What explains the crash of bank stock prices during COVID-19?

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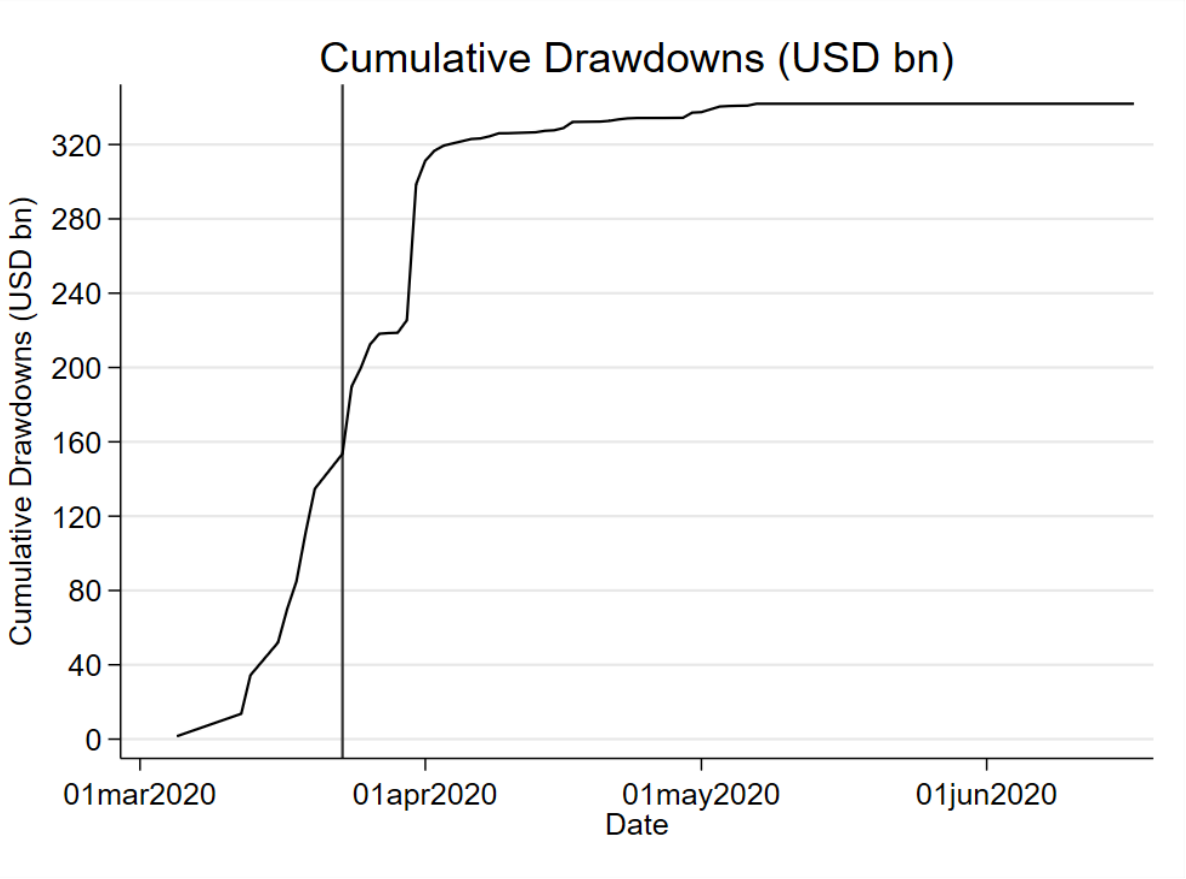
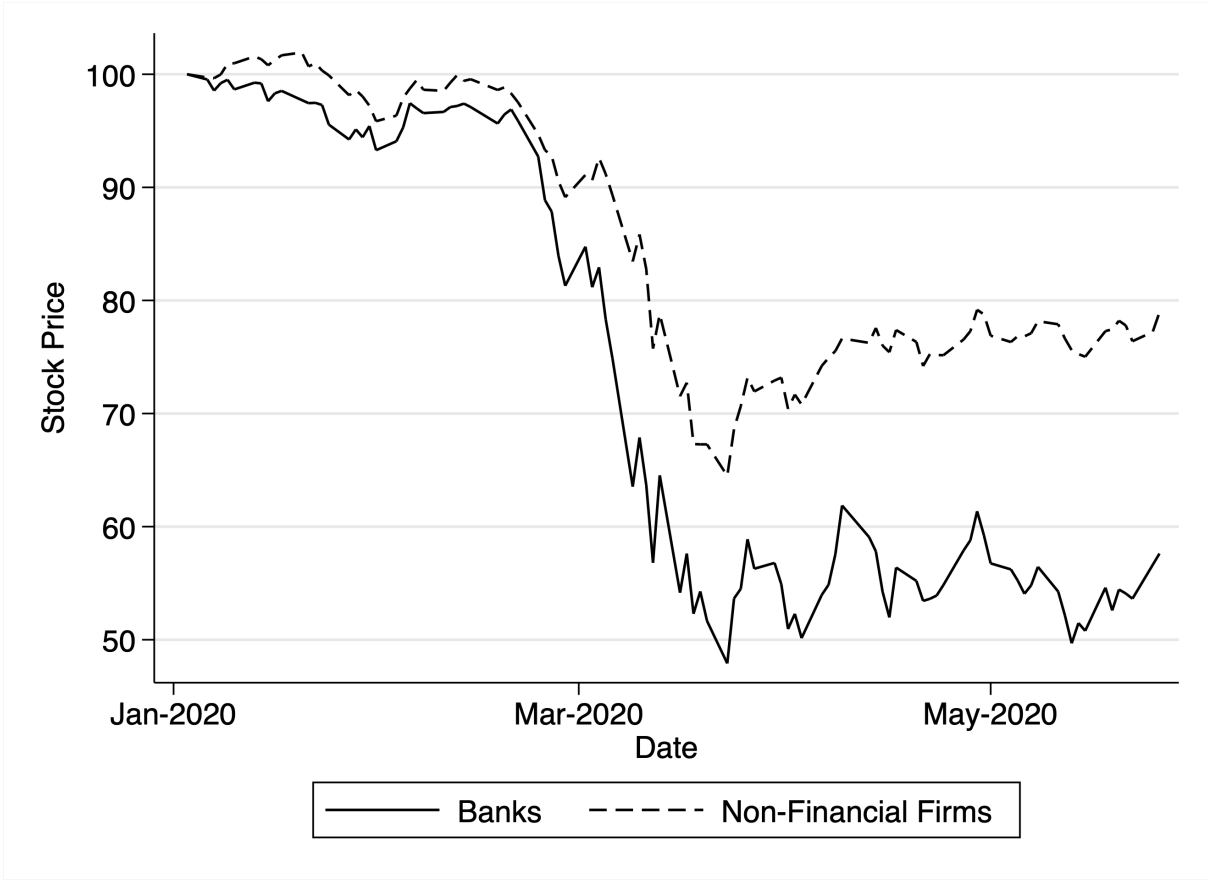
Bank stock returns have done worse than firms and corporates…





….during a period of unprecedented drawdowns of corporate credit lines

Motivation

- The COVID-19 pandemic has put the liquidity insurance function of banks for the U.S. economy to a real-life test.
  - Within four weeks, U.S. firms drew down > $300bn, particularly from BBB-rated and non-investment grade rated firms.

- We observe a rapid and persistent market value decline of U.S. bank equity (50%)

- Is bank "balance-sheet" liquidity priced in banks' stock returns?
  - Solvency vs Liquidity issues; Expected losses or capital lock-in to drawdowns?

This paper

- We show that balance sheet liquidity of banks *episodically* explains banks' stock returns (cross-section and time-series)
  - Firms with pre-arranged lines of credit drew down their undrawn facilities igniting liquidity risk for banks.

- Aggregate drawdown risk is not captured in traditional measures of
  - bank exposure (oil, retail, hotel sectors)
  - systemic risk (SRISK)

This paper

- We confirm that the episodic co-movement of balance-sheet liquidity risk and bank stock returns was also a feature of the global financial crisis (GFC, 2007-2008)
  - Liquidity risk during COVID explained through unused C&I credit lines, during GFC explained mainly through wholesale funding.

- We find evidence consistent with a “capital” rather than “funding” channel

- We demonstrate how the episodic nature of credit line drawdowns and re-pricing of balance-sheet liquidity risk can be incorporated into stress tests ($SRISK^{C}$).

