Why did bank stocks crash during COVID-19?

August 31, 2023

Online Appendix

(Not for publication)

Table of Content

Appendix A. Reversal of Credit Line Drawdowns

To investigate the effect of credit risk on corporate cash holdings during the COVID-19 pandemic, we construct a sample of all publicly listed U.S. firms, for which financial variables are available at the end of 2019 in Capital IQ. We drop financial firms and utilities and firms with total assets below US$100 million at the end of 2019. Our final sample comprises 1,971 U.S. nonfinancial firms. We construct the sample following Acharya and Steffen (2020a).

We use quarterly debt capital structure data from CapitalIQ and investigate changes in different debt capital structure components during Q4 2019 and Q4 2020 (Table A.1) and quarterly from Q4 2019 to Q3 2020 (Table A.2). Specifically, we inspect the following: drawn credit lines (*Drawn CL/Assets*), credit line usage (*Drawn CL/(Drawn CL + Undrawn CL)*), bond debt (*Bonds /Assets*), term loans (*Term loans/Assets*), total debt (*Total Debt / Assets*), and preference for cash (*Cash / (Cash + Undrawn CL)*).

Table A.1. Descriptive statistics of firm's capital structure (Q4 2019 vs. Q3 2020)

	Q4 2019	Q3 2020	Delta	t-stat
A. Full sample				
Drawn CL / (Drawn CL + Undrawn CL)	0.188	0.193	0.005	-1.469
Drawn CL / Assets	0.036	0.033	-0.003	2.874***
Bonds / Assets	0.156	0.166	0.01	-4.589***
Term Loans / Assets	0.078	0.070	-0.008	4.761***
Total Debt / Assets	0.344	0.355	0.011	-5.153***
Cash / (Cash + Undrawn CL)	0.497	0.580	0.083	-16.892***
B. AAA-A rated firms				
Drawn CL / (Drawn CL + Undrawn CL)	0.031	0.027	-0.004	0.394
Drawn CL / Assets	0.003	0.002	-0.001	1.445
Bonds / Assets	0.299	0.308	0.009	-0.894
Term Loans / Assets	0.007	0.007	0	0.386
Total Debt / Assets	0.349	0.363	0.014	-2.647***
Cash / (Cash + Undrawn CL)	0.498	0.548	0.05	-2.723***
C. BBB rated firms				
Drawn CL / (Drawn CL + Undrawn CL)	0.072	0.079	0.007	-0.412
Drawn CL / Assets	0.011	0.010	-0.001	0.531
Bonds / Assets	0.274	0.290	0.016	-3.395***
Term Loans / Assets	0.017	0.018	0.001	-0.357
Total Debt / Assets	0.356	0.372	0.016	-4.641***
Cash / (Cash + Undrawn CL)	0.333	0.437	0.104	-8.574***
D. NonIG rated firms				
Drawn CL / (Drawn CL + Undrawn CL)	0.162	0.215	0.053	-3.706***
Drawn CL / Assets	0.033	0.036	0.003	-1.57
Bonds / Assets	0.235	0.246	0.011	-2.042**
Term Loans / Assets	0.142	0.132	-0.01	3.264***
Total Debt / Assets	0.482	0.499	0.017	-3.861***
Cash / (Cash + Undrawn CL)	0.363	0.482	0.119	-10.894***
E. Unrated firms				
Drawn CL / (Drawn CL + Undrawn CL)	0.259	0.237	-0.022	1.303
Drawn CL / Assets	0.046	0.040	-0.006	4.227***
Bonds / Assets	0.080	0.089	0.009	-3.139***
Term Loans / Assets	0.070	0.061	-0.009	3.775***
Total Debt / Assets	0.280	0.286	0.006	-2.241**
Cash / (Cash + Undrawn CL)	0.592	0.658	0.066	-10.344***

Table A.2. Descriptive statistics of firm's capital structure (Q4 2019 to Q3 2020)

Panel A. Full sample

Variable	Mean	Std dev	Min	Max
Drawn CL / (Drawn CL + Undrawn CL) - Q4 2019	0.188	0.269	0.000	1.000
Drawn CL / (Drawn CL + Undrawn CL) - Q1 2020	0.381	0.353	0.000	1.000
Drawn CL / (Drawn CL + Undrawn CL) - Q2 2020	0.277	0.332	0.000	1.000
Drawn CL / (Drawn CL + Undrawn CL) - Q3 2020	0.193	0.288	0.000	1.000
Drawn CL / Assets - Q4 2019	0.036	0.073	0.000	0.355
Drawn CL / Assets - Q1 2020	0.058	0.086	0.000	0.400
Drawn CL / Assets - Q2 2020	0.046	0.081	0.000	0.396
Drawn CL / Assets - Q3 2020	0.033	0.069	0.000	0.340
Bonds / Assets - Q4 2019	0.156	0.192	0.000	0.909
Bonds / Assets - Q1 2020	0.158	0.194	0.000	0.923
Bonds / Assets - Q2 2020	0.167	0.198	0.000	0.873
Bonds / Assets - Q3 2020	0.166	0.198	0.000	0.855
Term Loans / Assets - Q4 2019	0.078	0.134	0.000	0.645
Term Loans / Assets - Q1 2020	0.078	0.132	0.000	0.617
Term Loans / Assets - Q2 2020	0.078	0.131	0.000	0.598
Term Loans / Assets - Q3 2020	0.070	0.124	0.000	0.565
Total Debt / Assets - Q4 2019	0.344	0.229	0.002	1.134
Total Debt / Assets - Q1 2020	0.370	0.240	0.002	1.180
Total Debt / Assets - Q2 2020	0.368	0.243	0.002	1.242
Total Debt / Assets - Q3 2020	0.355	0.241	0.002	1.228
Cash / (Cash + Undrawn CL) - Q4 2019	0.497	0.344	0.002	1.000
Cash / (Cash + Undrawn CL) - Q1 2020	0.608	0.333	0.005	1.000
Cash / (Cash + Undrawn CL) - Q2 2020	0.593	0.329	0.004	1.000
Cash / (Cash + Undrawn CL) - Q3 2020	0.580	0.331	0.006	1.000

