

Liquidity provision and co-insurance in bank syndicates

Kevin Kiernan
Fannie Mae

Vladimir Yankov
Fed Board

Filip Zikes
Fed Board

Bank of Finland
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- Banks are important providers of liquidity to the corporate sector in times of stress (\$4-5 trillion in outstanding credit line commitments in recent years)
- Close to 70 percent of credit lines are syndicated and contain on-demand components called sublimits (around \$300 billion)
- These sublimits create a network of interbank commitments and obligations
- Liquidity regulation is targeted at *individual* bank liquidity positions relative to credit line exposures and stability of funding
- But the capacity of the banking system as a whole to withstand large simultaneous drawdowns on credit depends on the network as well

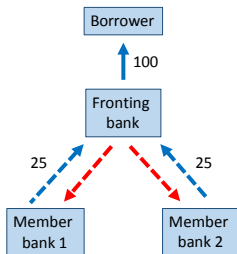
- 1 Develop a simple model of liquidity capacity of the banking sector that incorporates
 - The interbank network resulting from the process of syndication
 - Liquidity stress scenarios based on historical data and observed credit line contracts 2004–2020
- 2 Examine how banks' liquidity capacity evolves over time and is affected by post-GFC regulation
 - Liquidity capacity of the banking system significantly improved
 - Fronting commitments provide an economically meaningful liquidity insurance to the corporate sector
 - Capital requirements do not bind in times of stress, but liquidity requirements do even for moderate drawdowns
- 3 Study empirically how liquidity capacity relates to corporate liquidity management

Loan syndication, sublimits, and fronting exposures

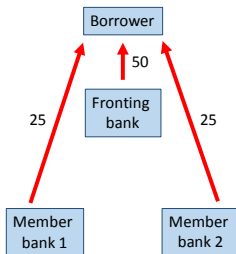
- Loan syndication is a form of risk-sharing arrangement among several banks
 - Drawdowns on credit lines normally requires participation of all syndicate banks and liquidity is available with some delay
 - Sublimits are components of credit lines such as swing lines and letters of credit that are available to draw on demand
- A designated "fronting bank" (could be different from lead) assumes all sublimit drawdowns on behalf of the syndicate
- Fronting bank may request participation by member banks and member banks have an obligation to fund their shares
- This leaves fronting banks exposed to liquidity shortfalls at member banks but it insures the borrower against these shortfalls

Liquidity co-insurance through fronting exposures

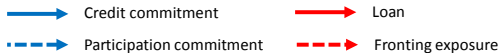
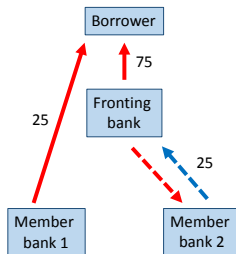
A. Before drawdown



B. After drawdown full participation



C. After drawdown limited participation



A model of liquidity capacity

Assets	Liabilities
Liquid assets (L_i)	Equity E_i
Illiquid loans (Z_i)	Deposits D_i
	Uninsured debt B_i
Undrawn revolvers u_i	
Fronting exposures $\sum_j f_{i,j}$	Participation commitments $\sum_j f_{j,i}$

- N banks endowed with heterogeneous balance sheets and credit commitments to the corporate sector
- Syndication of credit lines creates a network of fronting exposures and participation commitments $F := \{f_{i,j}\}$

System of budget constraints

- In a stress scenario, bank i experiences outflow of uninsured debt, $\lambda_B B_i$, and firm k draws a fraction of unused credit line (both regular revolver and sublimit) with bank i , $\bar{u}_{k,i}(\alpha)$
- Bank i receives request for funds:

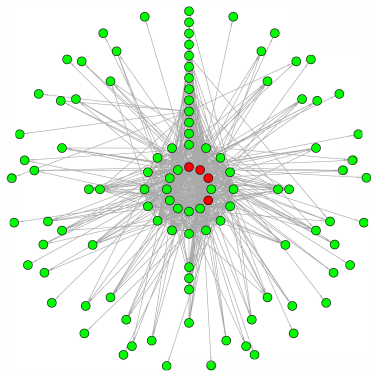
$$\bar{p}_i(\alpha) = \underbrace{\sum_{k=1}^K \bar{u}_{k,i}(\alpha)}_{\text{credit line draws}} + \underbrace{\sum_{j=1}^N \bar{f}_{j,i}(\alpha)}_{\text{participation commitments to fronting banks}}$$