Data

- All publicly listed BHC in the U.S., total assets > USD 100 million, match to CRSP/Compustat
- Bank balance-sheet variables (on the holding company level, FR-Y9C) are obtained from call reports
- Dealscan loan exposures to oil sector and affected industries (retail, hotel, gaming); LSTA secondary market prices
- SRISK from NYU vlab
- Bloomberg: oil volatility (CVOX), VIX, S&P 500 market return

Measuring balance-sheet liquidity

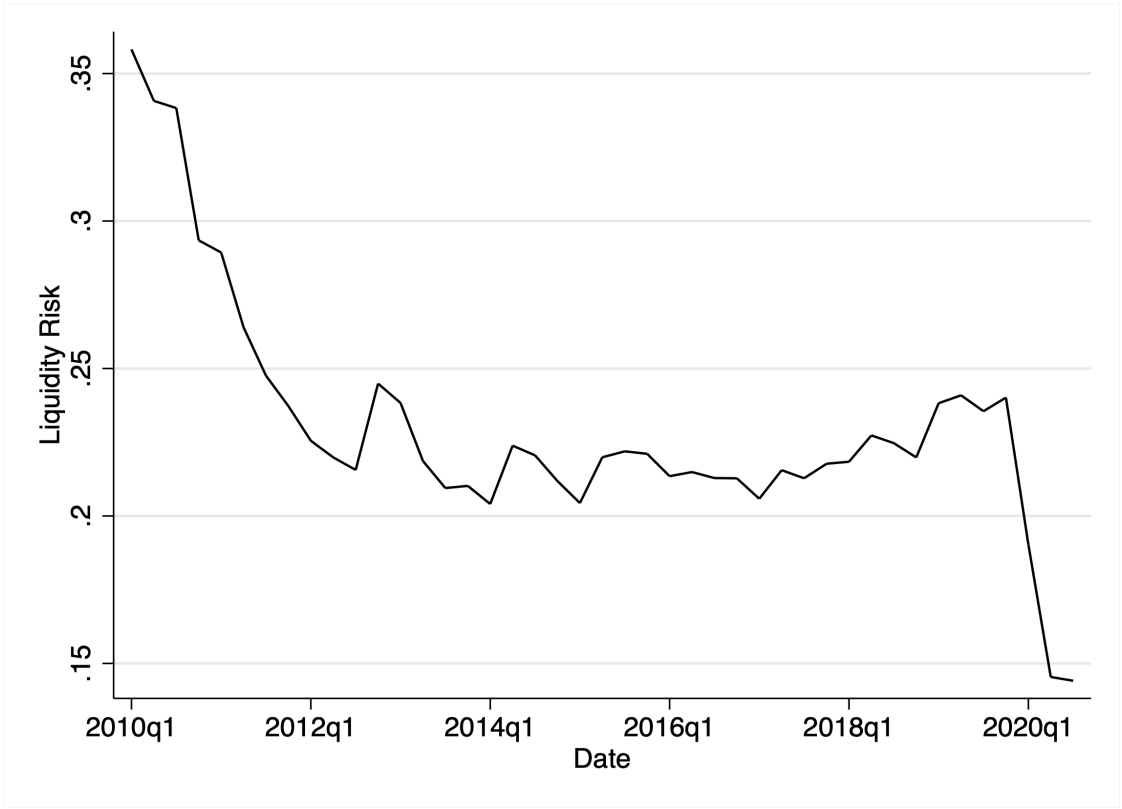
- *Unused Commitments*: The sum of credit lines secured by 1-4 family homes, secured and unsecured commercial real estate credit lines, commitments related to securities underwriting, commercial letter of credit, and other credit lines (which includes commitments to extend credit through overdraft facilities or commercial lines of credit).

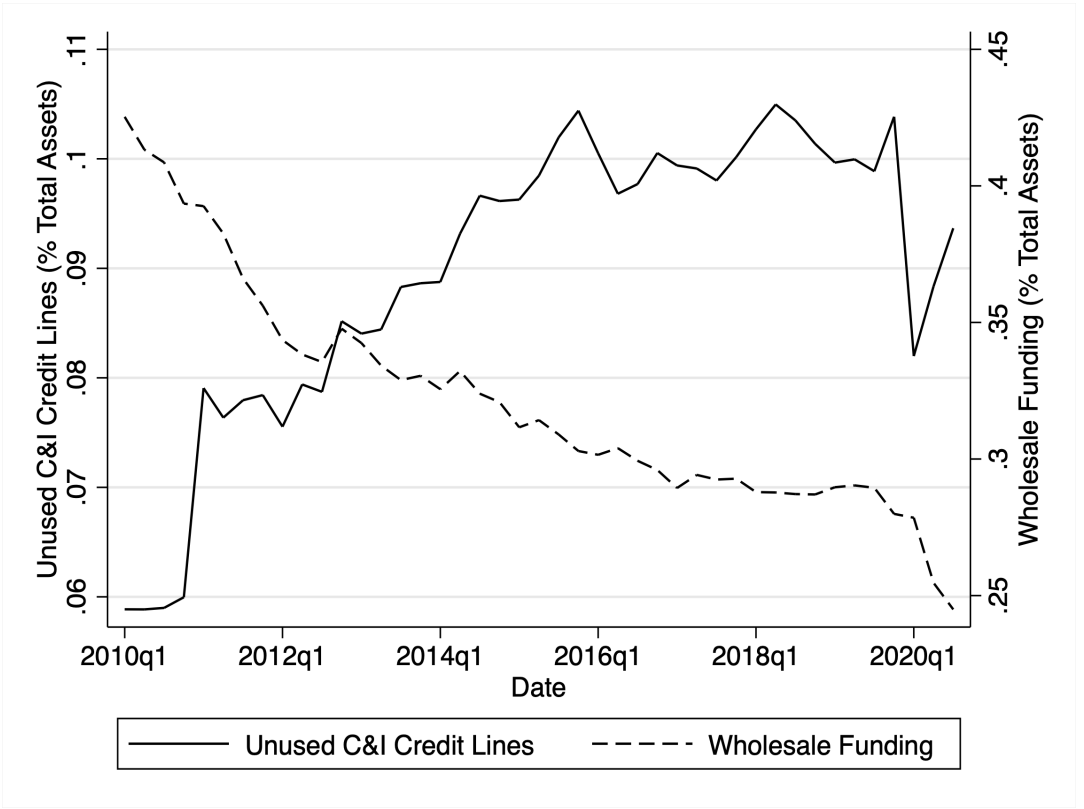
- *Wholesale Funding:* The sum of large time deposits, deposited booked in foreign offices, subordinated debt and debentures, gross federal funds purchased, repos and other borrowed money.

- *Liquidity*: The sum of cash, federal funds sold & reverse repos, and securities excluding MBS/ABS securities

$$Liquidity\ Risk = \frac{Unused\ commitments + Wholesale\ Funding - Liquidity}{Total\ Assets}$$