Panel B. AAA-A rated firms

Variable	Mean	Std dev	Min	Max
Drawn CL / (Drawn CL + Undrawn CL) - Q4 2019	0.031	0.113	0.000	0.911
Drawn CL / (Drawn CL + Undrawn CL) - Q1 2020	0.156	0.290	0.000	1.000
Drawn CL / (Drawn CL + Undrawn CL) - Q2 2020	0.069	0.195	0.000	0.958
Drawn CL / (Drawn CL + Undrawn CL) - Q3 2020	0.027	0.085	0.000	0.445
Drawn CL / Assets - Q4 2019	0.003	0.014	0.000	0.125
Drawn CL / Assets - Q1 2020	0.013	0.028	0.000	0.142
Drawn CL / Assets - Q2 2020	0.007	0.023	0.000	0.147
Drawn CL / Assets - Q3 2020	0.002	0.008	0.000	0.053
Bonds / Assets - Q4 2019	0.299	0.154	0.000	0.754
Bonds / Assets - Q1 2020	0.308	0.151	0.000	0.781
Bonds / Assets - Q2 2020	0.319	0.138	0.011	0.779
Bonds / Assets - Q3 2020	0.308	0.133	0.000	0.770
Term Loans / Assets - Q4 2019	0.007	0.017	0.000	0.108
Term Loans / Assets - Q1 2020	0.008	0.019	0.000	0.145
Term Loans / Assets - Q2 2020	0.007	0.013	0.000	0.058
Term Loans / Assets - Q3 2020	0.007	0.013	0.000	0.060
Total Debt / Assets - Q4 2019	0.349	0.145	0.046	0.753
Total Debt / Assets - Q1 2020	0.369	0.147	0.045	0.757
Total Debt / Assets - Q2 2020	0.376	0.135	0.062	0.757
Total Debt / Assets - Q3 2020	0.363	0.130	0.057	0.754
Cash / (Cash + Undrawn CL) - Q4 2019	0.498	0.322	0.002	1.000
Cash / (Cash + Undrawn CL) - Q1 2020	0.585	0.308	0.005	1.000
Cash / (Cash + Undrawn CL) - Q2 2020	0.564	0.296	0.004	1.000
Cash / (Cash + Undrawn CL) - Q3 2020	0.548	0.304	0.006	1.000

Panel C. BBB rated firms

Variable	Mean	Std dev	Min	Max
Drawn CL / (Drawn CL + Undrawn CL) - Q4 2019	0.072	0.165	0.000	1.000
Drawn CL / (Drawn CL + Undrawn CL) - Q1 2020	0.235	0.285	0.000	1.000
Drawn CL / (Drawn CL + Undrawn CL) - Q2 2020	0.129	0.241	0.000	1.000
Drawn CL / (Drawn CL + Undrawn CL) - Q3 2020	0.079	0.182	0.000	1.000
Drawn CL / Assets - Q4 2019	0.011	0.039	0.000	0.344
Drawn CL / Assets - Q1 2020	0.030	0.053	0.000	0.400
Drawn CL / Assets - Q2 2020	0.019	0.046	0.000	0.396
Drawn CL / Assets - Q3 2020	0.010	0.026	0.000	0.240
Bonds / Assets - Q4 2019	0.274	0.136	0.000	0.909
Bonds / Assets - Q1 2020	0.279	0.138	0.000	0.923
Bonds / Assets - Q2 2020	0.292	0.141	0.000	0.873
Bonds / Assets - Q3 2020	0.290	0.146	0.000	0.855
Term Loans / Assets - Q4 2019	0.017	0.035	0.000	0.203
Term Loans / Assets - Q1 2020	0.022	0.042	0.000	0.286
Term Loans / Assets - Q2 2020	0.021	0.038	0.000	0.221
Term Loans / Assets - Q3 2020	0.018	0.036	0.000	0.232
Total Debt / Assets - Q4 2019	0.356	0.145	0.048	1.001
Total Debt / Assets - Q1 2020	0.381	0.148	0.075	1.034
Total Debt / Assets - Q2 2020	0.382	0.148	0.064	1.040
Total Debt / Assets - Q3 2020	0.372	0.145	0.054	1.017
Cash / (Cash + Undrawn CL) - Q4 2019	0.333	0.254	0.002	1.000
Cash / (Cash + Undrawn CL) - Q1 2020	0.439	0.269	0.015	1.000
Cash / (Cash + Undrawn CL) - Q2 2020	0.446	0.267	0.004	1.000
Cash / (Cash + Undrawn CL) - Q3 2020	0.437	0.268	0.006	1.000

Panel D. NonIG rated firms

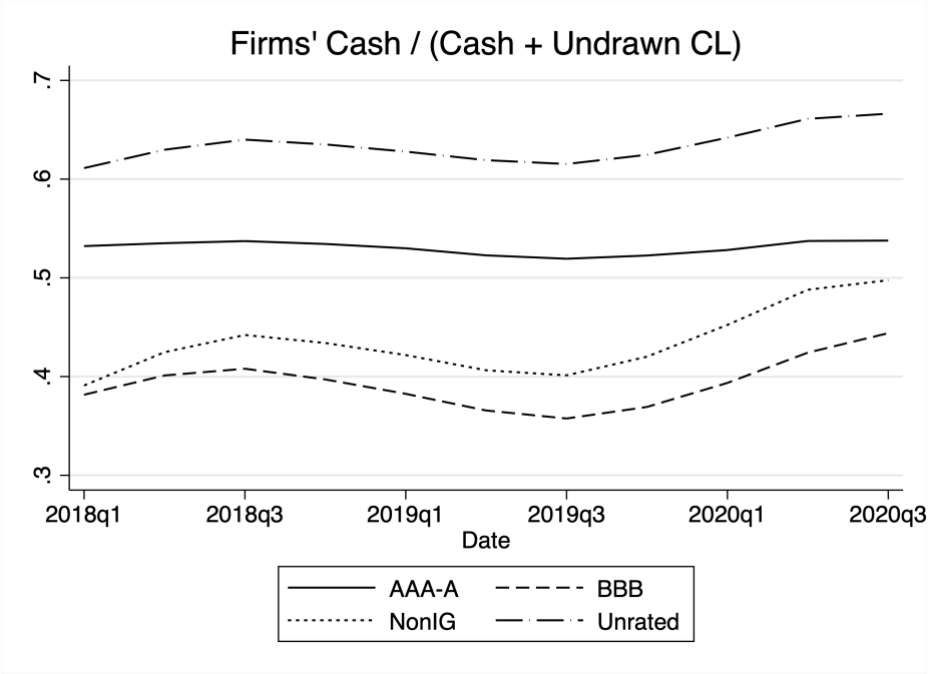
Variable	Mean	Std dev	Min	Max
Drawn CL / (Drawn CL + Undrawn CL) - Q4 2019	0.162	0.241	0.000	1.000
Drawn CL / (Drawn CL + Undrawn CL) - Q1 2020	0.443	0.353	0.000	1.000
Drawn CL / (Drawn CL + Undrawn CL) - Q2 2020	0.310	0.335	0.000	1.000
Drawn CL / (Drawn CL + Undrawn CL) - Q3 2020	0.215	0.301	0.000	1.000
Drawn CL / Assets - Q4 2019 n	0.033	0.066	0.000	0.355
Drawn CL / Assets - Q1 2020	0.067	0.078	0.000	0.400
Drawn CL / Assets - Q2 2020	0.048	0.071	0.000	0.396
Drawn CL / Assets - Q3 2020	0.036	0.068	0.000	0.340
Bonds / Assets - Q4 2019	0.235	0.187	0.000	0.909
Bonds / Assets - Q1 2020	0.236	0.190	0.000	0.923
Bonds / Assets - Q2 2020	0.252	0.199	0.000	0.873
Bonds / Assets - Q3 2020	0.246	0.199	0.000	0.855
Term Loans / Assets - Q4 2019	0.142	0.157	0.000	0.645
Term Loans / Assets - Q1 2020	0.141	0.157	0.000	0.617
Term Loans / Assets - Q2 2020	0.141	0.156	0.000	0.598
Term Loans / Assets - Q3 2020	0.132	0.150	0.000	0.565
Total Debt / Assets - Q4 2019	0.482	0.198	0.051	1.134
Total Debt / Assets - Q1 2020	0.518	0.205	0.059	1.180
Total Debt / Assets - Q2 2020	0.518	0.215	0.058	1.242
Total Debt / Assets - Q3 2020	0.499	0.217	0.053	1.228
Cash / (Cash + Undrawn CL) - Q4 2019	0.363	0.263	0.002	1.000
Cash / (Cash + Undrawn CL) - Q1 2020	0.540	0.320	0.005	1.000
Cash / (Cash + Undrawn CL) - Q2 2020	0.500	0.311	0.004	1.000
Cash / (Cash + Undrawn CL) - Q3 2020	0.482	0.302	0.006	1.000

