

Banks' Liquidity Management During the COVID-19 Pandemic

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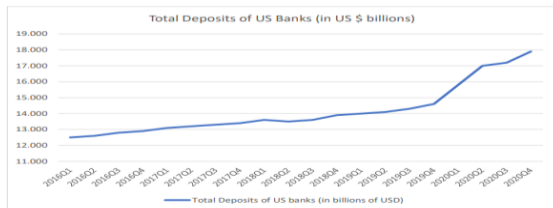
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Outline

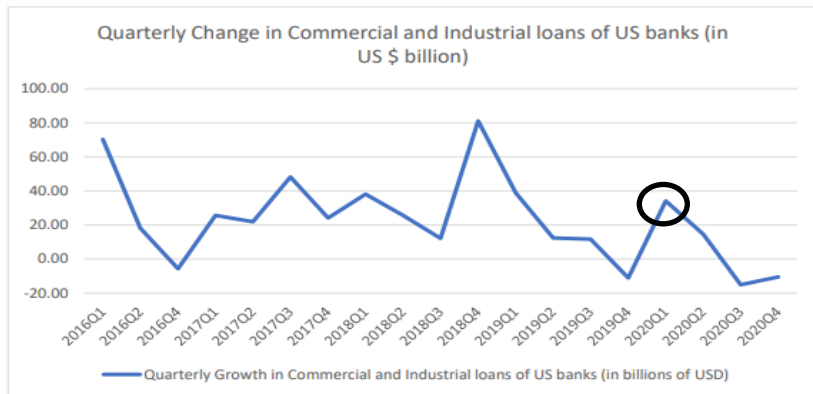
- Motivation
- Research Questions
- Related Literature
- Data and Summary Statistics
- Empirical Investigation
- Preliminary Results

- **Covid-19 Pandemic**
 - A severe economic downturn/uncertainty
 - Liquidity pressure and significant financial disruptions across the financial markets.
- **Household increases bank deposits during the pandemic**
 - Precautionary savings theory (Browning and Lusardi, 1996)/flight to safer investment (Bernanke, Gertler, and Gilchrist, 1996)



- **Banks liquidity management**

- Bank faced unprecedented credit drawdowns at the early stage of the pandemic



- **Federal Reserve intervention**
 - Liquidity injection to facilitate financial institutions in distress condition
- **Banks liquidity creation channels**
 - The market discipline channel (supply-side)
 - The internal capital market channel (demand-side)
 - The balance sheet liquidity channel

Research Questions

- How the Covid-19 pandemic shock affects banks' liquidity management, through three liquidity creation channels? In more detail, how banks adjust their lending, deposit rates and exposure to Federal Reserve liquidity facilities in response to Covid-19 pandemic shock?
 - Do the depositors ask for higher interest rates in riskier banks (weakly capitalized) during the pandemic (Market discipline theory)?
 - Do banks adjust deposit rates based on internal funding needs (internal capital market theory)?
 - How liquidity risk exposed banks adjust lending , deposit rates and Federal Reserve exposure to Federal Reserve liquidity facility during the pandemic (balance sheet liquidity channel)?

- **The market discipline channel**

- Depositors demand a higher rate from riskier banks, especially during the crises episodes, as a form to discipline the banks (Calomiris and Kahn, 1991; Calomiris, 1999; and Hett and Schmidt, 2017).
- Larger banks suffer fewer withdrawal than smaller ones (Billett, Garfinkel, and O'Neal, 1998; Goldberg and Hudgins, 2002).

- **The internal capital market theory theory**
 - Banks use deposits as an internal capital market, the increase in deposit rates should be based on their internal capital needs (attract deposits to fund new lending), see Diamond and Dybvig (1983), Houston, James, and Markus (1997) and Aschraft and Campello (2007).

- **The balance sheet liquidity channel**
 - Banks create and manage liquidity through loan commitments (Diamond and Dybvig, 1983; Holstrom and Tirole, 1998; and Kashyap, Rajan, and Stein, 2002).
 - During the 2007 financial crisis, banks with high exposure to unused loan commitments cut lending/failed to meet their obligations (Acharya and Mora, 2015).