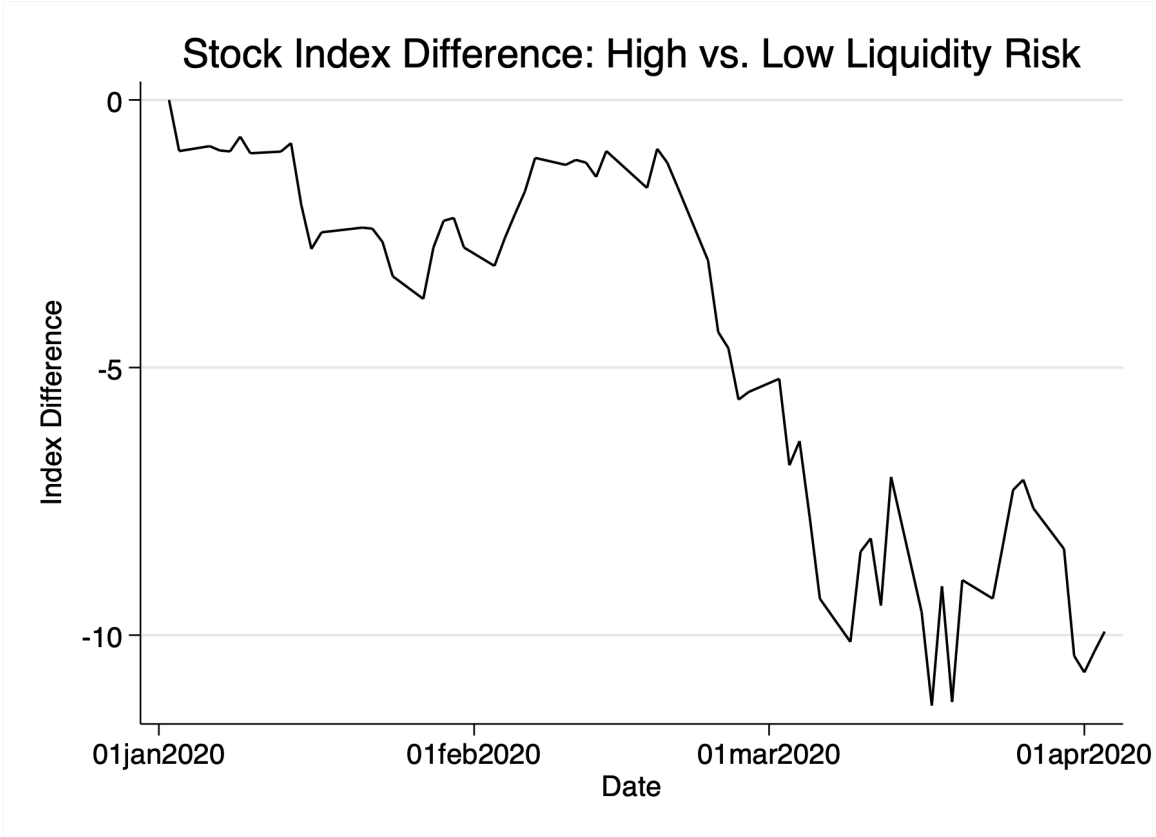
Bank balance-sheet liquidity risk: Q1 2010-Q3 2020

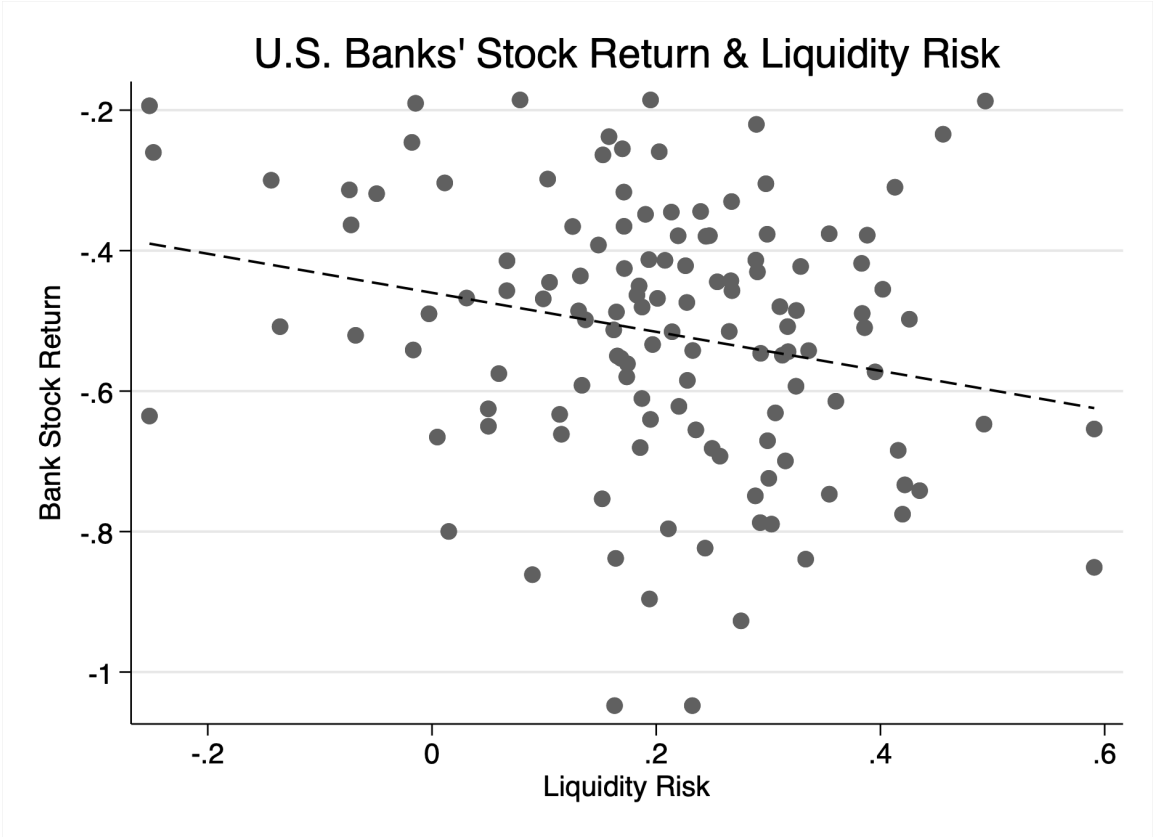




- Bank balance-sheet liquidity risk has increased since 2017
- … particularly because of unused commitments

Relative bank stock return crash explained by ex-ante liquidity risk





- Banks with high liquidity risk perform worse compared to other banks.

Methodology – Baseline tests (cross-section)

$$r_i = \alpha_i + \gamma LiquidityRisk_i + \sum \beta\, X_i + \varepsilon_i$$

- r_i is the excess return of bank *i*
- *X:* control variables (market beta, balance-sheet characteristics)
  - Key bank performance measures as to capitalization, asset quality, profitability, liquidity and investments (e.g., Fahlenbrach et al., 2012; Beltratti and Stulz, 2012)
- Sample period: Jan 1 – March 23 2020 (before Fed interventions)
- p-values reported in all tables

Baseline results: Jan 1 – March 23, 2020

	(1)	(2)	(3)	(4)
Liquidity Risk	-0.363***	-0.341*	-0.526**	-0.538**
	(0.003)	(0.072)	(0.010)	(0.016)
Controls	Equity beta	+ NPL/Loans, E/A, Non-Int Inc., Log(A), ROA, Deposits/Loans	+ Inc. Diversity, DtD, Loans/Assets, Deposits/Assets, Idio. Vola, Real Estate Beta,	+ Primary Dealer, Derivates/Assets
R-squared	0.243	0.334	0.392	0.392
Number obs.	127	127	127	127

- 1 std dev increase in Liquidity Risk -> 5% lower returns (7% of uncond. mean return)

Robustness: other exposures

	(1)	(2)	(3)	(4)	(5)
Liquidity Risk	-0.522**	-0.542**	-0.409*	-0.369*	-0.552**
	(0.010)	(0.016)	(0.051)	(0.082)	(0.014)
Credit Card Commitments /Assets	0.616				
	(0.120)				
Consumer Loans / Assets		0.0668			
		(0.878)			
Oil Exposures / Assets			-2.325***	-2.001***	
			(0.007)	(0.010)	
Other Sectoral Exposures / Assets				-6.326**	
				(0.050)	
SRISK / Assets					-8.209***
					(0.005)
Controls	Yes	Yes	Yes	Yes	Yes
R-squared	0.423	0.392	0.399	0.415	0.444
Number obs.	126	127	127	127	127

Summary of other tests

- Components of balance-sheet liquidity risk
- Episodic nature of balance-sheet liquidity risk
- Reversal of liquidity risk after fiscal and monetary support
- History repeats itself: Liquidity risk during the GFC

Understanding the mechanisms: ”funding channel” versus “capital channel”