Panel E. Unrated firms

Variable	Mean	Std dev	Min	Max
Drawn CL / (Drawn CL + Undrawn CL) - Q4 2019	0.259	0.300	0.000	1.000
Drawn CL / (Drawn CL + Undrawn CL) - Q1 2020	0.415	0.356	0.000	1.000
Drawn CL / (Drawn CL + Undrawn CL) - Q2 2020	0.329	0.345	0.000	1.000
Drawn CL / (Drawn CL + Undrawn CL) - Q3 2020	0.237	0.307	0.000	1.000
Drawn CL / Assets - Q4 2019	0.046	0.083	0.000	0.355
Drawn CL / Assets - Q1 2020	0.065	0.096	0.000	0.400
Drawn CL / Assets - Q2 2020	0.055	0.091	0.000	0.396
Drawn CL / Assets - Q3 2020	0.040	0.078	0.000	0.340
Bonds / Assets - Q4 2019	0.080	0.171	0.000	0.909
Bonds / Assets - Q1 2020	0.082	0.172	0.000	0.923
Bonds / Assets - Q2 2020	0.087	0.175	0.000	0.873
Bonds / Assets - Q3 2020	0.089	0.176	0.000	0.855
Term Loans / Assets - Q4 2019	0.070	0.132	0.000	0.645
Term Loans / Assets - Q1 2020	0.069	0.129	0.000	0.617
Term Loans / Assets - Q2 2020	0.070	0.127	0.000	0.598
Term Loans / Assets - Q3 2020	0.061	0.119	0.000	0.565
Total Debt / Assets - Q4 2019	0.280	0.236	0.002	1.134
Total Debt / Assets - Q1 2020	0.303	0.248	0.002	1.180
Total Debt / Assets - Q2 2020	0.299	0.250	0.002	1.242
Total Debt / Assets - Q3 2020	0.286	0.248	0.002	1.228
Cash / (Cash + Undrawn CL) - Q4 2019	0.592	0.362	0.002	1.000
Cash / (Cash + Undrawn CL) - Q1 2020	0.677	0.334	0.005	1.000
Cash / (Cash + Undrawn CL) - Q2 2020	0.670	0.331	0.004	1.000
Cash / (Cash + Undrawn CL) - Q3 2020	0.658	0.337	0.006	1.000

Figure A.1. Preference for cash

This figure shows the median Cash / (Cash + Undrawn CL) ratio (panel B) of U.S. nonfinancial firms over the Q1 2018 to Q3 2020 period.



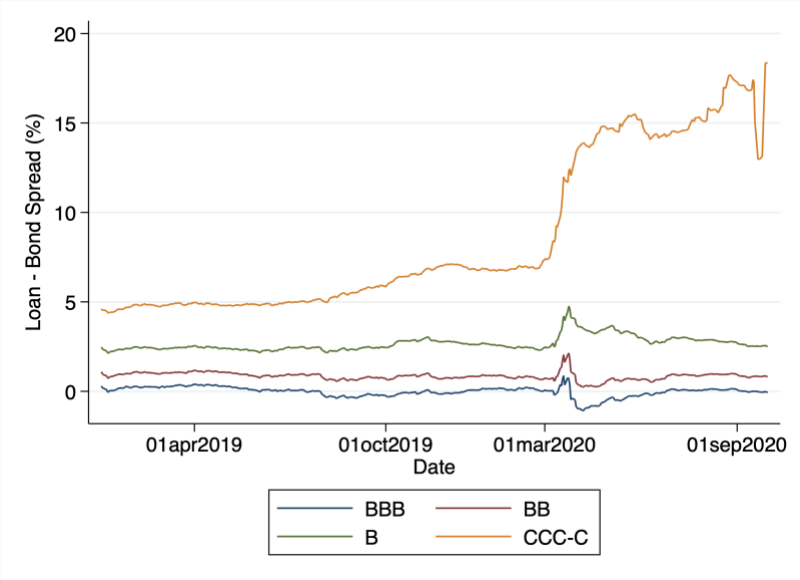
Preference for cash has increased / remained high during the 3 quarters in 2020, particularly of lower rated and unrated firms.

Appendix B. Loan versus bond spreads

This figure shows the time-series difference of loan and bond spreads (Figure B.1.) and splitting loans by rating classes (Figure B.2.). The loan spread is calculated based on Saunders et al. (2021). The sample is based on all loans traded in 2020 that were traded in the U.S. Leveraged Loan Index (LLI) obtained from Leveraged Commentary and Data (LCD) and matched to secondary loan market trading data from Refinitiv. The sample thus comprises about 1,000 U.S. non-financial firms. 3% of the observations are unrated (based on S&P ratings), 25% are CCC-C rated, 54% are B rated, 15% BB rated and 3% BBB rated. Loans with a "D" rating are dropped from the sample (35 firms). Loan spreads are constructed using a weighted average (with facility amounts as weights). Bond spreads are constructed based on Gilchrist and Zakrajšek (2012) and obtained from the Federal Reserve website.

Figure B.1. Loan-bond-spread difference

Figure B.2. Loan-bond-spread difference (by rating)



Appendix C. Discussion

Finally, we discuss the robustness of our results and its extensions along several dimensions in section 8 in the main body of the paper. (1) Alternative liquidity proxies used in the literature; (2) pricing of contingent drawdown options through credit line fees; (3) the role of covenants during the pandemic; and (4) repayment of credit lines after fiscal and monetary interventions.