- **Deposit Rates:**

- Provided by RateWatch: 12-month Certificates of Deposit with an account size up to \$10,000; 12-month Certificates of Deposit (CDs) with an account size up to \$100,000; and 12-month Certificates of Deposit (CDs) with an account size up to \$500,000.

- **Banks' Financial Condition:**

- Provided by: Reports of Condition and Income (Call Reports)

- **Bank Loans:**

- Syndicated loans data from Thomson Reuter's Dealscan.

Data and Summary Statistics

Table 1 Summary Statistics

Table 1 presents summary statistics for the variables used in the analysis. The sample period is 2016Q1-2020Q3. Panel A and Panel B show summary statistics for the analysis for the main sample (from Call Report). Panel C shows summary statistics for the sample that includes deposit rates for a variety of maturities and account sizes (from RateWatch).

Panel A. Summary Statistics of Main Sample (bank-quarter observations) in millions of \$

	N	Mean	Std.Dev	P5	P25	P50	P75	P95
Total Assets	105632	3252.2	51600.0	36.7	102.5	218.7	525.5	371.8
Total Deposits	105642	2512.6	39000.0	29.6	85.5	183.6	437.8	291.8
Total Equity	105471	359.7	5354.0	4.4	11.9	24.8	59.2	4.4
Commercial and Industrial loans	105642	387.8	5988.6	0.2	1.3	14.1	43.2	31.8
Net Loans and Leases	105632	1768.0	24100.0	16.5	59.4	140.7	359.0	251.8
Total Unused Commitments	105642	1388.8	24500.0	0.7	6.3	19.6	62.5	61.8
Total Federal Reserve Repurchase	105632	91.7	3605.6	0.0	0.0	0.0	1.6	0.0
Cash	105632	358.5	7527.5	2.2	6.9	15.1	36.3	21.8
Syndicated loans*	1206	9280.0	22300.0	0.0	81.3	652.0	6490.0	5411.8

Panel B. Summary Statistics of ratios in Main Sample (bank-quarter observations)

	N	Mean	Std.Dev	P5	P25	P50	P75	P95
Total Equity to Assets ratio	105471	0.123	0.069	0.081	0.096	0.110	0.130	0.0
Total Deposits to Assets ratio	105642	0.829	0.092	0.705	0.804	0.848	0.879	0.0
Total Liabilities to Total Assets ratio	105642	0.878	0.070	0.812	0.870	0.890	0.904	0.0
Unused Commitments ratio	104995	0.137	0.090	0.025	0.084	0.128	0.174	0.0

Panel C. Summary Statistics of Deposit Rates (bank-quarter observations)

	N	Mean	Std.Dev	P5	P25	P50	P75	P95
12-month CD rate, \$10k accounts (12MCD10K rate)	83565	0.658	0.486	0.150	0.300	0.500	0.900	1.000
12-month CD rate, \$100k accounts (12MCD100K rate)	80787	0.686	0.496	0.150	0.341	0.500	0.950	1.000
12-month CD rate, \$500k accounts (12MCD500K rate)	71679	0.708	0.507	0.150	0.350	0.520	1.000	1.000

- **1. Market Discipline theory**

- $Deposit_rate_{i,q} = \alpha + \beta_1 EA_{i,q-n} * I(q < 2020) + \beta_2 EA_{i,q-n} * I(q \geq 2020) + \gamma B_{i,q} + \delta T_q + \varepsilon_{i,q}$

- The above equation is testing the relationship between deposit rates and equity to asset ratio, interacted with a dummy to distinguish pre-pandemic episode and pandemic episode, with bank fixed effects and time fixed effects.
- A negative sign of beta should be expected if market discipline works.