- Feasible payment must satisfy:

$$p_i(\alpha) \leq \underbrace{L_i - \lambda_B B_i}_{\text{liquid assets}} + \underbrace{\sum_{j=1}^N f_{i,j}(\alpha)}_{\text{participation commitments by member banks}}$$

- Equilibrium payment $\{p_i^*(\alpha)\}_{i=1}^N$ solved using the fictitious sequential default algorithm of Eisenberg and Noe (2001)
 - Limited liability and priority of debt obligations
 - No fire sales of illiquid assets
 - Drawdowns serviced in proportion to contractual exposures
- Liquidity capacity of the banking sector characterized by:
 - Set of illiquid banks
 - System-wide liquidity shortfalls
 - Effective reallocation of liquidity through fronting

- Information on syndicated bank credit lines:
 - Refinitiv and Loan Connector (DealScan)
 - Information on credit line utilization CapitalIQ and FR Y-14
 - Information on sublimits (DealScan) and fronting exposures (FR Y-14)
- Bank balance sheet information: FR Y-9C and LCR disclosures
- Borrower information: S&P Compustat, CRSP, Moody's Analytics and CreditEdge, and S&P Capital IQ
- Final dataset: 5451 borrowers, 754 bank holding companies, sample period 2004:Q1 until 2020:Q2
 - We include non-financial borrowers along with financials and utilities



- A well-defined core-periphery structure
- Core consists of largest banks
- Significant net fronting exposures at a few banks in the core (in red)
- Core-periphery structure relatively stable over time

Liquidity stress scenarios

- Outflow of short-term wholesale funding: 0 or 10%
- Drawdowns (by industry) calibrated to match those observed during the GFC 2007-2009, COVID-19, and bank-reported exposure-at-default (EAD):

	GFC 2007-2009	COVID 2020Q1	EAD 2019Q4
Average	8.8%	15.6%	53.6%

- We also examine uniform drawdown rates ranging from 0 to 100%.

Drawdowns and liquidity shortfalls (with STWF outflow)

	2006Q4			2019Q4		
	GFC	COVID	EAD	GFC	COVID	EAD
Drawdown amount (\$)	215	282	970	534	653	2346
Drawdown/(HQLA-STWFO)	0.68	0.89	3.08	0.18	0.22	0.78
Overall shortfall (\$)	59	95	727	92	118	869
Overall shortfall/Drawdown	0.27	0.34	0.75	0.17	0.18	0.37
Banks with shortfall	35	41	63	16	21	51
— LCR banks	4	6	10	2	2	4
— Core banks	6	8	14	0	0	1

Table: Aggregate drawdowns and overall liquidity shortfall (liquidity demanded minus liquidity provided) in different drawdown scenarios with 10% short-term wholesale funding outflow.

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Sublimits and fronting (with STWF outflow)

	2006Q4			2019Q4		
	GFC	COVID	EAD	GFC	COVID	EAD
Sublimit shortfall (\$)	5.5	13	143	1.5	1.6	15
Sublimit shortfall/Drawdown	0.13	0.25	0.76	0.04	0.03	0.08
Net fronting (\$)	5	7	16	2	3	32
Net fronting/Sublimit	0.14	0.16	0.35	0.05	0.06	0.2
Net front. banks with shortfall	1	3	4	0	0	0

Table: Sublimit shortfall (liquidity demanded minus liquidity provided) and net fronting (liquidity provided by fronting banks in excess of their pro-rata shares) in different drawdown scenarios with 10% short-term wholesale funding outflow.