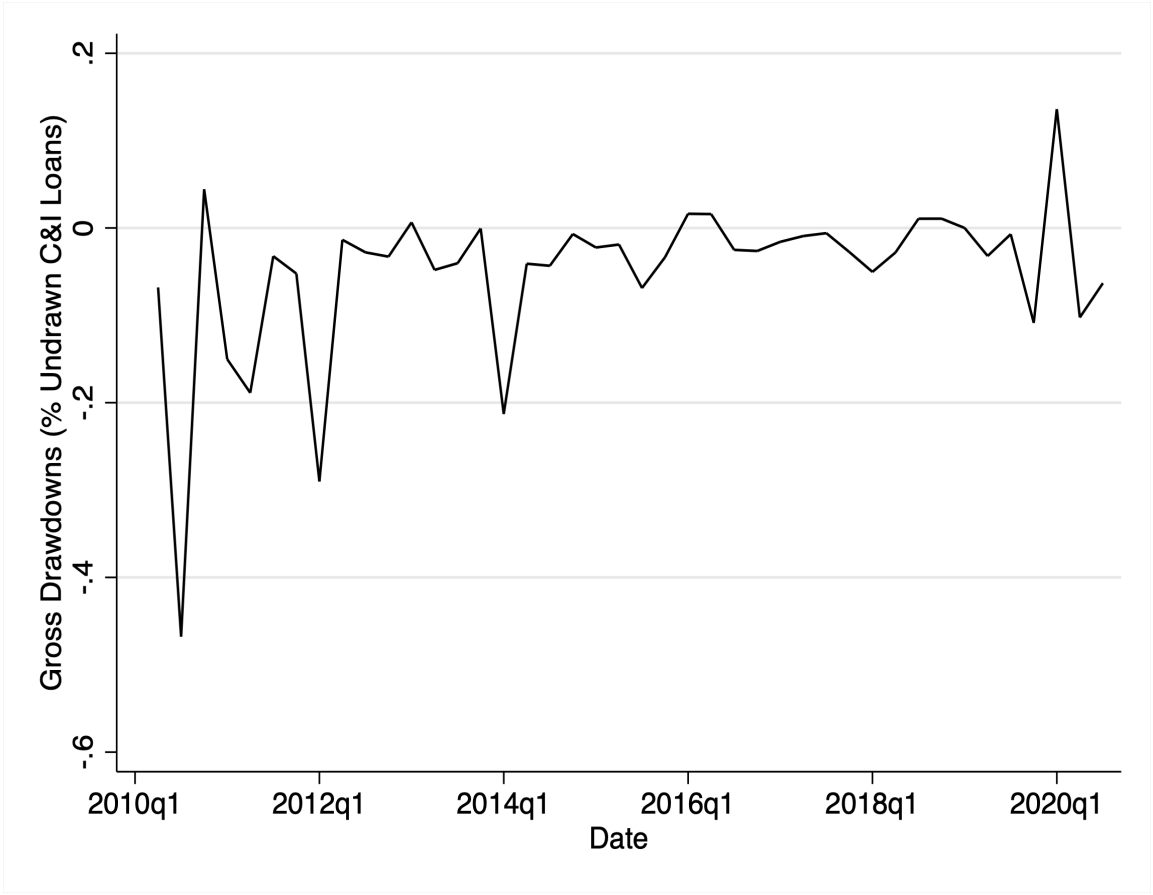
- Balance-sheet liquidity risk can explain stock returns in periods of aggregate risk.

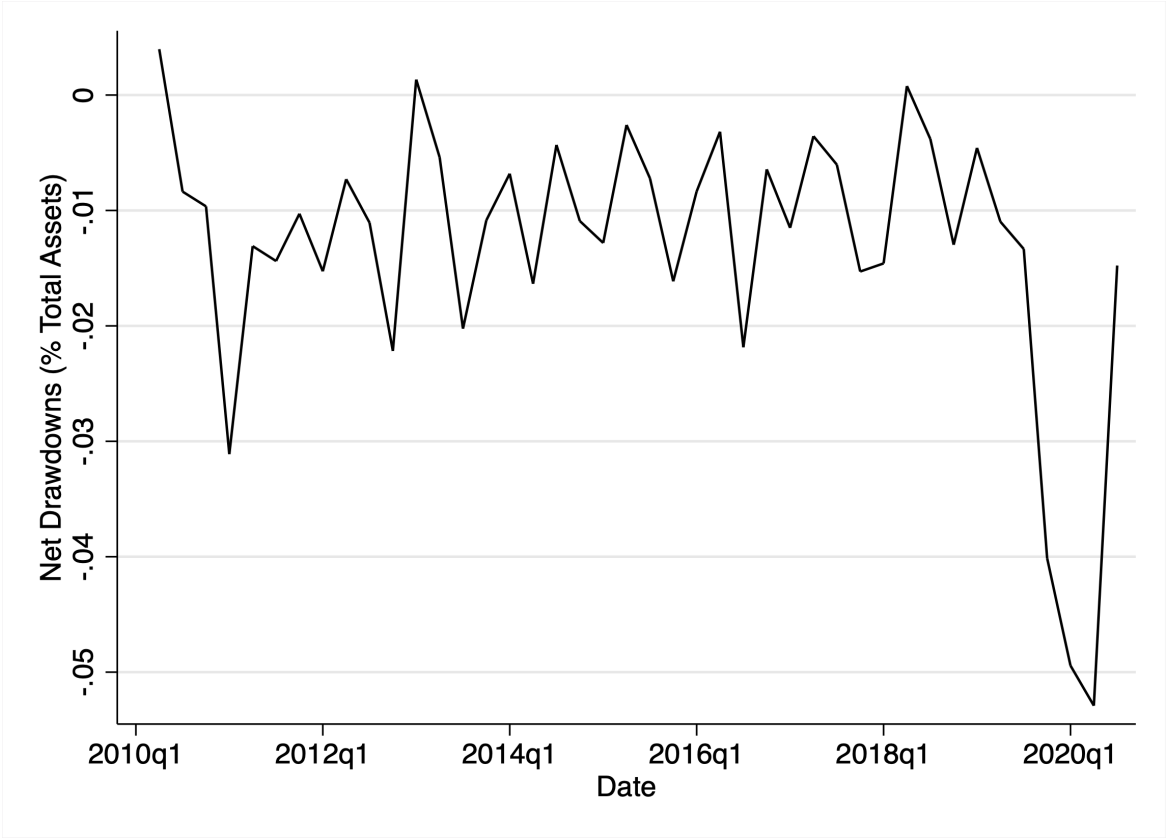
- What are the mechanisms?
  - “Funding channel” vs. “capital channel”

- *Gross Drawdowns:* % change of unused C&I credit lines Q4’19 –Q1’20

- *Net Drawdowns*: Change in unused C&I commitments minus the change in deposits (all relative to total assets)

Net vs. gross drawdowns





- Deposit inflows > drawdowns -> funding likely not the binding constraints for banks

Bank capital is binding constraint that drives banks‘ stock returns during COVID (3/1-3/23/2020)

	(1)	(2)	(3)	(4)	(5)
Net drawdowns	0.0926		0.219	0.128	0.0866
	(0.885)		(0.736)	(0.844)	(0.889)
Gross drawdowns		-4.457**	-4.593**	-3.929**	-4.172**
		(0.034)	(0.023)	(0.044)	(0.046)
Gross drawdowns x Capital Buffer				1.588*	
				(0.084)	
SRISK / Assets					-6.706*
					(0.071)
Controls	Yes	Yes	Yes	Yes	Yes
R-squared	0.353	0.378	0.379	0.393	0.424
Number obs.	127	127	127	127	127

- A one std. dev. increase in *Gross Drawdowns* reduces bank stock returns by about 4.2%

Methodology – Khwaja and Mian (2008) estimator (within syndicate)

$$Loan_{i,b,m} = \beta_1 \times Post + \beta_2 \times Exp_b \times Post + (\eta_i \times \eta_b \times \eta_m) + \varepsilon_{i,b,m}$$

- $Loan_{i,b,m,t}$, which is the loan amount (or number of loans) issued to firm *i* by bank *b* as loan-type *m* in month *t*.
- Exp_b: Gross or net drawdowns by bank *b*
- $(\eta_i \times \eta_b \times \eta_m)$: firm x bank x loan type fixed effect; panel collapsed into a pre- and post COVID period

Capital constrained banks reduce term lending, only those with more deposit inflows can provide commitments

	(1)	(2)	(3)	(4)	(5)
				Term Loans	Credit Lines
Post x Gross Drawdowns	-2.609***		-1.710**	-2.315*	-1.086
	(0.000)		(0.040)	(0.067)	(0.323)
Post x Net Drawdowns		-0.824***	-0.545**	-0.741	-0.548*
		(0.001)	(0.048)	(0.137)	(0.098)
Post	-0.342***	-0.419***	-0.377***	-0.315***	-0.416***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Borrower x Bank x Term Loan FE	Yes	Yes	Yes		
Borrower x Bank FE				Yes	Yes
R-squared	0.223	0.223	0.223	0.189	0.240
Number obs.	17944	17944	17944	5770	12174

- Dependent var: Log (1 + #loans); log(amount) as depend same results

Brief summary (key message)

- Balance-sheet liquidity risk of banks affects banks' stock prices during an aggregate economic downturn when firms' liquidity demand through credit line drawdowns becomes highly correlated, but not before.

