

Liquidity Restrictions, Runs, and Central Bank Interventions: Evidence from Money Market Funds

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Motivation

- Prime money market funds (MMFs) are vulnerable to acute investor runs during crises.
 - Important short-term funding providers for financial and nonfinancial firms (with \$1 trillion pre-COVID assets).
- After the 2008 financial crisis revealed the fragility of prime MMFs, the SEC introduced reforms aiming to make MMFs
 - more liquid and less prone to runs
 - ultimately capable to withstand stress without the need for Fed's emergency intervention.
- The 2016 MMF reforms introduce the concept of redemption gates and liquidity fees:
 - Prime MMFs can impose **gates and fees** on their investors once their **weekly liquid assets (WLA) fall below 30%**.

Motivation: Controversy of gates and fees [1/2]

- The introduction of gates and fees was intended to
 - “mitigate (the run) risk and the potential impact for investors and markets.” [SEC Chair White (2014)]
- The controversy of gates and fees:
 - Allowing funds to impose gates and fees “could actually increase an investor’s incentive to redeem”. [SEC Commissioner Stein (2014)]
 - “As the chance that a gate will be imposed increases, investors will have a strong incentive to rush to redeem ahead of others to avoid the uncertainty of losing access to their capital.” [SEC Commissioner Stein (2014)]
 - Raised concerns from the academics. [McCabe et al. (2013); Cipriani et al. (2014); Hanson, Scharfstein and Sunderam (2015); Lenkey and Song (2016)]

Motivation: Controversy of gates and fees [2/2]

- Strategic complementarities induced by fear of gates and fees:
 - The expectation that other investors will withdraw money and drive WLA below the 30% threshold may incentivize investors to run preemptively.
- Institutional investors of prime MMFs are extremely concerned about how quickly they can monetize their investments.
 - Having their investments suspended (redemption gates) or having to pay up to 2% (liquidity fees) to redeem their shares is considered impermissible.

Motivation: What can we learn from the COVID-19 crisis?

- Could the COVID-19 crisis shed some light on the debate about gates and fees?
 - Background: During the two weeks from March 9 to 20, 2020, institutional prime MMFs lost about 30% of their assets to redemptions.
 - Could the WLA-contingent gates and fees introduced in the MMF reforms have exacerbated the run?
- How did the Fed intervention stop the run on MMFs?

Key findings

- ① How does the fear of WLA-contingent gates and fees drive MMF outflows during the COVID-19 crisis?
 - The sensitivity of outflows to funds' WLAs increases substantially in crisis times.
 - Outflows accelerate as funds' WLAs approach the 30% regulatory threshold.
 - Rule out alternative explanations: driven by concerns for fund liquidity condition? Reverse causality? Floating NAV?
- ② Effects of the Fed intervention (Money Market Fund Liquidity Facility, MMLF)
 - Who benefits more from the MMLF and how?
 - Identify the role of MMLF in stopping the MMF run.

Anecdotal evidence

- Our findings about the relationships between redemptions and WLA are consistent with the views of market participants.
 - The president of Crane Data: “The 30% threshold has become the most important metric tracked by institutional prime investors.”
 - Blackrock: The WLA ratio is an “amber flashing light” for investors. “The fear of the imposition of a liquidity fee or redemption gate essentially converted the 30% WLA threshold to a new ‘break the buck’ triggering event for investors.”
 - Fitch Ratings: “Investors’ attention is all about funds’ WLAs.”

Sample and data

- Crisis period: Mar 9-20, 2020; Pre-crisis: 4 weeks before crisis; Post-MMLF: 2 weeks after crisis.
- iMoneyNet:
 - High-frequency MMF information (daily AUM, WLA, DLA; weekly fund characteristics and portfolio composition)
- SEC Form N-MPF
 - Security-level holding information for MMFs (monthly)
- MMLF confidential microdata:
 - Details on participants and securities pledged at the MMLF

Gates, fees and MMF runs

We analyze the following questions:

- Does the fear of gates and fees drive MMF redemptions during crisis?
 - Does the sensitivity of fund flows to WLA intensify?
 - Do outflows accelerate as WLA approaches the 30% regulatory threshold for gates and fees?
- Could outflows be driven by investors' concerns for asset illiquidity (since WLA is also a liquidity measure)?
 - Use another liquidity measure (daily liquid assets, or DLA)
 - Study whether WLA drives outflows during the 2008 MMF run
- Any other alternative explanations?
 - Reverse causality, floating NAV, risky holdings, sponsorship, heterogeneity in investors?