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Drawdown feasibility

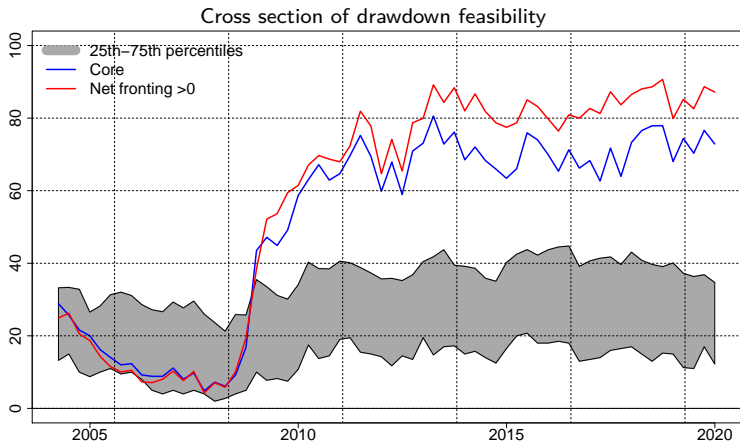


Figure: Drawdown feasibility: the maximum drawdown rate (%) that a bank can sustain before becoming illiquid in the model.

Effect on liquidity coverage ratios (LCR)

	Fraction drawn (%)					
	0	10%	25%	50%	75%	100%
Average LCR	1.23	0.98	0.79	0.55	0.39	0.25
Min LCR	1.06	0.55	0.21	0	0	0
# breaches	0	6	10	14	14	15

Table: The cross section of liquidity coverage ratios pre- and post-stress for all LCR banks. LCR values below 1 are considered breaches.

$$LCR_i \equiv \frac{HQLA_i}{\underbrace{\phi_D D_i + \phi_B B_i + \phi_U U_i}_{\text{Outflow}} - \min\{\text{Inflow}, 0.75 \times \text{Outflow}\}} \geq 1.$$

Effect on capital ratios

		Fraction drawn (%)					
		0	10%	25%	50%	75%	100%
All LCR banks	Average	12.30	12.12	12.00	11.89	11.81	11.77
	Min	7.44	7.43	7.42	7.37	7.36	7.36
	Max	26.19	24.39	23.85	23.02	22.57	22.56
	# breaches	0	0	0	0	0	0
U.S. GSIBs	Average	12.43	12.24	11.97	11.55	11.16	10.79
	Min	11.14	10.96	10.70	10.30	9.92	9.56
	Max	16.43	16.14	15.72	15.07	14.47	13.91
	# breaches	0	0	0	0	0	0

Table: The cross section of tier 1 capital ratios pre- and post-stress for all LCR banks and for U.S. GSIBs only. Capital ratios that fall below regulatory minima are considered breaches.

- Test for the presence of assortative matching on liquidity characteristics

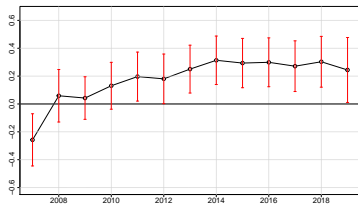
$$LiqMan_{k,t} = \beta'_L Liquidity_{i,t-1} + \beta'_E Capital_{i,t-1} + \beta'_D Deposits_{i,t-1} + \alpha_k + \beta_i + \tau_t + \gamma' X_{k,t-1} + \epsilon_{k,i,t}$$

where

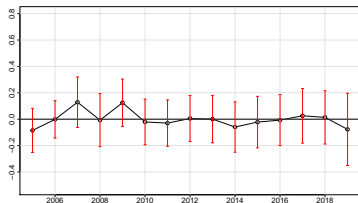
- $LiqMan = \{\text{Cash/Assets, Revolver/Assets, Revolvers/Liquidity}\}$
- $Liquidity_{i,t-1}$, $Capital_{i,t-1}$, and $Deposits_{i,t-1}$ are lead and (average) member banks' liquid assets, equity capital, and insured deposit.
- $X_{k,t-1}$ includes measures of firm credit risk, systemicness (MES), and Tobin's Q.
- Firm (α_k), bank (β_i), and time fixed effects (τ_t)

