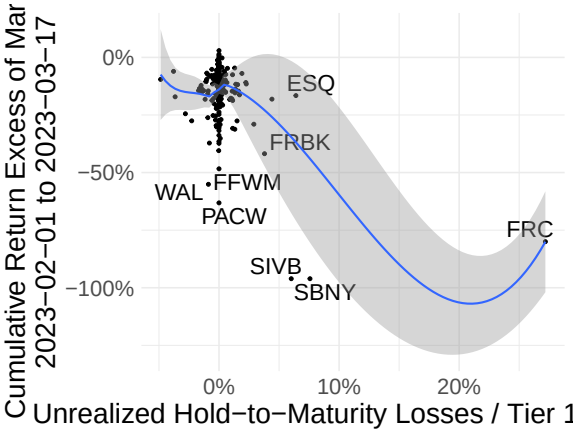
Against the conventional wisdom...

- Deposits (even uninsured) were typically considered as a reliable source of funding
  - Ivashina and Scharfstein (2010), Hanson et al. (2015), and Bai et al. (2018)
  - LCR adopts relatively low run-off rates than other market funding sources
- Most of the HTM securities were “highly liquid”
  - “High Quality Liquid Assets” under the Liquidity Coverage Ratio assumptions
- more negative returns if
  1. having more HTM securities

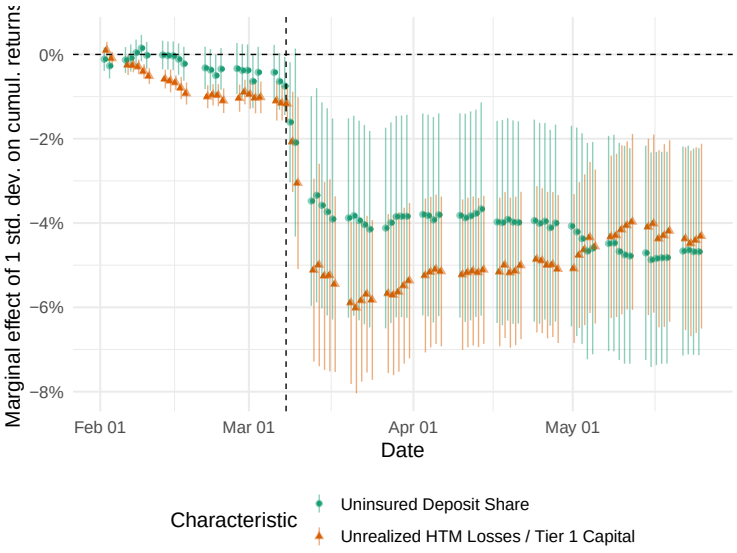


Against the conventional wisdom...

- Deposits (even uninsured) were typically considered as a reliable source of funding
  - Ivashina and Scharfstein (2010), Hanson et al. (2015), and Bai et al. (2018)
  - LCR adopts relatively low run-off rates than other market funding sources
- Most of the HTM securities were “highly liquid”
  - “High Quality Liquid Assets” under the Liquidity Coverage Ratio assumptions
- more negative returns if
  1. having more HTM securities
  2. having more implied HTM losses



Effects over time, Feb 1 - May 25



- small effects prior to the run
- distinct jump after the run
- persistent decline, while HTM losses became relatively less critical

Quantifying the impact of HTM assets and deposits

	(1)	(2)	(3)	(4)	(5)
Constant	-0.156***	-0.156***	-0.156***	-0.156***	-0.145***
	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)
Uninsured Deposit Share	-0.048***			-0.035***	-0.030***
	(0.015)			(0.011)	(0.009)
HTM Asset Share		-0.046**		-0.020	-0.008
		(0.018)		(0.015)	(0.007)
Unrealized HTM Losses / Tier 1 Capital			-0.062***	-0.048***	0.007
			(0.014)	(0.009)	(0.018)
Uninsured Deposit Share					-0.008
× HTM Asset Share					(0.008)
Uninsured Deposit Share					-0.040***
× Unrealized HTM Losses / Tier 1 Capital					(0.015)
Observations	224	224	222	222	222
R^2	0.139	0.124	0.224	0.328	0.420
Adjusted R^2	0.135	0.120	0.221	0.318	0.406

- HTM losses, rather than HTM asset holdings mattered
- More negative impact of HTM losses with higher uninsured deposit reliance (Jiang et al. 2023)

What factors were the same vs. different in 2023?