- Balance-sheet liquidity risk of banks – mainly driven by undrawn credit lines – has severe implications on their ability to extend new loans because it requires capital once these credit lines are drawn.

- Can we quantify the required "contingent capital" that arises due to balance-sheet liquidity risk?

Contingent capital shortfall in a crisis

- Existing measures of stress tests do not account for the impact of banks' contingent liabilities in times of stress.
  - E.g., Acharya et al. (2012), Acharya et al. (2016), Brownlees and Engle (2017)

- Impact of aggregate drawdown risk can be decomposed into two components.

1. Off-balance-sheet (i.e., contingent) liabilities enter banks' balance sheets as loans and need to be funded with capital.

2. Account for the re-pricing of liquidity risk (γ, i.e., loading on *Liquidity Risk*)

"Contingent" capital shortfall in a systemic crisis ($SRISK^{CL}$)

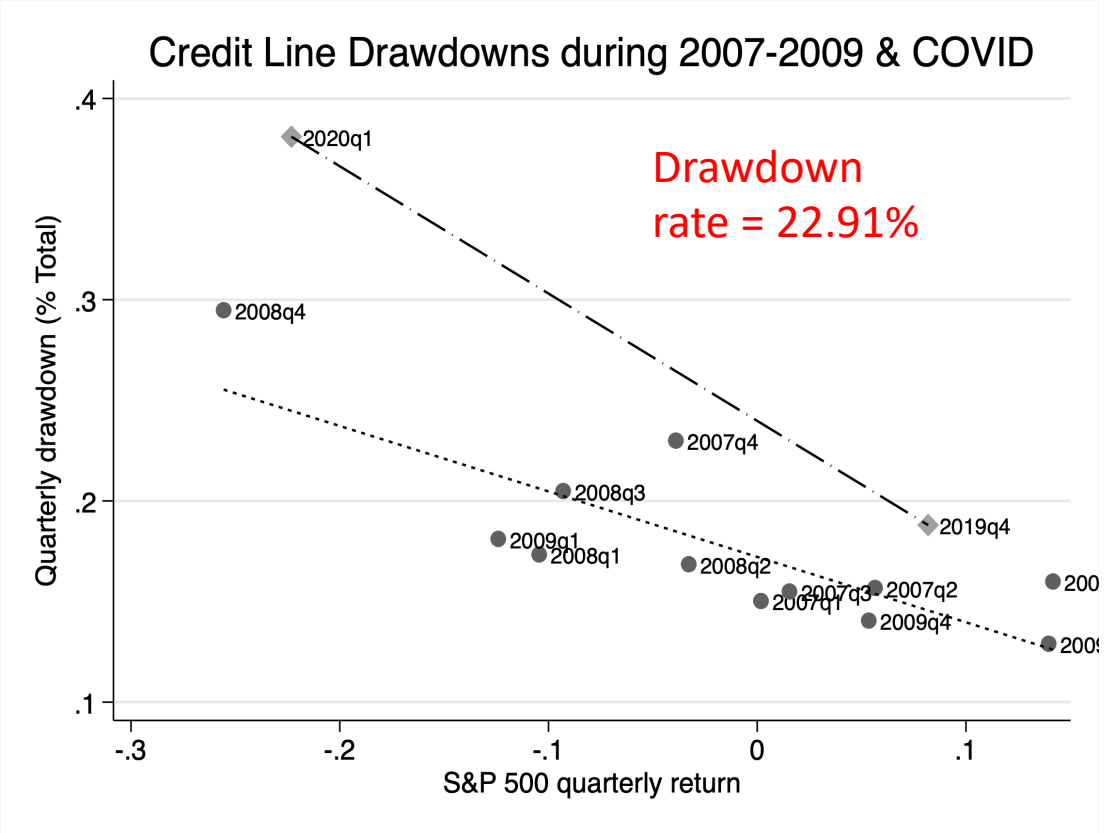
i. $Incremental\ SRISK_{i,t}^{CL}$ recognizes that drawdowns of credit lines in crisis states represent contingent liabilities of banks $(Debt_{i,t+h}|Crisis\ \neq Debt_{i,t}$):

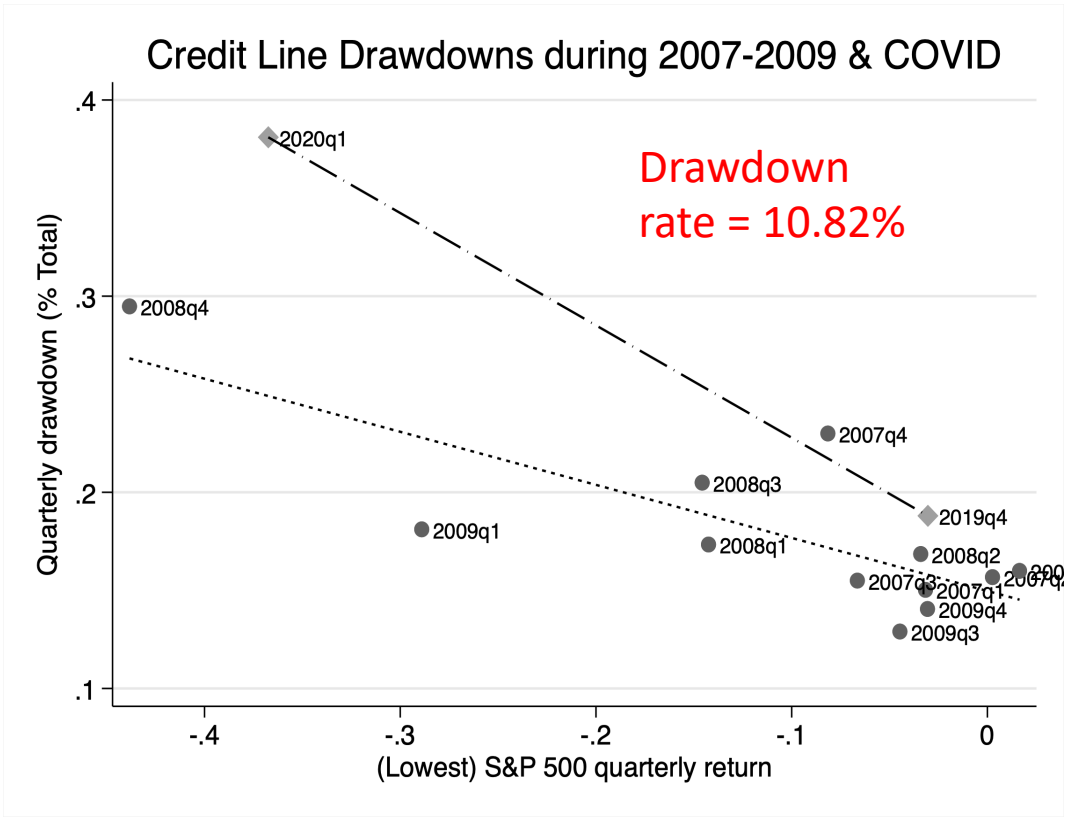
$$Incremental\ SRISK_{i,t}^{CL} = K\left[E\left[Debt_{i,t+h}|Crisis\right] - Debt_{i,t}\right]$$

$$= K \times E[Drawdown\ rate\ |\ Crisis]$$
$$\times Undrawn\ Credit\ Lines_{i,t}$$

- $E[Drawdown\ rate\ |\ Crisis]$ is estimated using past drawdown rates extrapolated for a market index fall of 40%

"Contingent" capital shortfall in a systemic crisis ($SRISK^{CL}$)





- $SRISK^{CL}$ is between $12bn and $27bn

"Contingent" capital shortfall in a systemic crisis ($SRISK^C$)

ii. $Incremental\ SRISK_{i,t}^{LRMES^C}$ recognizes that LRMES does not account for the episodic effect of balance-sheet liquidity risk of banks on stock returns:

$$Incremental\ SRISK_{i,t}^{LRMES^C} = (1-K)\times\Delta LRMES^C{}_{i,t}\times Equity_{i,t}$$

- where $\Delta LRMES^C{}_{i,t} = \hat{\gamma}\times Liquidity\ Risk_{i,t}$ and $\hat{\gamma}$ is the estimated coefficient from our tests on balance-sheet liquidity risk.