Matching on liquidity characteristics

Firm revolver-to-assets and bank liquidity
Lead bank HQLA-to-assets



Member banks' HQLA-to-assets



Coefficient estimates and 5/95 confidence intervals

- Firms that rely more on revolving lines of credit tend to borrow from syndicates with more liquid lead banks
- Member banks' liquidity does not seem to matter
- The assortative matching between lead banks' liquidity and firms reliance on credit lines arose post-crises

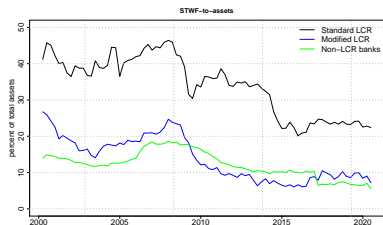
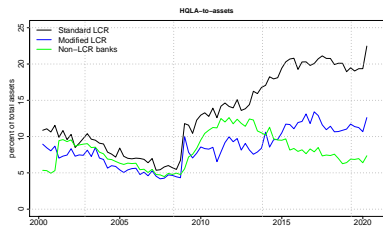
- The liquidity capacity of the banking system increased significantly post-GFC
- Fewer banks experience liquidity shortfalls in a stress scenario and the core of the fronting network is more resilient
- Regulatory capital is not a binding constraint for honoring credit line drawdowns but liquidity requirements are
- Firms with higher reliance on credit lines in their liquidity management have become more likely to obtain credit lines from syndicates with higher liquidity capacity

- Incorporating deposit flows
 - Newly created deposits concentrate at lead banks
 - Drawdowns never utilized (precautionary liquidity)
 - Synergies between drawdowns and deposit inflows (flight to safety)
- Determinants of fronting exposures
- Determinants of syndicate formation - matching of lead banks with member banks based on balance sheet characteristics

Appendix

- Synergies of deposit-taking and provision of credit line
 - Kashyap et al. (2002), Gatev and Strahan (2006), Gatev et al. (2009), Pennacchi (2006)
 - GFC: Acharya and Mora (2015), Ivashina and Scharfstein (2010), Cornett et al. (2011)
 - COVID-19: Chodorow-Reich et al. (2021), Kapan and Minoiu (2020), Li et al. (2020), Acharya and Steffen (2020), Acharya et al. (2021b), and Greenwald et al. (2020)
- Syndicated loan markets
 - Liquidity provision in loan syndicates: Santos and Viswanathan (2020)
 - Role of lender centrality: Harris et al. (2020), Karolyi (2015), Gupta et al. (2017), Cai et al. (2018)
 - Role of long-term relationships and bank health: Chodorow-Reich (2014) and Schwert (2018)
- Inter-bank markets
 - Core-periphery structure: Craig and von Peter (2014) and Beltran et al. (2021), Farboodi (2014)
- Corporate liquidity management
 - Holmstrom and Tirole (1998) and Acharya et al. (2013)

Balance sheet liquidity



- Large banks subject to liquidity regulation (LCR) significantly increase liquidity positions defined as high-quality liquid assets (HQLA)
- Standard LCR banks also significantly reduced reliance on unstable short-term wholesale funding (STWF)

Liquidity shortfalls and fronting (no STWF outflow)

	2006Q4			2019Q4		
	GFC	COVID	EAD	GFC	COVID	EAD
Overall shortfall (\$)	18	25	386	66	89	811
Overall shortfall/Drawdown	0.08	0.09	0.4	0.12	0.14	0.35
Sublimit shortfall (\$)	0.6	0.4	61.29	1	1	14
Sublimit shortfall/Drawdown	0.01	0.01	0.33	0.03	0.02	0.08
Net fronting (\$)	2	3	25	1	2	29
Net fronting/Sublimit	0.04	0.05	0.2	0.03	0.04	0.18
Banks with shortfall	12	15	44	9	13	41
— LCR banks	1	1	8	2	2	4
— Core banks	1	3	13	0	0	1
— Net fronting banks	0	0	3	0	0	0

Table: Liquidity shortfall (liquidity demanded minus liquidity provided) and net fronting (liquidity provided by fronting banks in excess of their pro-rata shares) in different drawdown scenarios without short-term wholesale funding outflow.