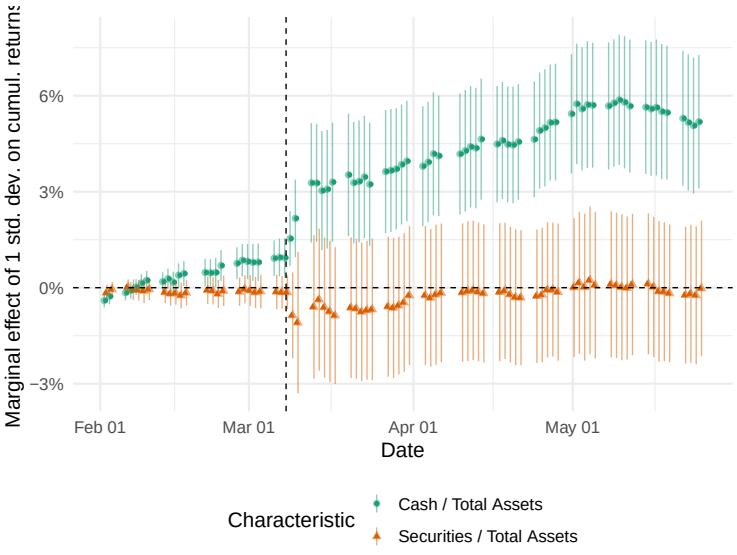
- Liquid assets: Resilience against withdrawals
  - Liquidity Coverage Ratio (LCR): Hold HQLAs to cover 30 days of withdrawals
  - For LCR, both (Treasury and agency) securities and cash are HQLAs
  - Securities and cash had different effects in this episode
  - Cash was very valuable, but selling liquid securities experienced would mark losses
- Capitalization
  - Had an effect mitigating spillovers
- Asset quality (i.e., non-performing loans)
  - Did not have a significant effect, unlike 07-09

Liquid assets: Cash vs securities

	(1)	(2)	(3)	(4)	(5)
	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)
Liquid Assets / Total Assets	-0.009		0.007		
	(0.012)		(0.011)		
Cash / Total Assets		0.015**		0.032***	0.024***
		(0.007)		(0.009)	(0.008)
Securities / Total Assets		-0.020		-0.008	-0.005
		(0.013)		(0.011)	(0.008)
Uninsured Deposit Share			-0.051***	-0.056***	-0.054***
			(0.015)	(0.015)	(0.014)
Cash / Total Assets					0.015**
× Uninsured Deposit Share					(0.007)
Securities / Total Assets					-0.015
× Uninsured Deposit Share					(0.015)

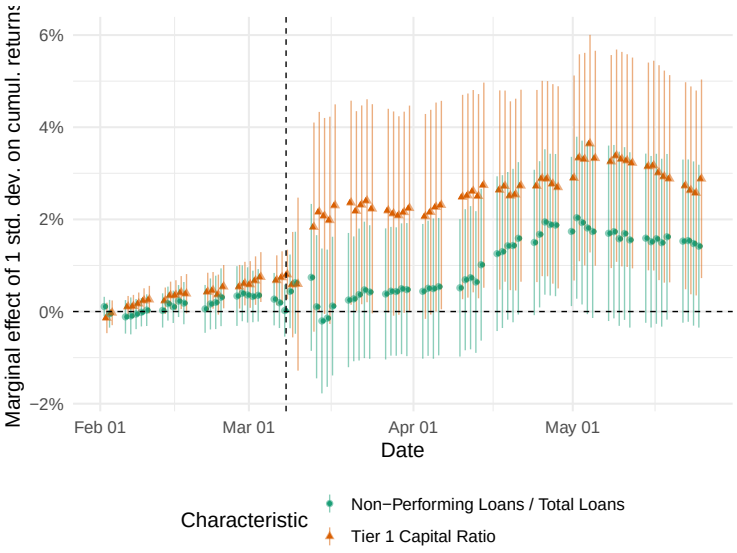
- cash helped (particularly if using more uninsured deposits)
- securities did not
- securities, even if liquid, can cause a problem when selling