Fund WLA levels and crisis outflows [1/2]

- Does the sensitivity of fund flows to WLA intensify during the crisis?
 - Sample period: Feb 6–Mar 20, 2020; focusing on institutional prime MMFs.
 - $Flow_{i,t} = \beta_1 Crisis_t + \beta_2 WLA_{i,t-2} + \beta_3 Crisis_t \times WLA_{i,t-2} + Controls_{i,t-1} + \varepsilon_{i,t}$
- Independent variables:
 - $WLA_{i,t-2}$: WLA as of day $t - 2$, the most recent reading available to investors on day t
 - $Crisis$: a dummy equal to one for the period Mar 9–20
 - Controlling for lagged fund characteristics: abnormal yield, safe holdings, risky holdings, log(fund size), expense ratio, bank affiliation dummy, and fund age.

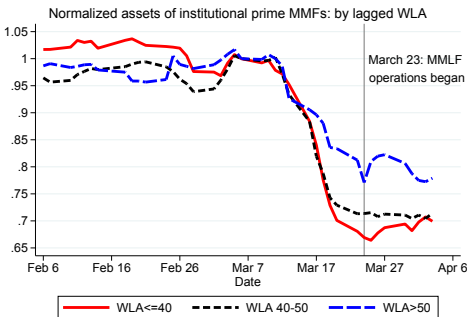
Fund WLA levels and crisis outflows [2/2]

- Relative to normal times, a one-SD decrease in WLA → a one-percentage-point increase in daily outflows during the crisis.
- Robust to controlling for lagged fund flow and day fixed effects; Parallel trends assumption holds.

Dependent variable: daily fund percentage flow				
	(1)	(2)	(3)	(4)
Crisis	-8.639*** (2.532)	-7.034*** (2.123)		
WLA	-0.009 (0.033)	-0.008 (0.028)	-0.013 (0.030)	-0.023 (0.042)
WLA × Crisis	0.139*** (0.050)	0.112** (0.043)	0.123*** (0.044)	0.133** (0.048)
Adj. R^2	0.147	0.174	0.253	0.252
Obs.	1018	1018	1018	1018
Controls	Yes	Yes	Yes	Yes
Lagged dependent variable		Yes	Yes	Yes
Day FE			Yes	Yes
Parallel trends check				Yes

Acceleration of crisis outflows when WLA is closer to 30% [1/3]

- Do outflows accelerate as funds' WLA approaches the 30% threshold?
- Split fund-day sample into 3 segments based on lagged WLA: $WLA(\leq 40)$, $WLA(40\text{ to }50)$, $WLA(> 50)$.



Acceleration of crisis outflows when WLA is closer to 30% [2/3]

- Do outflows accelerate as funds' WLA approaches the 30% threshold?
 - Sample period: Feb 6–Mar 20, 2020; Focusing on institutional prime MMFs.
 - $Flow_{i,t} = \beta_1 Crisis_t + \beta_2 WLA(\leq 40)_{i,t-2} + \beta_3 Crisis \times WLA(\leq 40)_{i,t-2} + \beta_4 WLA(40to50)_{i,t-2} + \beta_5 Crisis \times WLA(40to50)_{i,t-2} + \beta_6 WLA(> 50)_{i,t-2} + \beta_7 Crisis \times WLA(> 50)_{i,t-2} + Controls_{i,t-1} + \varepsilon_{i,t}$
 - $WLA(\leq 40)$ equals WLA if the fund's WLA is below or equal to 40% and zero otherwise.

Acceleration of crisis outflows when WLA is closer to 30% [3/3]

- For funds with WLA below 40%, a one-SD decrease in WLA → a 2-percentage-point increase in daily outflows during the crisis (33% higher than the crisis outflows of funds with WLA above 50%).

Dependent variable: daily fund percentage flow			
	(1)	(2)	(3)
Crisis × WLA(≤ 40)	0.308*** (0.084)	0.297*** (0.089)	0.290*** (0.086)
Crisis × WLA(40-50)	0.265*** (0.085)	0.258*** (0.083)	0.254*** (0.082)
Crisis × WLA(> 50)	0.230*** (0.061)	0.228*** (0.063)	0.229*** (0.067)
Adj. R^2	0.177	0.256	0.254
Obs.	1018	1018	1018
Lagged dependent variable	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Day FE		Yes	Yes
Parallel trends check			Yes
p -value: Crisis × L = Crisis × M	0.00	0.03	0.05
p -value: Crisis × L = Crisis × H	0.00	0.02	0.02

Outflows driven by investors' concern for illiquidity? DLA vs. WLA [1/2]

- Since WLA is also a liquidity measure for fund assets...
 - Could the intensified flow-WLA relation be driven by investors' concerns for fund illiquidity (rather than gates and fees)?
- Use an alternative liquidity measure: DLA
 - **DLA**: the share of a MMF's assets that could be converted to cash overnight; an important indicator of the fund's liquidity conditions.
 - The SEC requires MMFs to maintain their DLA above 10% and disclose it at the same frequency as WLA.
- The key difference between DLA and WLA: the option to impose gates and fees is only contingent on WLA.
 - If our results are indeed driven by asset illiquidity, we should find similar flow sensitivities to DLA.