Incremental $SRISK^{LRMESC}$
Re-pricing of balance-sheet liquidity risk

Name	MV	Liquidity Risk	$LRMES^{Cmin}$	$LRMES^{Cmax}$	Incremental $SRISK^{LRMESC}$ $LRMES^{C}_{min}$	Incremental $SRISK^{LRMESC}$ $LRMES^{C}_{max}$
JPMORGAN CHASE & CO.	437,226	20.3%	6.9%	10.9%	30,276	47,766
BANK OF AMERICA CORPORATION	316,808	25.7%	8.8%	13.8%	27,761	43,799
WELLS FARGO & COMPANY	227,540	24.2%	8.2%	13.0%	18,768	29,610
CITIGROUP INC.	174,415	37.1%	12.6%	19.9%	22,047	34,784
U.S. BANCORP	92,603	46.3%	15.8%	24.9%	14,631	23,084
PNC FINANCIAL SERVICES GROUP, INC., THE	69,945	39.9%	13.6%	21.5%	9,514	15,011
M&T BANK CORPORATION	22,400	22.6%	7.7%	12.1%	1,724	2,720
FIFTH THIRD BANCORP	21,815	29.9%	10.2%	16.1%	2,222	3,506
KEYCORP	19,936	41.7%	14.2%	22.4%	2,834	4,472
CITIZENS FINANCIAL GROUP, INC.	17,654	46.1%	15.7%	24.8%	2,772	4,374
Total (Top 10 Banks)	1,400,341				132,550	209,126
Total (Vlab Banks)	1,601,754				149,543	235,935
Total (All Sample Banks)	1,756,619				158,024	249,316

- Overall, incremental SRISK as of Dec 31, 2019 is over $250bn.

Concluding Remarks

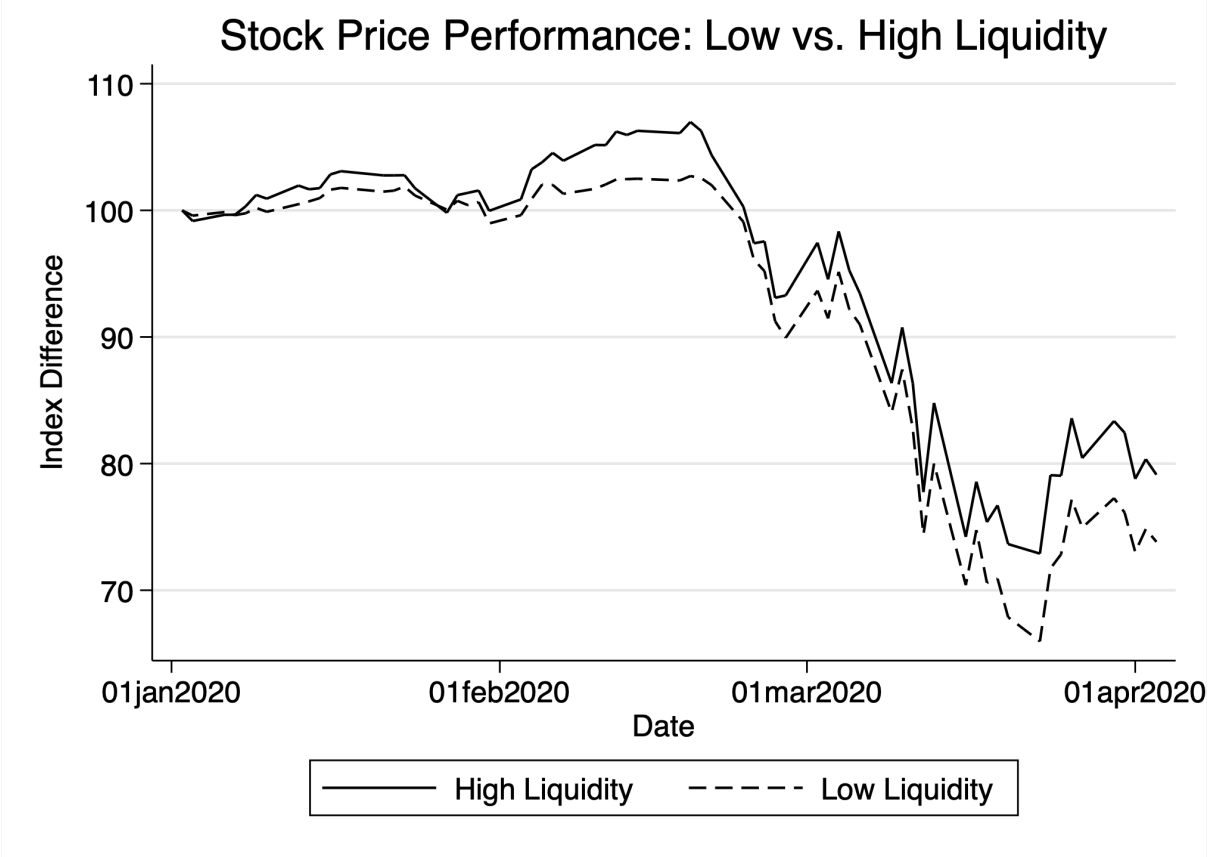
Conclusion

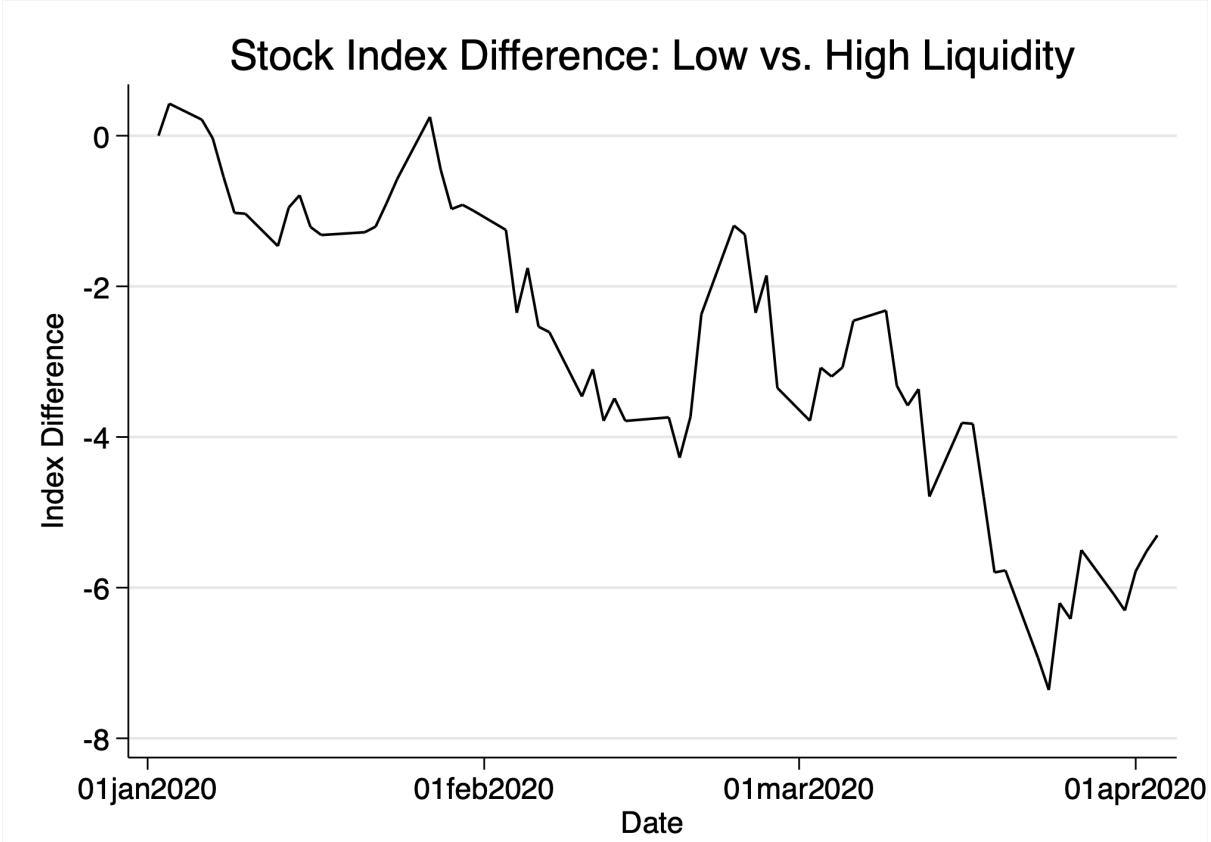
- Balance-sheet liquidity risk of banks episodically explains banks‘ stock returns.