Dynamic effects: Cash vs securities



- Pre SVB, cash holdings slowly began to predict higher cumulative returns across banks, but securities did not
- Impact of cash holdings jumped immediately after SVB, becoming stronger over time

Dynamic effects: Capital and NPLs

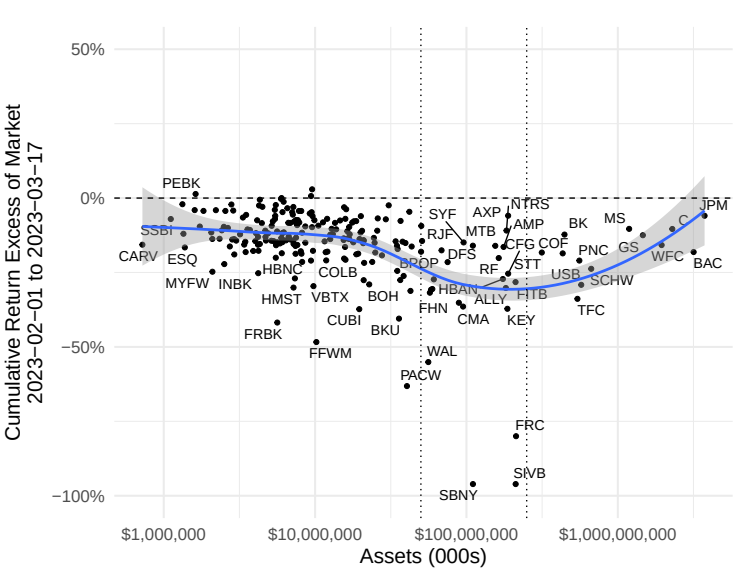


- Better capitalization helped mitigating spillovers
- Unlike the Great Recession, bad assets (NPL) were not associated with spillovers

Bank size as a factor in spillover effects

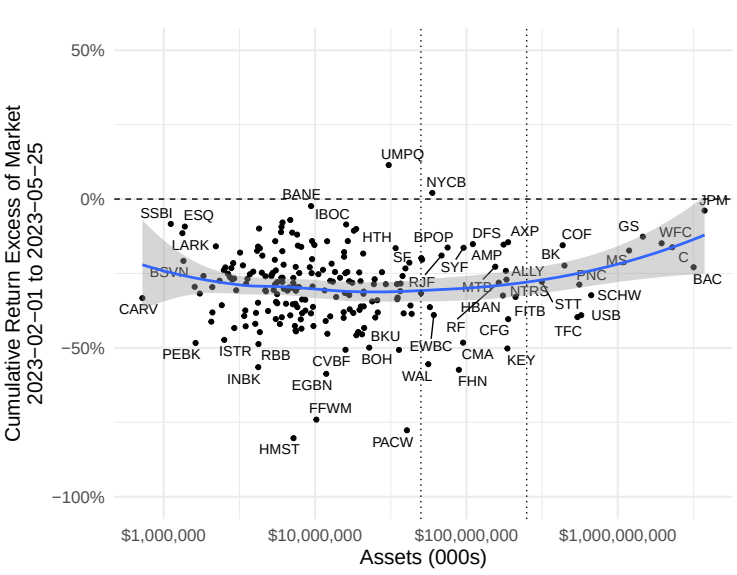
- 2018 regulatory rollback
  - Easing regulation for mid-sized banks
  - Threshold for SIFIs increase to $250 billion (from $50 billion)