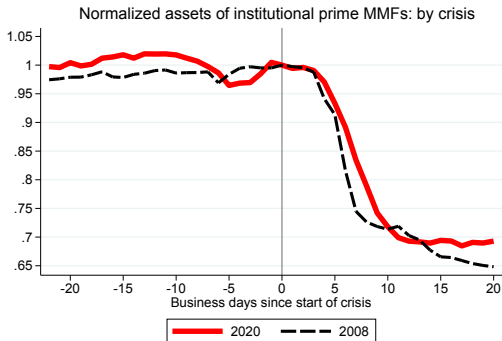
Outflows driven by investors' concern for illiquidity? DLA vs. WLA [2/2]

- DLA does not have any significant impact on fund flows during the crisis.
- The effects of WLA on crisis-time flows remain strong, even after controlling for the DLA effects.

Dependent variable: daily fund percentage flow				
	(1)	(2)	(3)	(4)
Crisis	-3.495*** (1.266)		-6.982*** (2.087)	
DLA	-0.004 (0.015)	-0.006 (0.018)	0.004 (0.013)	0.003 (0.016)
Crisis × DLA	0.038 (0.039)	0.062 (0.043)	-0.020 (0.047)	0.007 (0.055)
WLA			-0.012 (0.026)	-0.014 (0.027)
Crisis × WLA			0.125** (0.058)	0.118* (0.065)
Adj. R^2	0.163	0.243	0.173	0.252
Obs.	1020	1020	1018	1018
Lagged dependent variable	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Day FE		Yes		Yes

Outflows driven by investors' concern for illiquidity? 2008 vs. 2008 [1/2]

- Study the 2008 MMF run, when MMF investors were not subject to WLA-contingent gates and fees.
 - Both runs last about 2 weeks before the Fed's intervention, with an outflow of about 30% of AUMs for institutional prime MMFs.



Note: AUMs are normalized to one for Sep 9, 2008 and Mar 6, 2020.

Outflows driven by investors' concern for illiquidity? 2020 vs. 2008 [2/2]

- The coefficient on $Crisis \times WLA$ is substantially smaller than that in the 2020 results.
- investor flows do not exhibit stronger sensitivity to WLA for funds with lower WLA.

Dependent variable: daily fund percentage flow				
	(1)	(2)	(3)	(4)
$Crisis \times WLA$	0.023** (0.010)	0.022** (0.010)		
$Crisis \times WLA(\leq 40)$			-0.006 (0.024)	-0.027 (0.022)
$Crisis \times WLA(40-50)$			0.033* (0.019)	0.019 (0.016)
$Crisis \times WLA(>50)$			0.015 (0.012)	0.008 (0.011)
Adj. R^2	0.053	0.096	0.055	0.098
Obs.	3925	3925	3925	3925
Lagged dependent variable	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Day FE		Yes		Yes

Alternative explanation: Reverse causality?

- Use an instrument variable for *WLA*:
 - *Maturing*: predetermined amount of a fund's term assets that are going to mature on a given day during the crisis.
 - The instrumented *WLA* continues to explain crisis-time flows.

Estimator:	OLS		IV	
	(1)	(2)	First Stage (WLA)	
			(3)	(4)
Maturing			0.573*** (0.090)	0.571*** (0.081)
Second Stage				
Dependent variable: daily fund percentage flow				
WLA	0.105** (0.046)	0.094* (0.045)	0.377** (0.152)	0.315* (0.166)
Adj. R^2	0.269	0.287	0.013	0.066
Obs.	327	327	327	327
First-stage F statistic			40	50
Lagged dependent variable		Yes		Yes
Controls	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes

Alternative explanation: Driven by floating net asset value (NAV)?

- In the 2016 MMF reform, institutional MMFs are required to adopt floating NAV.
 - Floating NAV could expose investors to more uncertainty.
- Fund NAV doesn't drive flows during the crisis.
 - Possible explanation: The lowest NAV during crisis is \$0.998, while lowest WLA is 27%.