C.1. Constructing our liquidity proxies

In Online Appendix D.1 , we discuss provide a more extensive discussion of the different liquidity proxies used in the literature.

A. Berger and Bouwman (2009) liquidity creation measure

To replicate the Berger-Bouwman (2009) measure on liquidity creation using FR Y-9C data, we apply the data mapping available in Berger et al. (2020).[1] Individual on- and off-balance sheet items are aggregated and weighted in line with the classification provided by Berger & Bouwman (2009). Finally, the weighted positions are combined to the aggregate liquidity creation measure for each bank holding company. Note that we only replicate Berger & Bouwman's so-called "catfat" measure, which is constructed by classifying balance sheet items by category (see Berger & Bouwman, 2009) and includes on- as well as off-balance sheet positions.

B. Bai et al. (2018) liquidity risk measure (LMI)

To construct the Bai et al. (2018) liquidity mismatch index (LMI), we use information provided in the paper's Online Appendix together with the FR Y-9C call report template for 2019Q4 to map all balance sheet items, except deposits, to the variables in our dataset. The deposit data is constructed in line with the approach outlined in Bai et al. (2018), using FFIEC 031 call report data for commercial banks aggregated for the respective parent bank holding company.[2]

[1] Berger, A.N., C.H.S. Bouwman, B. Imbierowicz and C. Rauch (2020), How are banks special? – Let me count the ways.

[2] We thank Jennie Bai for detailed guidance how to construct their measure.

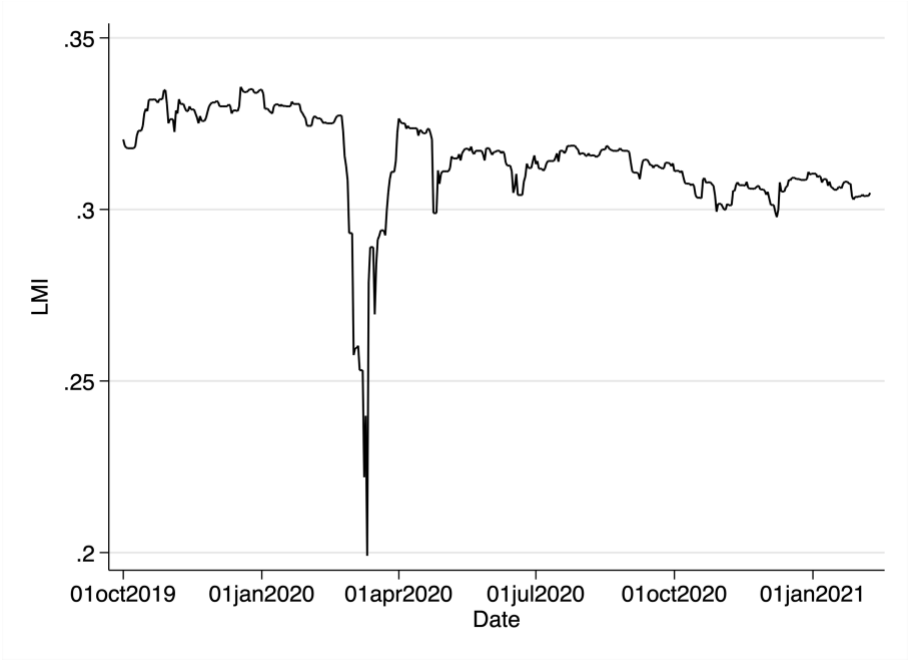
Commercial banks and bank holding companies are matched with the help of the FSSD's relationship table. We consider a bank holding company to be a commercial bank's parent, if their relationship exists at least until 31 December 2019.

In the next step, we calculate the asset and liability weights per category as indicated in Bai et al. (2018) using the parameters and estimates provided by the authors. Accordingly, haircut values as well as the magnitude of the Frist Principal Component used in constructing our measure are averages taken from Bai et al. (2018). As described in the main text of the paper, we use two different proxies for the liquidity premium μ_t, which is defined as the OIS - 3m Treasury Bill spread. We create the LMIs using the worst liquidity condition in March 2020 (*LMI – 2020*). We weigh the aggregate positions with the respective asset/liability weight to calculate the liquidity risk measure per bank holding company.

The LMI measure is constructed as of Q4 2019. We also construct a time-series LMI measure using a daily adjusting liquidity weight. We plot the time-series in Figure D.1. below. Liquidity risk increases significantly in March 2020 within a few days and then returned almost to a pre-COVID-19 level when monetary and fiscal policy measures have been implemented.

Figure C.1. Dynamic LMI during COVID-19

Figure C.1. plots the times-series LMI measure using a daily adjusted OIS-3m Treasury spread measure as liquidity weight.



Appendix D. Time-series evidence for bank returns link to drawdowns

Our cross-sectional results linking bank stock returns to bank-level exposure to credit-line drawdowns also has a time-series counterpart. Using time-series regressions, we find that aggregate drawdowns can explain bank stock returns with high *ex-ante* exposure to *Liquidity Risk* during the March 1, 2020 to March 23, 2020 period. We run the following time-series regression[3]:

$$r_{i,t} = \beta_0 + \gamma \left[Liquidity\ Risk_i \times Log(DD)_{i,t}\right] + \beta_m r_{m,t} + \beta_{HML} HML_t + \beta_{SMB} SMB_t + \mu_i + \varepsilon_{i,t} \quad (2)$$

We interact *Liquidity Risk* with the natural logarithm of the realized daily aggregate credit-line drawdowns (*Log(DD)*). $r_{i,t}$ is the daily bank excess return, $r_{m,t}$ is the daily market excess return, *HML* (high minus low) and *SML* (small minus large) are the Fama-French factors; μ_i are bank fixed effects. We use Newey–West standard errors. The results are reported in Table D.1.

Column 1 shows the impact of total aggregate credit-line drawdowns. Bank (daily) stock returns are significantly lower when aggregate drawdowns in the economy increase and banks have more balance-sheet liquidity risk. We then disaggregate credit-line drawdowns across BBB-rated firms (column (2)), non-investment-grade rated firms (column (3)) and unrated firms (column (4)).[4] Stock returns for banks with greater liquidity risk are lower, particularly when drawdowns of riskier firms accelerate. Overall, both our cross-sectional and time-series tests suggest that bank balance-sheet liquidity risk can episodically affect bank stock returns, emerging in an aggregate downturn due to an increased aggregate demand for drawing down bank credit lines.

[3] We also run a pooled cross-sectional regression using OLS and standard errors clustered at the bank level. The results remain unchanged.

[4] Due to the high correlations between cumulative credit-line drawdowns across different rating classes, common variance inflator tests reject using them together in a single regression.