Bank size as a factor in spillover effects



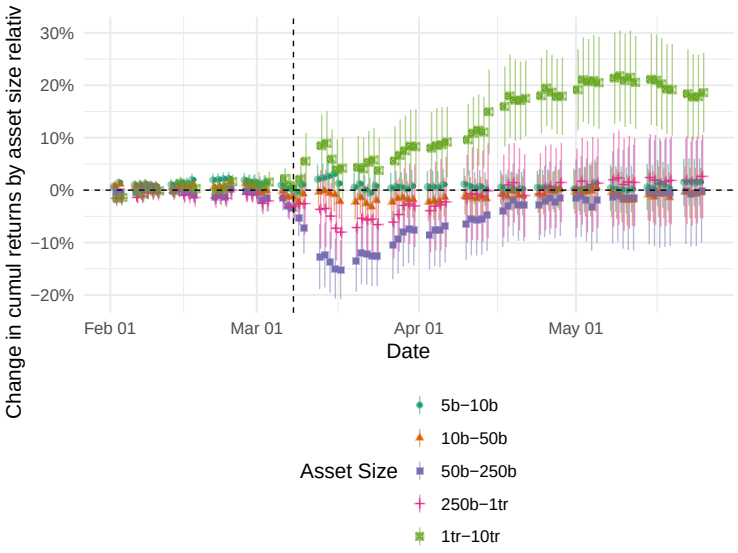
- Initially, mid-sized banks experienced larger spillover effects
  - Up to March 17 (a week after the failure)
  - Distinct underperformance by banks between 50 - 250 billion (similar size to SVB)
  - note, these “super-regional” banks faced relaxed regulation

Bank size as a factor in spillover effects



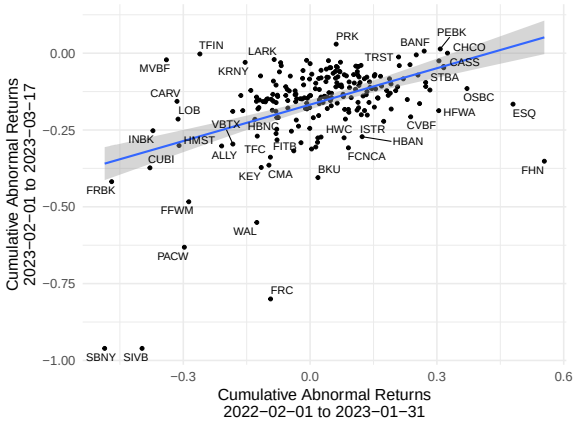
- Up to May 25
- Over time, losses spread to the rest of the banking system
- However, largest banks experienced gains compared to others

Bank size as a factor in spillover effects



- Clear initial underperformance of super regional banks
- Clear eventual outperformance of the largest banks ($>$ \$1 trillion)
- With systemic instability, depositors' flight to quality to TBTF banks (Caglio et al. 2023, Kang, Luck, and Plosser 2023)

What was expected? What was a surprise?



- Strong correlation between 2022 stock returns and post-SVB returns after SVB failure
- Investors seem to have factored in some of the vulnerabilities observed during the SVB crisis
- Which factors were expected?
- Which factors had a surprise effect?

What was expected? What was a surprise?