- This occurs during an aggregate economic downturn when firms’ liquidity demand through credit line drawdowns becomes highly correlated.

- Firms with pre-arranged credit lines, however, are rewarded...

Firms with pre-arranged credit lines are rewarded





Conclusion (continued)

- Bank stock returns during the pandemic also co-move heavily with bank-level loan exposure to the oil sector & other affected sectors
  - Liquidity risk of banks' balance sheet remains a key factor in explaining bank stock prices

- Bank capital (rather than funding) appears to be the binding constraint.

- The episodic nature of credit line drawdowns and balance-sheet liquidity risk can be incorporated tractably into bank capital stress tests.

Appendix

Liquidity risk and bank stock returns

	(1)	(2)	(3)	(4)	(5)	(6)
	January 2020		February 2020		1/3-23/3/2020	
Liquidity Risk	-0.0254	-0.0521	-0.0000740	-0.0138	-0.338***	-0.472**
	(0.231)	(0.208)	(0.997)	(0.739)	(0.002)	(0.020)
Equity Beta	-0.0112	-0.0200	-0.0404***	-0.000248	-0.214***	-0.103
	(0.362)	(0.212)	(0.000)	(0.985)	(0.002)	(0.190)
Controls		Yes		Yes		Yes
R-squared	0.0167	0.157	0.113	0.282	0.211	0.359
Number obs.	127	127	127	127	127	127

- During the March 1st to 23rd period, liquidity risk emerges as a priced risk factor
- ... in an aggregate downturn with an increase in aggregate liquidity demand for credit lines of firms.

Components of liquidity risk

	(1)	(2)	(3)	(4)	(5)
Unused C&I Loans / Assets	-1.278***	-1.308***	-1.383***	-1.148**	-1.012**
	(0.002)	(0.002)	(0.001)	(0.013)	(0.043)
Liquidity / Assets		0.284	0.293	0.204	0.153
		(0.376)	(0.357)	(0.541)	(0.642)
Wholesale Funding / Assets			-0.349	-0.401	-0.349
			(0.430)	(0.376)	(0.440)
Equity Beta	-0.140**	-0.135*	-0.124*	-0.107	-0.122*
	(0.043)	(0.052)	(0.089)	(0.132)	(0.096)
Oil Exposure				-2.187***	-2.000**
				(0.009)	(0.012)
Other Sectoral Exposures					-4.763
					(0.194)
R-squared	0.386	0.390	0.393	0.417	0.425
Number obs.	127	127	127	127	127

Bank stock prices hardly recover but effect of liquidity risk somewhat reverses

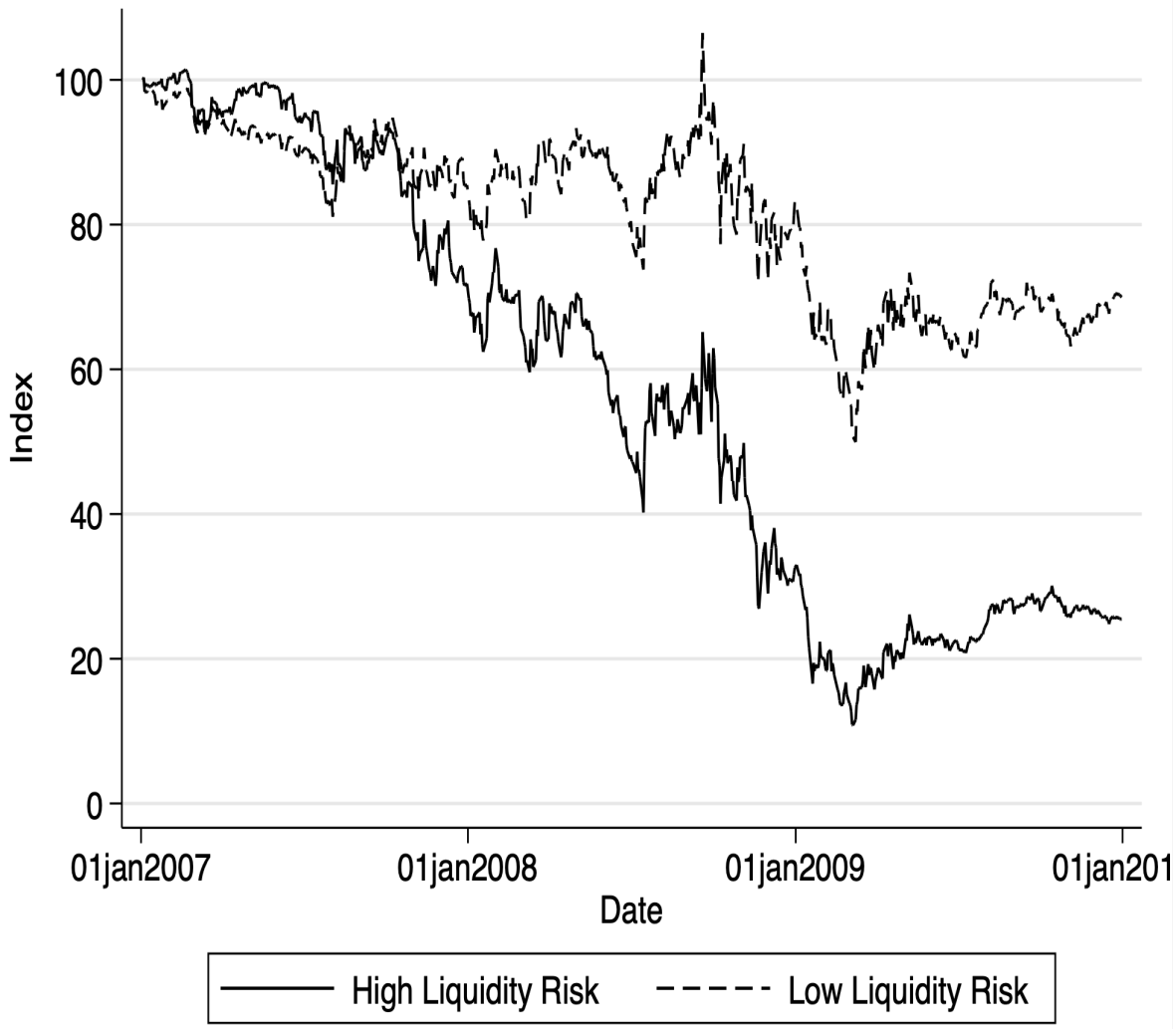
Panel A. Descriptive statistics of banks' stock returns