Empirical investigation

- 1. Market Discipline theory
- Market discipline theory is absent in both pre-pandemic and the pandemic episodes

Panel A. Whole sample	Dependent Variables:		12-Month CD \$10k account rate		12-Month CD \$500k account rate	
	(1) i=1	(2) i=3	(1) i=1	(2) i=3		
Equity to assets ($t-i$) \times I ($q < 2020Q1$)	0.005*** (7.40)	0.006*** (8.61)	0.005*** (6.25)	0.006*** (7.48)		
Equity to assets ($t-i$) \times I ($q \geq 2020Q1$)	0.002*** (2.95)	0.003*** (3.84)	0.004*** (3.19)	0.004*** (3.72)		
Bank Fixed effects	Yes	Yes	Yes	Yes		
Quarter Fixed Effects	Yes	Yes	Yes	Yes		
R-squared	0.703	0.703	0.724	0.724		
No. of obs.	83,565	83,565	71,679	71,679		

Panel B. Deposit Rates and Bank Tier 1 Capital to Risk-Weighted-Assets Ratio (10% lower-capitalized banks)	Dependent Variables:			
	12-Month CD \$10k account rate		12-Month CD \$500k account rate	
	(1) i=1	(2) i=3	(1) i=1	(2) i=3
Equity to assets ($t-i$) \times I ($q < 2020Q1$)	0.006 (1.02)	0.013** (2.01)	0.016** (2.35)	0.019*** (2.71)
Equity to assets ($t-i$) \times I ($q \geq 2020Q1$)	0.020** (2.03)	0.029*** (2.78)	0.028* (1.84)	0.023 (1.48)
Bank Fixed effects	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes
R-square	0.740	0.739	0.770	0.765
No. of obs.	8,062	8,072	6,861	6,875

- **2. Internal Capital Market theory**

- $Deposit_growth_{i,q} = \alpha + \beta_1 Loan\ growth_{i,q-n} * I(q < 2020) + \beta_2 Loan\ growth * I(q \geq 2020) + \beta_3 Deposit\ rate_{i,q-n} * I(q < 2020) + \beta_4 Deposit\ rate * I(q \geq 2020) + \gamma B_{i,q} + \delta T_q + \varepsilon_{i,q}$
- The above equation is testing a triple interaction between deposit growth, deposit rates and lending growth.
- 3 different types of loan growth is used: net loans and leases growth; Commercial and Industrial loans growth and syndicated loan growth (for giant banks).
- The sample is also separated by bank asset size and capitalized ratio.

Empirical investigation

- **2. Internal Capital Market theory – relationship between deposit growth and loan growth**
- We find the absence of internal Capital Market theory before the Covid-19 pandemic, but the increase in the loans plays an important role in determining the growth in deposits during the pandemic.

Panel A. Deposit Growth, Loan Growth and Deposit Rates

	Dependent Variable: Deposit Growth			
	(1) i=1	(2) i=3	(3) i=1	(4) i=3
12-Month CD \$500k account rate ($t-i$) \times I ($q < 2020Q1$)			-6.099 (0.28)	29.469 (1.27)
12-Month CD \$500k account rate ($t-i$) \times I ($q \geq 2020Q1$)			-275.610*** (7.26)	-222.678*** (7.05)
Net Loans and Leases ($t-i$) \times I ($q < 2020Q1$)	-0.384*** (39.73)	-0.119*** (11.73)	-0.347*** (32.84)	-0.106*** (9.56)
Net Loans and Leases ($t-i$) \times I ($q \geq 2020Q1$)	0.587*** (85.77)	0.121*** (14.65)	0.658*** (86.09)	0.0769*** (8.89)
Bank Fixed effects	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes
R-squared	0.289	0.227	0.322	0.248
No. of obs.	105,581	105,552	75,691	78,532

Empirical investigation

- **2. Internal Capital Market theory – relationship between deposit growth and loan growth**
- We find the absence of internal Capital Market theory before the Covid-19 pandemic, but the increase in the loans plays an important role in determining the growth in deposits during the pandemic.