	(1)	(2)	(3)
Assets [0-5b]	-0.113***		
	(0.009)		
Assets (5b-10b]	-0.115***	0.005	0.013
	(0.010)	(0.013)	(0.013)
Assets (10b-50b]	-0.160***	-0.034**	-0.035**
	(0.013)	(0.017)	(0.015)
Assets (50b-250b]	-0.314***	-0.169***	-0.150***
	(0.046)	(0.028)	(0.026)
Assets (250b-1tr]	-0.224***	-0.102***	-0.078**
	(0.026)	(0.030)	(0.030)
Assets (1tr-10tr]	-0.122***	0.018	0.029
	(0.016)	(0.029)	(0.030)
Constant		-0.127***	-0.140***
		(0.011)	(0.010)
Uninsured Deposit Share		-0.037***	-0.026**
		(0.013)	(0.010)
Tier 1 Capital Ratio		0.009	0.010
		(0.009)	(0.008)
Cash / Total Assets		0.036***	0.022**
		(0.009)	(0.009)
Unrealized HTM Losses / Tier 1 Capital		-0.041***	-0.039***
		(0.009)	(0.007)
Cumulative Abnormal Returns (2022)			0.274***
			(0.063)
Observations	224	216	216

- Comparing columns 2 and 3 (with and without 2022 returns controlled)
  - Uninsured deposit reliance and cash holdings become less significant
  - Not much difference for the HTM losses

Regressing 2022 returns on “vulnerability” factors

	(1)	(2)	(3)	(4)
Assets (50b-250b]	-0.006	-0.039	-0.060	-0.060
	(0.037)	(0.042)	(0.041)	(0.041)
Assets (250b-1tr]	-0.038*	-0.061	-0.085**	-0.084**
	(0.022)	(0.043)	(0.038)	(0.038)
Assets (1tr-10tr]	0.005	-0.008	-0.033	-0.018
	(0.038)	(0.045)	(0.041)	(0.046)
Uninsured Deposit Share		-0.021*	-0.034***	-0.042***
		(0.012)	(0.012)	(0.013)
HTM Asset Share		-0.007	-0.005	-0.006
		(0.015)	(0.013)	(0.013)
Unrealized HTM Losses / Tier 1 Capital		-0.012	-0.007	-0.007
		(0.011)	(0.012)	(0.011)
Cash / Total Assets			0.048***	0.052***
			(0.010)	(0.011)
Securities / Total Assets			-0.0005	-0.0002
			(0.010)	(0.011)
Tier 1 Capital Ratio				-0.003
				(0.012)
Non-Performing Loans / Total Loans				-0.014
				(0.010)

- stronger correlation $\rightarrow$ investors had worried more about that specific factor in advance
- investors partially accounted for risks from uninsured deposits and limited cash holdings.
- Size, HTM losses, or capitalization factors were not factored in.

Why surprised? HTM losses

- HTM losses matter only if materialized

  ... which happens upon the significant funding withdrawals
- Investors understood the cost of uninsured deposit reliance during monetary tightening, but didn't expect a "run" forcing banks to sell HTM securities

1 As long as depositors did not care about HTM losses and not running for that reason, no need for investors to worry either

2 However, SVB run was a "wake-up" call, changing depositors' perception of bank assets, spreading runs to other banks.

→ "information view" of banking panic (Gorton 1985, Dang, Gorton, and Holmstrom 2020)

Why surprised? Asset size and capitalization

- Bank size can influence the survival likelihood (e.g., TBTF), but this becomes critical only when experiencing systemic instability.
  - mid-sized banks and the relaxation of regulations that they experienced.As concerns about the entire banking system grew over time, flying-to-quality investors sought safety in the largest “systemic” banks.these effects are significant only when conditioned on the occurrence of a systemic disruption, which may have a small unconditional probability ex ante.
- Note, banks were considered to be well-capitalized before the crisis, so capitalization did not matter very much before SVB.

Conclusion

- Quantify spillover effects during the SVB episode in the stock market
  - Significant heterogeneity across banks
- Key factors in heterogeneity:
  - Implied losses in HTM securities mattered
  - Uninsured deposits, as with SVB, mattered
  - Securities vs. cash: Not all liquid assets are the same
- Markets anticipated biggest declines in 2022
  - Somehow anticipated vulnerabilities with uninsured deposits
  - Did not foresee damages from implied losses from HTM securities as they materialize only when they are liquidated
- Important challenges for regulators in designing regulation and stress test