Table D.1. Time-series relationship of bank stock returns and liquidity risk (Daily drawdown sample)

This table reports the results of the regression of U.S. banks' daily stock returns on *Liquidity Risk* interacted with natural logarithm of cumulative drawdowns from credit lines by U.S. firms until this day over the 1 – 23 March 20201 period. We include all firms (column (1)), the BBB-rated firms only (column (2)), then focus on non-investment grade rated firms (column (3)) and then on unrated firms (column (4)). We also include the daily market access return (r_m), *HML* and *SMB* as well as bank fixed effects; standard errors are Newey–West.

	(1)	(2)	(3)	(4)
		3/1-3/23/2020		
Liquidity Risk x Log(DD)	-0.00862***			
	(0.001)			
Liquidity Risk x Log(DD^{BBB})		-0.00221**		
		(0.011)		
Liquidity Risk x Log(DD^{NonIG})			-0.0109***	
			(0.001)	
Liquidity Risk x Log($DD^{Not\ rated}$)				-0.00238**
				(0.019)
r_m	1.064***	1.068***	1.068***	1.064***
	(0.000)	(0.000)	(0.000)	(0.000)
SMB	0.871***	0.895***	0.897***	0.871***
	(0.000)	(0.000)	(0.000)	(0.000)
HML	1.014***	0.995***	0.989***	1.010***
	(0.000)	(0.000)	(0.000)	(0.000)
Bank Fixed Effect	Yes	Yes	Yes	Yes
Number obs.	2,626	2,626	2,626	2,626

Appendix E. Robustness using alternative liquidity proxies and time windows

Table E.1. Robustness using deposit inflows

In this table which follows the structure of Table 5, we replace Net Drawdowns with Deposits, defined as the deposit inflow in Q1 2020 relative to total assets. We run the same regressions (including SRISK/Assets, interaction terms with High Capital and Capital Buffer and include also the interaction terms of Gross Drawdowns and the capital measures) and find qualitatively and quantitatively similar results.

	(1)	(2)	(3)	(4)	(5)	(6)
Deposit Inflows	-0.356	-0.393	-0.534	-0.284	-0.366	-0.295
	(0.421)	(0.333)	(0.347)	(0.497)	(0.527)	(0.461)
Gross drawdowns	-5.262***	-4.964***	-5.128***	-5.204***	-8.788***	-4.822**
	(0.006)	(0.010)	(0.006)	(0.006)	(0.001)	(0.011)
SRISK / Assets		-6.236**				
		(0.039)				
Deposits x High Capital			0.177		-0.0356	
			(0.848)		(0.969)	
Deposits x Capital Buffer				0.161		0.139
				(0.285)		(0.324)
Gross drawdowns x High Capital					5.948**	
					(0.043)	
Gross drawdowns x Capital Buffer						1.770*
						(0.051)
High Capital			0.0610		0.0304	
			(0.190)		(0.554)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.415	0.457	0.424	0.421	0.439	0.439
Number obs.	147	147	147	147	147	147

In Table E.1, we replace *Net Drawdowns* with *Deposits*, defined as the deposit inflow in Q1 2020 relative to total assets. We run the same regressions (including *SRISK/Assets*, interaction terms with *High Capital* and *Capital Buffer* and include also the interaction terms of *Gross Drawdowns* and the capital measures) and find qualitatively and quantitatively similar results to Table 5.

Table E.2. Liquidity Risk during the GFC

This table reports the results of OLS regressions of U.S. bank' excess stock returns on *Liquidity Risk* and its components during the Q2:2007 to Q2:2009 period. Columns (1) and (2) show panel regressions over the entire period and include control variables from column (5) of Table 2 and quarter fixed effects. Standard errors are clustered at the BHC level. Columns (3) to (11) show the results for each quarter. Control variables are lagged by one quarter. P-values based on robust standard errors are in parentheses. All variables are defined in Appendix III.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Q2 2007–Q2 2009		Q2 2007	Q3 2007	Q4 2007	Q1 2008	Q2 2008	Q3 2008	Q4 2008	Q1 2009	Q2 2009
Liquidity Risk	-0.0961***										
	(0.000)										
Unused C&I Loans / Assets		-0.133***	0.0639	-0.0379	-0.0534	-0.295***	-0.383*	-0.0419	-0.549**	0.239	0.214
		(0.005)	(0.271)	(0.649)	(0.549)	(0.001)	(0.071)	(0.811)	(0.037)	(0.346)	(0.402)
Liquidity / Assets		-0.00562	-0.0839	0.0114	0.238**	0.105	0.302*	-0.101	0.0312	0.0381	-0.490*
		(0.915)	(0.365)	(0.901)	(0.023)	(0.374)	(0.099)	(0.687)	(0.898)	(0.880)	(0.069)
Wholesale Funding / Assets		-0.144***	-0.0447	-0.131**	-0.154*	-0.0281	-0.229	-0.158	-0.285	-0.0421	-0.332*
		(0.008)	(0.369)	(0.022)	(0.097)	(0.805)	(0.180)	(0.388)	(0.202)	(0.858)	(0.097)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes									
Cluster (Bank)	Yes	Yes									
R-squared	0.340	0.341	0.200	0.137	0.335	0.164	0.298	0.291	0.346	0.318	0.103
Number obs.	3,072	3,072	364	359	355	346	342	340	327	323	316

We test the effect of liquidity risk on stock returns during the GFC period using the same methodology as in the main body of the paper. The results are reported in Table E.2. In a first step, we run a regression of bank stock returns on *Liquidity Risk* (column (1)) and its components (column (2)) over the Q2 2007 to Q2 2009 period, including one quarter lagged control variables as well as quarterly fixed effects. Standard errors are clustered at the bank level.

As in the COVID-19 episode, banks with higher *ex-ante* balance-sheet liquidity risk had lower stock returns during the GFC period, which is in part driven by banks' exposure to undrawn credit lines. In contrast to the pandemic, however, banks' rollover risk through wholesale funding exposure also had an economically large effect during the GFC period consistent with Acharya and Mora (2015).

We then investigate these effects separately for each quarter (columns (3)–(11)). We confirm that balance-sheet liquidity risk also episodically explained bank stock returns during the GFC period. In particular, rollover risk for banks rose in Q3 and Q4 2007, i.e., in the first phase of the GFC, when the Asset Backed Commercial Paper (ABCP) market froze as documented in Acharya et al. (2013). Thereafter, credit-line drawdown risk for banks increased, particularly in Q4 2008 after the Lehman default and abated afterwards, when the Federal Reserve and U.S. government responded to the economic fallout of the Lehman Brothers default with a variety of measures to support the liquidity of the banking sector, including large guarantee programmes. Wholesale funding risk still remained of concern for banks even in Q2 2009. That is, while unused C&I credit lines are also clearly important during the GFC, the results also show that wholesale funding exposure and having access to liquidity (cash) impacts bank stock returns, highlighting that a holistic measure of balance-sheet liquidity risk is useful for its robust measurement across different stress episodes (otherwise, we would force an average effect across banks for individual components).