Panel A. Deposit Growth, Loan Growth and Deposit Rates

	Dependent Variable: Deposit Growth			
	(1) i=1	(2) i=3	(3) i=1	(4) i=3
12-Month CD \$10k account rate $(t-i) * I(q < 2020Q1)$			13.774 (0.67)	-3.761 (0.16)
12-Month CD \$10k account rate $(t-i) * I(q \geq 2020Q1)$			-298.991*** (8.41)	-341.083*** (10.87)
Commercial and Industrial Loans $(t-i) * I(q < 2020Q1)$	-1.033*** (39.67)	-0.441*** (16.25)	-1.050*** (38.52)	-0.430*** (14.95)
Commercial and Industrial Loans $(t-i) * I(q \geq 2020Q1)$	-0.299*** (19.61)	1.299*** (101.88)	-0.307*** (19.17)	1.312*** (98.70)
Bank Fixed effects	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes
R-Squared	0.229	0.310	0.250	0.341
No. of obs.	105,581	105,552	83,520	83,451

Empirical investigation

- **2. Internal Capital Market theory – relationship between deposit rates and lending growth**
- However, we find there is no significant positive relationship between lending growth and deposit rates, which suggesting internal capital market theory might not work during the pandemic.

Panel A. Whole sample	Dependent Variables:					
	12-Month CD \$10k rate		12-Month CD \$100k rate		12-Month CD \$500k rate	
	i=1	i=3	i=1	i=3	i=1	i=3
Loan Growth (t-i) * I (q<2020Q1)	-0.0015 (0.91)	0.0003 (0.16)	-0.0009 (0.49)	0.0033* (1.73)	-0.0020 (1.03)	0.0003 (0.16)
Loan Growth (t-i) * I (q≥2020Q1)	0.0001 (0.08)	0.0025* (1.66)	0.0002 (0.15)	0.0022 (1.47)	0.0001 (0.05)	0.0006 (0.36)
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.7031	0.7031	0.7064	0.7064	0.7239	0.7239
No. of obs.	83,554	83,545	80,813	80,804	71,674	71,666

• 3. The balance sheet channel-Deposit rates and Liquidity Risk

- $Deposit_rate_{i,q}/Deposit_growth_{i,q} = \alpha + \beta_1 Liquidity\ risk_{i,q-n} * I(q < 2020) + \beta_2 Liquidity\ risk * I(q \geq 2020) + \gamma B_{i,q} + \delta T_q + \varepsilon_{i,q}$

- We investigate how liquidity-exposed banks (measured by unused commitment) adjust lending , deposit rates and Federal Reserve exposure to Federal Reserve liquidity facility during the pandemic.
- Liquidity risk - Firm drawdown credit line (involuntary lending)

- **3. The balance sheet channel-Liquidity risk and Deposit rates**
- We should expect a positive relationship between the unused commitments and the deposit rates. However, the results show that high unused commitment exposed banks do not increase their deposit rates.

Panel A. Whole sample	Dependent Variables:			
	12-Month CD \$10k rate		12-Month CD \$500k rate	
	(1) (i-1)	(2) (i-3)	(3) (i-1)	(4) (i-3)
Liquidity Risk (t-i) * I (q<2020Q1)	-0.1641*** (4.03)	-0.1523*** (3.72)	-0.1906*** (4.13)	-0.1943*** (4.21)
Liquidity Risk (t-i) * I (q≥2020Q1)	-0.3021*** (6.11)	-0.3053*** (6.25)	-0.3345*** (5.04)	-0.3670*** (5.50)
Bank Fixed effects	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes
R-squared	0.7033	0.7033	0.7240	0.7240
No. of obs.	83,565	83,565	71,679	71,679