Dependent variable: daily fund percentage flow				
	(1)	(2)	(3)	(4)
Crisis×NAV	0.021 (0.094)	-0.113 (0.111)	0.030 (0.097)	-0.091 (0.109)
Crisis×WLA			0.098** (0.044)	0.124*** (0.041)
Adj. R^2	0.167	0.239	0.175	0.251
Obs.	992	992	989	989
Lagged dependent variable	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Day FE		Yes		Yes

Other alternative explanation

- Driven by investors' concerns for the credit quality of fund asset?
 - Use security-level information to calculate the share of riskier assets (long-term insecure debt, long-term nonfinancial debt).
- Driven by unobservable fund/investor characteristics?
 - Use expense ratio as proxy for investor sophistication levels.
 - Use bank affiliation as proxy for sponsor support
 - Control for fund fixed effects
 - Use normalized WLA (capturing how far a fund's WLA is from 30% relative to the average distance in normal times)

The stabilizing effects of the MMLF

We analyze the following questions:

- Who use more of the MMLF facility and what assets do they pledge? (Using micro-level MMLF data)
- What's the effect of the MMLF in stemming MMF outflows?
 - The key challenge: With other policy actions around the same time, how to identify MMLF-specific effects?
 - Compare the behavior of MMLF-eligible and ineligible funds.

What drives the usage of MMLF facility? [1/2]

- MMLF was launched on March 23 to allow MMFs to liquidate some of their assets to meet redemptions.
 - The usage of MMLF is substantial: about \$56 billion in two weeks (about 8% of total prime fund assets).
- Who use more of the MMLF facility and what assets do they pledge?
 - Use micro-level MMLF data and MMF security-level holding data
 - Construct a fund-CUSIP level data set
 - $SharePledged_{i,j} = \beta_1 \text{Log}(\text{Time to Maturity})_j + \beta_2 \text{Crisis } \Delta WLA_i + \beta_3 \text{Crisis Flow}_i + \text{Controls}_j + \text{Controls}_i + \varepsilon_{i,j}$

What drives the usage of MMLF facility? [2/2]

- Funds with larger crisis-time declines in their WLAs use more of the MMLF.
- Funds prioritize to pledge longer-maturity securities at the MMLF.

Dependent variable: share of securities pledged at the MMLF				
	(1)	(2)	(3)	(4)
log(Time to maturity)	5.722*** (0.805)	6.605*** (0.963)	6.498*** (0.950)	6.337*** (0.950)
Institutional	9.437*** (2.734)			
Crisis Δ WLA		-1.010*** (0.410)	-1.290*** (0.411)	
Crisis fund flow			0.136 (0.138)	
Sample	All prime	Institutional	Institutional	Institutional
Adj. R^2	0.163	0.189	0.189	0.208
Obs.	4784	2303	2303	2303
Security-level controls	Yes	Yes	Yes	Yes
Security type FE	Yes	Yes	Yes	Yes
Fund-level controls		Yes	Yes	
Fund FE				Yes

Identify the effect of the MMLF in stemming MMF outflows [1/2]

- Immediately following the launch of MMLF, the runs on MMFs stop.
- How to disentangle the MMLF effects from those of other policy efforts?
 - Domestic prime MMFs (eligible) vs. Offshore USD prime MMFs (ineligible)
 - Same investment pool (CP and CDs), similar investor base (institutional), and comparable crisis-time outflows (25% and 30%)
- If MMF runs were stopped mainly by broad-based market improvements, we should observe a similar rebound in fund flows for offshore USD prime MMFs.

Identify the effect of the MMLF in stemming MMF outflows [2/2]

- Domestic MMFs had a much quicker and larger rebound in their flows following MMLF relative to the MMLF-ineligible offshore funds.
- Offshore funds only experience significant recovery in flows in the 2nd week after the MMLF.

Dependent variable: daily fund percentage flow			
	(1)	(2)	(3)
MMLF	0.980 (0.569)		
MMLF × Domestic	0.941* (0.529)		
MMLF_Week1		0.109 (0.718)	0.218 (0.713)
MMLF_Week1 × Domestic		1.324** (0.521)	1.017* (0.542)
MMLF_Week2		1.851*** (0.410)	1.361*** (0.331)
MMLF_Week2 × Domestic		0.558 (0.573)	0.511 (0.529)
Adj. R^2	0.047	0.059	0.108
Obs.	1079	1079	1022
Controls			Yes

Conclusions

- 1 Fear of (WLA-contingent) gates and fees exacerbates investor runs on MMF during the COVID-19 crisis.
 - The sensitivity of outflows to funds' WLAs increases substantially in crisis times
 - Outflows accelerate as funds' WLAs approach the 30% threshold.
 - Our results are not driven by concerns for fund liquidity condition, reverse causality, or floating NAV.
- 2 We identify the role of the MMLF in stopping the MMF run.