Table E.3. Wholesale funding and bank stock returns during GFC and COVID

This table reports the results of OLS regressions of banks' excess stock returns onto our measure of liquidity risk as well as various proxies for wholesale funding and its components. Columns (1) to (4) report results for the GFC period before the collapse of Lehman Brothers (Q3 2007 – Q2 2008). Columns (5) to (8) report the results for the Covid period (Q1 2020). Detailed variable definitions can be found in Appendix III.

Panel A. Standalone Regressions

	GFC before Lehman				COVID			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Liquidity Risk	-0.113***				-0.445***			
	(0.002)				(0.000)			
Unused Commitments / Assets		-0.111**	-0.111**	-0.120*		-1.084***	-1.020***	-1.149***
		(0.017)	(0.024)	(0.070)		(0.001)	(0.001)	(0.000)
Liquidity / Assets		0.110	0.114	0.0643		0.488***	0.487***	0.326*
		(0.185)	(0.154)	(0.429)		(0.006)	(0.008)	(0.083)
Wholesale Funding / Assets (Acharya and Mora, 2015)		-0.120				-0.279		
		(0.172)				(0.107)		
Wholesale Funding / Assets (Dubios and Lambertini, 2018)			0.0142				-0.0788	
			(0.896)				(0.689)	
Large Time Deposits / Assets				-0.223*				-1.164**
				(0.059)				(0.034)
Foreign Deposits / Assets				-0.124				-0.0464
				(0.467)				(0.846)
Subordinated Debt / Assets				0.225				-1.581
				(0.802)				(0.445)
Fed Funds Purchased / Assets				0.322				1.681
				(0.175)				(0.117)
Other Borrowed Money / Assets				0.189				0.0778
				(0.412)				(0.892)
R-squared	0.539	0.539	0.538	0.542	0.471	0.486	0.480	0.523
Number obs.	595	595	595	595	147	147	147	147

Panel B. Interactions with size	**GFC before Lehman**				**COVID**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Liquidity Risk	-0.0653				-0.508***			
	(0.214)				(0.001)			
Liquidity Risk x Large Bank	-0.0915				0.113			
	(0.141)				(0.516)			
Unused Commitments / Assets		-0.0482	-0.0534	-0.0667		**-1.353*** **	**-1.136** **	**-1.363*** **
		(0.490)	(0.450)	(0.395)		**(0.002)**	**(0.010)**	**(0.001)**
Unused Commitments / Assets x Large Bank		-0.108	-0.107	-0.121		**0.394**	**0.175**	**0.350**
		(0.147)	(0.118)	(0.294)		**(0.328)**	**(0.664)**	**(0.427)**
Liquidity / Assets		0.147	0.154	0.126		0.361	0.470*	0.309
		(0.173)	(0.143)	(0.297)		(0.139)	(0.097)	(0.222)
Liquidity / Assets x Large Bank		-0.0538	-0.0551	-0.0330		0.214	0.0561	0.179
		(0.710)	(0.670)	(0.820)		(0.487)	(0.864)	(0.579)
Wholesale Funding / Assets		-0.0571				**-1.007** **		
(Acharya and Mora, 2015)		(0.577)				**(0.035)**		
Wholesale Funding / Assets x Large Bank		-0.0895				**0.859**		
(Acharya and Mora, 2015)		(0.420)				**(0.102)**		
Wholesale Funding / Assets			**0.150**				-0.156	
(Dubios and Lambertini, 2018)			**(0.158)**				(0.800)	
Wholesale Funding / Assets x Large Bank			**-0.232***				0.0877	
(Dubios and Lambertini, 2018)			**(0.071)**				(0.889)	
Large Time Deposits / Assets				**-0.225***				**-2.553** **
				(0.096)				**(0.013)**
Large Time Deposits / Assets x Large Bank				**0.0950**				**2.350** **
				(0.595)				**(0.041)**
Fed Funds Purchased / Assets				0.364				2.198
				(0.139)				(0.265)
Fed Funds Purchased / Assets x Large Bank				-0.0672				-1.613
				(0.785)				(0.514)
Other Borrowed Money / Assets				0.354				-0.164
				(0.178)				(0.863)
Other Borrowed Money / Assets x Large Bank				-0.223				0.111
				(0.334)				(0.874)
Large Bank	0.0226	0.0412	0.0478*	0.0227	0.00917	-0.168	-0.0173	-0.141
	(0.239)	(0.112)	(0.067)	(0.410)	(0.875)	(0.207)	(0.882)	(0.343)
R-squared	0.541	0.542	0.542	0.546	0.474	0.502	0.482	0.550
Number obs.	595	595	595	595	147	147	147	147

We perform a series of additional tests that strengthen our results and provide a more nuanced view on the role of wholesale funding on bank stock returns during the COVID-19 pandemic.

As explained in Section 3.2 in the main body of the paper, we use as a measure for *Wholesale Funding* the definition in Acharya and Mora (2015), abbreviated as AM. As robustness, we use a different measure for *Wholesale Funding* also used in Dubois and Lambertini (2018), abbreviated as DL. The key differences between both measures are: The DL measure does not include large time deposits nor subordinated debt. In contrast to AM, it adds commercial paper. A minor difference is that DL split other borrowed money by maturity (< and >= 1 year) and differentiates between repos and fed fund purchased.

We run the regressions for Table 4, Panel B in the main body of the paper and include these proxies as alternative measures for wholesale funding and its components. We report these results in Panel A of Table E.3. Columns (1) to (4) show the results for the GFC period (until the default of Lehman Brothers) and columns (5) to (8) over the Q1 2023 period. In columns (2), (3) and (6), (7) we use the AM and DL wholesale funding proxies. In columns (4) and (8), we include the individual components. Both of the AM and DL proxies are insignificant during both crises. *Unused Commitments / Assets* are economically more meaningful in the COVID period as well as *Liquidity / Assets.* Interestingly, *Large Time Deposits / Assets* negatively impacts bank stock returns in both stress periods.

In Panel B of Table E.3., we interact our variables with a measure of bank size, "Large", which takes a value of 1 if bank size is larger than the median bank. Focusing on the COVID period, we find that wholesale funding risk matters for small banks. The coefficient of the AM measure is negative and significant. The DL measure is not because it does not account for large time deposits. Column (6) shows that small banks with large time deposits have lower stock returns.

This is consistent with the interpretation that – while on aggregate banks did experience deposit inflows – there are difference in the cross-section with smaller banks likely loosing funding that favors large banks that might be deemed “too big to fail”.