Panel B. Banks with higher Liquidity Risk (top 10%)	Dependent Variables:			
	12-Month CD \$10k rate		12-Month CD \$500k rate	
	(1) (i-1)	(2) (i-3)	(3) (i-1)	(4) (i-3)
Liquidity Risk (t-i) * I (q<2020Q1)	-0.4710*** (4.36)	-0.4278*** (3.74)	-0.4273*** (3.17)	-0.3170** (2.27)
Liquidity Risk (t-i) * I (q≥2020Q1)	-0.7390*** (5.83)	-0.7191*** (5.63)	-0.5374*** (2.93)	-0.4195** (2.28)
Bank Fixed effects	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes
R-squared	0.7468	0.7438	0.7658	0.7646

- **3. The balance sheet channel-Liquidity risk and Deposit Growth**
- Negative relationship between deposit growth and liquidity risk, indicating banks with high liquidity risk are more vulnerable to deposit outflows.

	Dependent Variable: Deposits to total assets growth					
	Whole sample of Banks		Lower 10% of Liquidity Risk Banks		Higher 10% of Liquidity Risk Banks	
	(1)	(2)	(3)	(4)	(5)	(6)
	(i=1)	(i=3)	(i=1)	(i=3)	(i=1)	(i=3)
Liquidity Risk (t-i) * I (q<2020Q1)	-4.2251*** (14.84)	-2.2994*** (8.13)	-5.2655 (1.33)	-1.3958 (0.88)	-6.2469*** (6.79)	-6.8107*** (7.46)
Liquidity Risk (t-i) * I (q≥2020Q1)	-3.6686*** (10.75)	-1.9597*** (5.83)	-9.5066 (1.63)	-5.1037 (1.21)	-5.8180*** (5.75)	-6.2368*** (6.21)
Bank Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared	0.0768	0.0754	0.2278	0.2279	0.1886	0.1799
No. of obs.	105,611	105,611	10,487	10,436	11,129	11,154

- **3. The balance sheet channel-Liquidity risk and bank lending**
- Positive relationship between liquidity risk and commercial and industrial loan growth

	Dependent Variable: Δ Commercial and Industrial Loans			
	Higher 10% of Liquidity Risk Banks		Lower 10% of Liquidity Risk Banks	
	(1)	(2)	(3)	(4)
	(i=1)	(i=3)	(i=1)	(i=3)
Liquidity Risk (t-i) * I (q<2020Q1)	89.066*	103.071**	-26.175	-1.236
	(1.73)	(2.02)	(0.81)	(0.10)
Liquidity Risk (t-i) * I (q \geq 2020Q1)	202.036***	223.717***	4.344	145.474***
	(3.27)	(3.69)	(0.09)	(4.25)
Bank Fixed effects	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes
R-squared	0.0443	0.0444	0.1193	0.1162
No. of obs.	11,129	11,154	10,487	10,436

- **3. The balance sheet channel-Liquidity risk and bank lending**
- $Loan\ growth_{i,q} = \alpha + \beta_1 Liquidity\ risk_{i,q-n} * I(q < 2020) + \beta_2 Liquidity\ risk * I(q \geq 2020) + \gamma B_{i,q} + \delta T_q + \varepsilon_{i,q}$
- Negative relationship between liquidity risk and net loan and leases

	Dependent Variable: Δ Net Loans and Leases			
	Higher 10% of Liquidity Risk Banks		Lower 10% of Liquidity Risk Banks	
	(1)	(2)	(3)	(4)
	(i=1)	(i=3)	(i=1)	(i=3)
Liquidity Risk (t-i) * I (q<2020Q1)	359.191*** (3.52)	195.909* (1.93)	25.230 (0.09)	-575.118*** (5.21)
Liquidity Risk (t-i) * I (q≥2020Q1)	-243.094** (1.99)	-418.632*** (3.48)	665.850 (1.63)	176.158 (0.60)
Bank Fixed effects	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes
R-squared	0.0978	0.0977	0.0682	0.0713
No. of obs.	11,129	11,154	10,487	10,436

Empirical investigation

- **3. The balance sheet channel-Liquidity risk and bank lending**
- Negative relationship between liquidity risk and syndicated loans