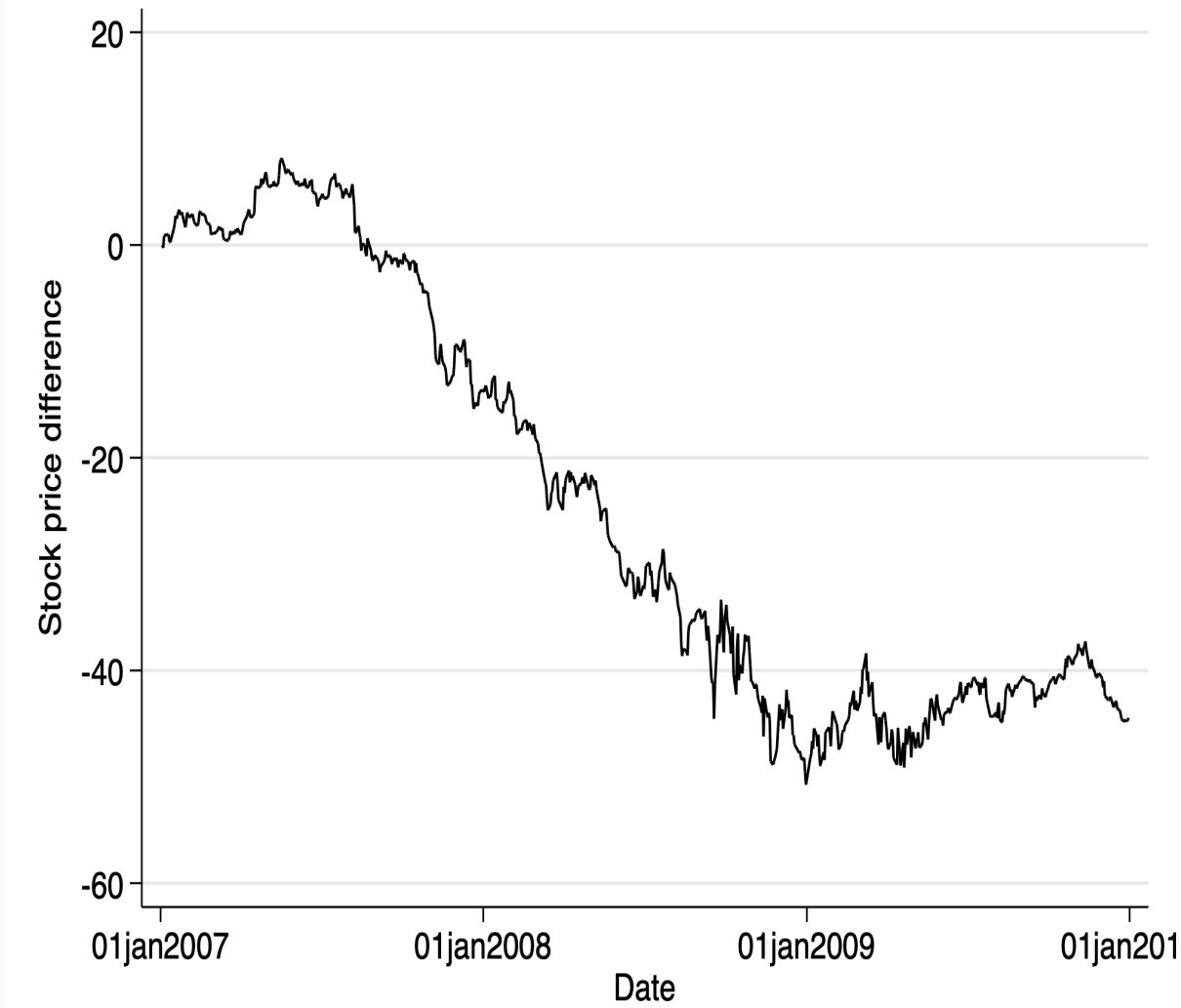
	Obs.	Mean	Std Dev	Min	Max
Return April 2020	127	.1140058	.0878647	-.0997281	.385558
Return May 2020	127	-.039326	.080453	-.4542235	.2228914
Return June 2020	127	.0119836	.0528534	-.1546759	.1514292
Return 3/24-6/30/2020	127	.1793604	.1639635	-.3437108	.6509989

Panel B. Pricing of liquidity risk

	(1)	(2)	(3)	(4)	(5)	(6)
	Apr 20	May 2020	June 2020		3/24/-6/30/2020	
Liquidity Risk	0.0876	0.0626	0.103*		0.349	
	(0.466)	(0.433)	(0.089)		(0.108)	
Unused C&I Loans / Assets				0.282**		1.048***
				(0.028)		(0.002)
Liquidity / Assets				-0.0920		0.0260
				(0.461)		(0.949)
Wholesale Funding / Assets				-0.0185		1.206***
				(0.908)		(0.004)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.284	0.275	0.154	0.174	0.304	0.358
Number obs.	127	127	127	127	127	127

History doesn’t exactly repeat itself, but it often rhymes (for banks)!





Liquidity risk and bank stock return during the Global Financial Crisis (2007-2009)

	(1) Q1 2007	(2) Q2 2007	(3) Q3 2007	(4) Q4 2007	(1) Q1 2008	(2) Q2 2008	(3) Q3 2008	(4) Q4 2008	(5) Q1 2009
Liquidity Risk	0.0118	-0.00262	**-0.0727**	**-0.153**	**-0.160**	**-0.262**	0.0469	-0.102	-0.00628
	(0.745)	(0.962)	**(0.046)**	**(0.002)**	**(0.017)**	**(0.000)**	(0.644)	(0.386)	(0.956)
Beta	-0.00720	-0.0117	0.0114	-0.0389	0.0377	-0.0707	0.0299	-0.0586	-0.149
	(0.612)	(0.588)	(0.439)	(0.167)	(0.073)	(0.008)	(0.336)	(0.080)	(0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.0303	0.0302	0.0843	0.173	0.0966	0.326	0.338	0.201	0.301
Number obs.	225	225	225	225	237	237	237	237	237

- Liquidity risk for banks ignited in Q3 2007, i.e., when ABCP market froze.
- No pricing of liquidity risk in bank stock returns after Fed measures

Components of *Liquidity Risk*

	(1) Q3 2007	(2) Q4 2007	(3) Q1 2008	(4) Q2 2008
Unused Commitments / Assets	**-0.222**	-0.0263	**-0.360**	-0.188
	(0.013)	(0.864)	**(0.000)**	(0.375)
Wholesale Funding / Assets	-0.0360	**-0.151**	-0.0436	**-0.162**
	(0.519)	**(0.037)**	(0.602)	**(0.077)**
Liquidity / Assets	0.0678	**0.277**	0.171	**0.523**
	(0.363)	**(0.002)**	(0.125)	**(0.000)**
Beta	0.0247	-0.0622	0.0355	-0.0779
	(0.108)	(0.030)	(0.087)	(0.003)
Controls	Yes	Yes	Yes	Yes
R-squared	0.104	0.221	0.123	0.339
Number obs.	225	225	237	237

- Co-movement of the components of *Liquidity Risk* might vary over time
- Holistic *Liquidity Risk* measure is useful -> otherwise force average effect across banks for individual components

Incremental $SRISK^{CL}$ – Contingent liability

Name	Unused C&I Commitments (USD mn)	Drawdown rate: 10.82%	Drawdown rate: 22.91%	Debt (USD mn)
JPMORGAN CHASE & CO.	273,278	2,365	5,009	2,496,125
BANK OF AMERICA CORPORATION	310,824	2,690	5,697	2,158,067
WELLS FARGO & COMPANY	198,316	1,717	3,635	1,748,234
CITIGROUP INC.	200,912	1,739	3,682	1,817,838
U.S. BANCORP	96,020	831	1,760	433,158
PNC FINANCIAL SERVICES GROUP, INC., THE	84,238	729	1,544	358,342
M&T BANK CORPORATION	9,260	80	170	109,692
FIFTH THIRD BANCORP	39,328	340	721	148,517
KEYCORP	33,070	286	606	129,380
CITIZENS FINANCIAL GROUP, INC.	33,682	292	617	142,497
	1,278,928	11,070	23,440	9,541,849
	1,434,367	12,416	26,289	10,759,335
	1,492,916	12,923	27,362	

$SRISK^C$
Incremental SRISK as of Dec 31, 2019 over $250 bn

Name	SRISK (Q4 2019) w/o neg SRISK	SRISK (Q4 2019) w/ neg SRISK	$SRISK^C_{min}$	$SRISK^C_m$
JPMORGAN CHASE & CO.	0	-27,848	32,641	52,775
BANK OF AMERICA CORPORATION	14,898	14,898	30,452	49,496
WELLS FARGO & COMPANY	24,425	24,425	20,485	33,245
CITIGROUP INC.	60,887	60,887	23,786	38,467
U.S. BANCORP	0	-19,352	15,462	24,843
PNC FINANCIAL SERVICES GROUP, INC., THE	0	-9,895	10,243	16,555
M&T BANK CORPORATION	0	-3,862	1,804	2,890
FIFTH THIRD BANCORP	2,067	2,067	2,562	4,227
KEYCORP	299	299	3,121	5,078
CITIZENS FINANCIAL GROUP, INC.	3,005	3,005	3,064	4,991
Total (Top 10 Banks)	105,581	44,623	143,621	232,566
Total (Vlab Banks)	111,135	36,680	161,958	262,224
Total (All Sample Banks)			170,947	276,678