Overall, wholesale funding does not appear to substantially effect stock returns of banks during COVID, but it matters for smaller banks.

Table E.4. Liquidity risk and bank stock returns – robustness using the Fahlenbrach et al. (2021) measurement period

This table reports the results of OLS regressions of U.S. banks' excess stock returns over the 2/2/2020 – 3/23/2020 period on bank *Liquidity Risk* and a bank's *Equity Beta* and control variables. We add *SRISK/Assets* as an additional control (column (6)). *SRISK* is available for banks in the vlab database. The regression includes a dummy for banks for whom we do not find exposure data (unreported). P-values based on robust standard errors are in parentheses. All variables are defined in Appendix III.

	(1)	(2)	(3)	(4)	(5)	(6)
Liquidity Risk	-0.282***	-0.363***	-0.516***	-0.501***	-0.509***	-0.489***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Equity Beta	-0.932***	-0.859***	-0.699***	-0.679***	-0.683***	-0.521***
	(0.000)	(0.000)	(0.001)	(0.002)	(0.002)	(0.009)
NPL / Loans		-5.964***	-2.136	-1.925	-1.769	-2.105
		(0.000)	(0.224)	(0.280)	(0.327)	(0.253)
Equity Ratio		0.636	0.0271	0.00738	-0.240	-0.721
		(0.296)	(0.965)	(0.991)	(0.714)	(0.244)
Non-Interest Income		0.206**	0.0832	0.115	0.0892	0.0452
		(0.031)	(0.433)	(0.280)	(0.437)	(0.674)
Log(Assets)		-0.00251	-0.0336**	-0.0385**	-0.0292	0.00333
		(0.843)	(0.035)	(0.022)	(0.123)	(0.876)
ROA		-5.476*	0.178	-0.0254	2.265	3.328
		(0.089)	(0.959)	(0.994)	(0.599)	(0.406)
Deposits / Loans		-0.0153	-0.0506***	-0.0483***	-0.0515***	-0.0442***
		(0.290)	(0.002)	(0.005)	(0.005)	(0.009)
Income Diversity			0.0189	-0.00435	0.00629	0.00466
			(0.830)	(0.962)	(0.945)	(0.952)
Distance-to-Default			0.0738**	0.0717**	0.0729**	0.0651**
			(0.029)	(0.035)	(0.028)	(0.024)
Loans / Assets			-0.475**	-0.472**	-0.425**	-0.360*
			(0.019)	(0.021)	(0.043)	(0.075)
Deposits / Assets			0.0124	0.0355	-0.00594	-0.190
			(0.954)	(0.893)	(0.982)	(0.436)
Idiosyncratic Volatility			-1.156***	-1.199***	-1.078**	-1.127**
			(0.004)	(0.003)	(0.017)	(0.012)
Real Estate Beta			0.189	0.196*	0.147	0.124
			(0.102)	(0.091)	(0.290)	(0.340)
Current Primary Dealer Indicator				0.131	0.0807	-0.0479
				(0.176)	(0.464)	(0.637)
Derivatives / Assets				-0.00403	-0.00330	0.00340
				(0.471)	(0.564)	(0.556)
Credit Card Commitments /Assets					-0.000441	-0.0697
					(0.994)	(0.231)
Consumer Loans / Assets					-0.203	-0.120
					(0.428)	(0.641)
SRISK /Assets						-7.726***
						(0.002)
R-squared	0.251	0.322	0.430	0.433	0.439	0.504
Number obs.	147	147	147	147	147	147

As a robustness test, we repeat our tests using the crisis window used in Fahlenbrach et al. (2021), i.e., the Feb 2nd to March 23rd, 2020 period. The results are reported in Table E.4. above. Our results regarding *Liquidity Risk* remain robust.

Figure E.1. Stock prices and credit line commitments

This figure shows stock prices of U.S. banks with *Low* or *High Credit Line Commitments* using a median split to distinguish between banks. We plot the difference between the stock prices of both groups of banks indexed at Jan 1, 2020. All variables are defined in Appendix III.

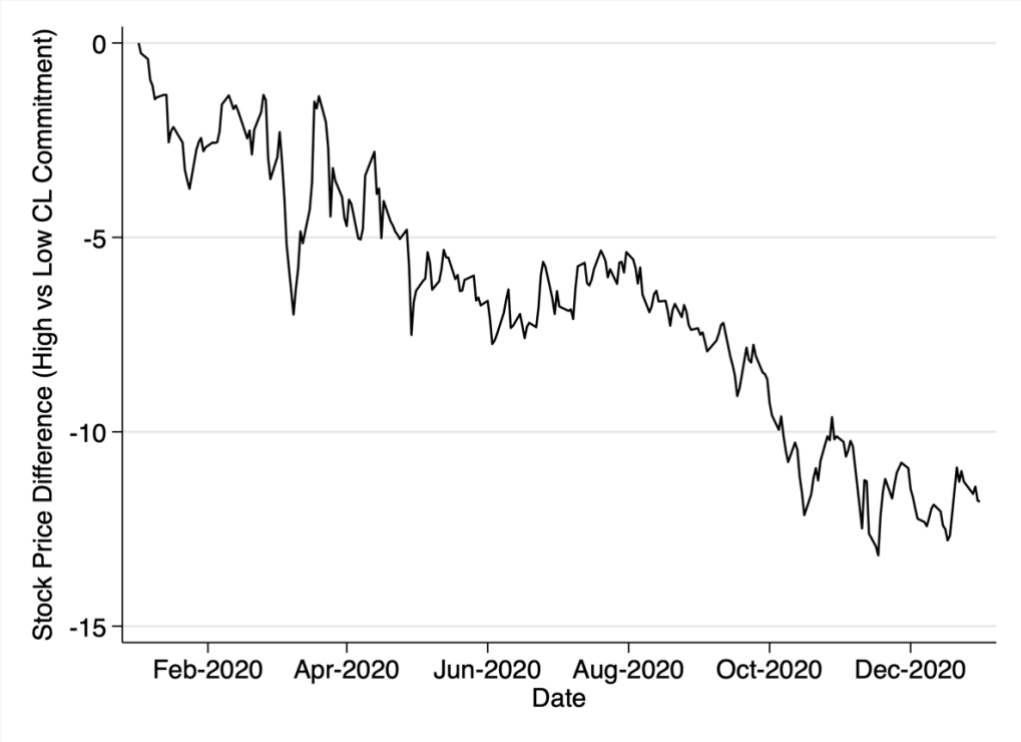
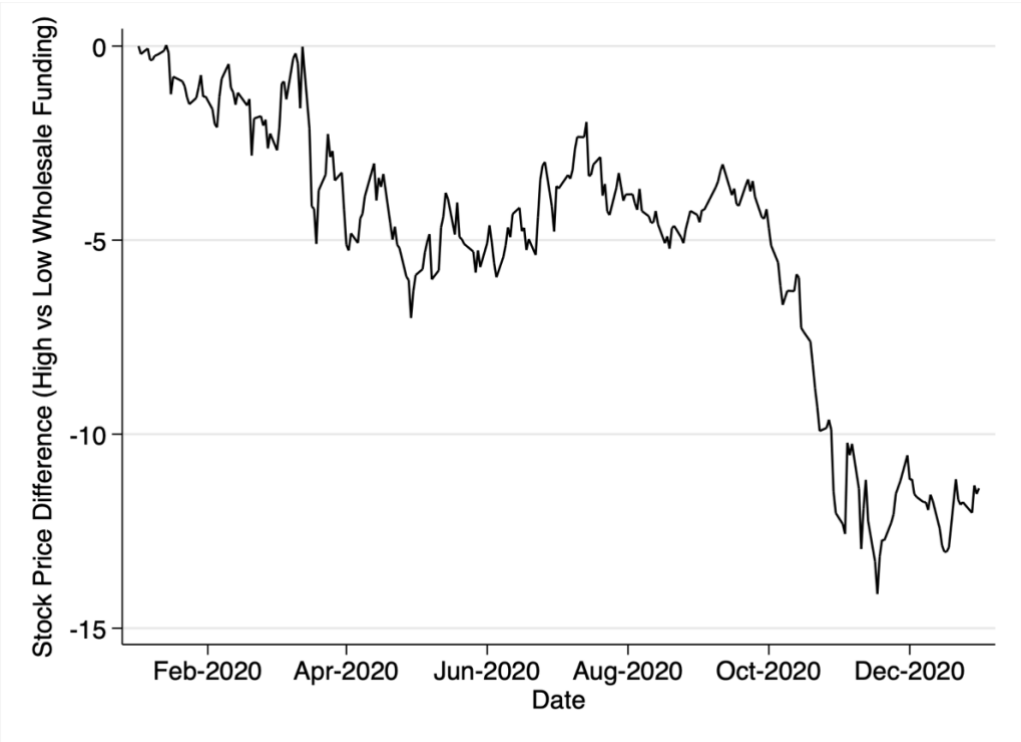