	Dependent Variables: Syndicated Loans [€]					
	Whole sample of Banks [€]		Lower 10% of Liquidity Risk Banks [€]		Higher 10% of Liquidity Risk Banks [€]	
	(1)	(2) [€]	(3)	-(4) [€]	(5)	-(6) [€]
	(i=1) [€]	(i=3) [€]	(i=1) [€]	(i=3) [€]	(i=1) [€]	(i=3) [€]
Liquidity Risk (t-i) * I (q<2020Q1) [€]	-19.664* [€]	-11.464 [€]	-297.833 [€]	0.586 [€]	-27.065 [€]	-24.566 [€]
	(1.64) [€]	(1.23) [€]	(1.34) [€]	(0.04) [€]	(1.57) [€]	(1.43) [€]
Liquidity Risk (t-i) * I (q≥2020Q1) [€]	-55.565*** [€]	-47.065*** [€]	126.860 [€]	175.900 [€]	-108.039*** [€]	-102.291*** [€]
	(4.38) [€]	(4.53) [€]	(0.74) [€]	(1.47) [€]	(5.55) [€]	(5.31) [€]
Bank Fixed effects [€]	Yes [€]	Yes [€]	Yes [€]	Yes [€]	Yes [€]	Yes [€]
Quarter Fixed Effects [€]	Yes [€]	Yes [€]	Yes [€]	Yes [€]	Yes [€]	Yes [€]
R-squared [€]	0.8222 [€]	0.8218 [€]	0.6577 [€]	0.6487 [€]	0.8367 [€]	0.8363 [€]
No. of obs. [€]	1,706 [€]	1,706 [€]	183 [€]	182 [€]	971 [€]	972 [€]

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- **3. The balance sheet channel-Liquidity risk and Federal Reserve liquidity injection**
- Positive relationship between liquidity risk and Federal Reserve liquidity injection
- Banks with high liquidity risk, increase their exposure to the liquidity facilities offered by the Federal Reserve.

	Dependent Variable: Δ Liquidity Risk ^{e2}			
	Higher 10% Liquidity Risk Banks ^{e1}		Lower 10% Liquidity Risk Banks ^{e1,e2}	
	(1)	(2) ^{e2}	(3)	(4) ^{e2}
Δ Fed Liquidity (t-i) \times I (q<2020Q1) ^{e2}	(i=1) ^{e2} 0.0026 ^{e2} (0.29) ^{e2}	(i=3) ^{e2} 0.0289*** ^{e2} (3.07) ^{e2}	(i=1) ^{e2} 0.0371*** ^{e2} (8.31) ^{e2}	(i=3) ^{e2} -0.0060 ^{e2} (1.29) ^{e2}
Δ Fed Liquidity (t-i) \times I (q \geq 2020Q1) ^{e2}	0.0601*** ^{e2} (3.13) ^{e2}	0.0408* ^{e2} (1.85) ^{e2}	-0.0039 ^{e2} (0.44) ^{e2}	-0.0146 ^{e2} (1.28) ^{e2}
Bank Fixed effects ^{e2}	Yes ^{e2}	Yes ^{e2}	Yes ^{e2}	Yes ^{e2}
Quarter Fixed Effects ^{e2}	Yes ^{e2}	Yes ^{e2}	Yes ^{e2}	Yes ^{e2}
R-squared ^{e2}	0.9542 ^{e2}	0.9502 ^{e2}	0.6113 ^{e2}	0.6107 ^{e2}
No. of obs. ^{e2}	10,488 ^{e2}	10,488 ^{e2}	10,472 ^{e2}	10,418 ^{e2}

Summary

- We investigate bank liquidity management during the Covid-19 pandemic through 3 banks liquidity creation channels.
- Depositors do not exercise market discipline to weakly-capitalized banks.
- During the pandemic, we provide evidence that deposit growth is positively correlated with lending growth, but negatively correlated with deposit rates.
- Banks with higher liquidity risk do not offer higher deposit rates, however they cut their lending and increase their exposures to the liquidity facilities offered by the Fed.