Figure E.2. Stock prices and wholesale funding

This figure shows stock prices of U.S. banks with *Low* or *High Wholesale Funding* using a median split to distinguish between banks. We plot the difference between the stock prices of both groups of banks indexed at Jan 1, 2020. All variables are defined in Appendix III.



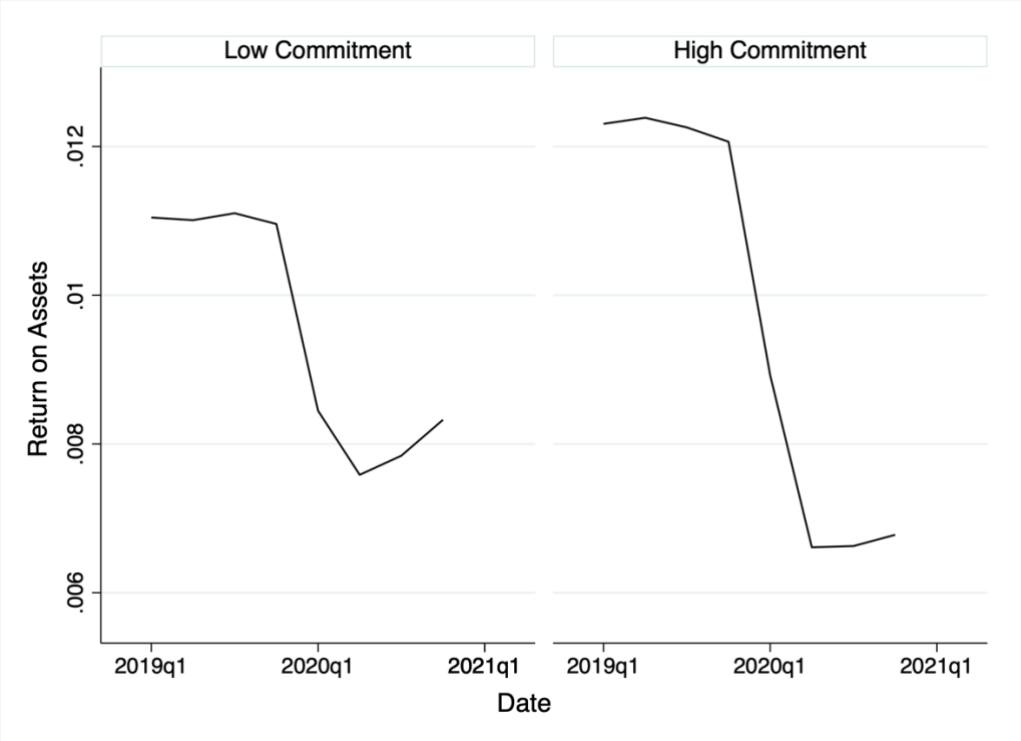
Figures E.1. and E.2. show the difference in the development of stock prices between banks with above vs. below median *Unused Commitments / Assets* ratios and the difference in the development of stock prices between banks with above vs below median *Wholesale Funding / Assets* ratios, respectively.

Both figures show that banks with high exposure to either unused credit lines or wholesale funding perform worse during the COVID-19 pandemic. However, during our main sample period (the pre-intervention period ending March 23, 2020 and the post-intervention period Q2 2020) unused credit lines appear to be the main driver of bank stock prices.

Appendix F. Relationship between credit line commitments and profitability

Figure F.1. Profitability by level of credit line commitment

This figure shows the average return on assets of banks which have a below median (low, left) or above median (high, right) credit line commitments to assets ratio. The quarterly sample runs from 2019Q1 to 2020Q4. The sample of banks is a subet of all banks in our sample selected on similarity in capitalization, NPL-to-loan ratio, asset size and the loan-to-asset ratio. All variables are defined in Appendix III.



How do credit line commitments relate to profitability? We matched banks along the following dimensions: size, loans-to-assets ratio, NPL-to-loans ratio, and Tier 1 regulatory capital ratio. We then compared the profitability (measured as a bank's return on assets (ROA)) between matched banks with either above or below median credit line commitments. We then investigated performance differences of banks during the COVID-19 pandemic as well as before and after the stress period. Our results are consistent with those w.r.t to the implications of aggregate drawdown risk on stock returns discussed in the main body of the paper.

Specifically, we find that ROA is higher outside of the Covid crisis but drops significantly more during the crisis for banks that have high credit line commitments. We show this graphically in Figure F.1. above. These results complement our evidence from stock returns,

and we thus conjecture that credit lines are not a value-destroying activity, but that through the cycle, banks with more exposure to aggregate drawdown have more cyclical and more volatile profits.