Does Liquidity Management Induce Fragility in Treasury Prices? Evidence from Bond Mutual Funds

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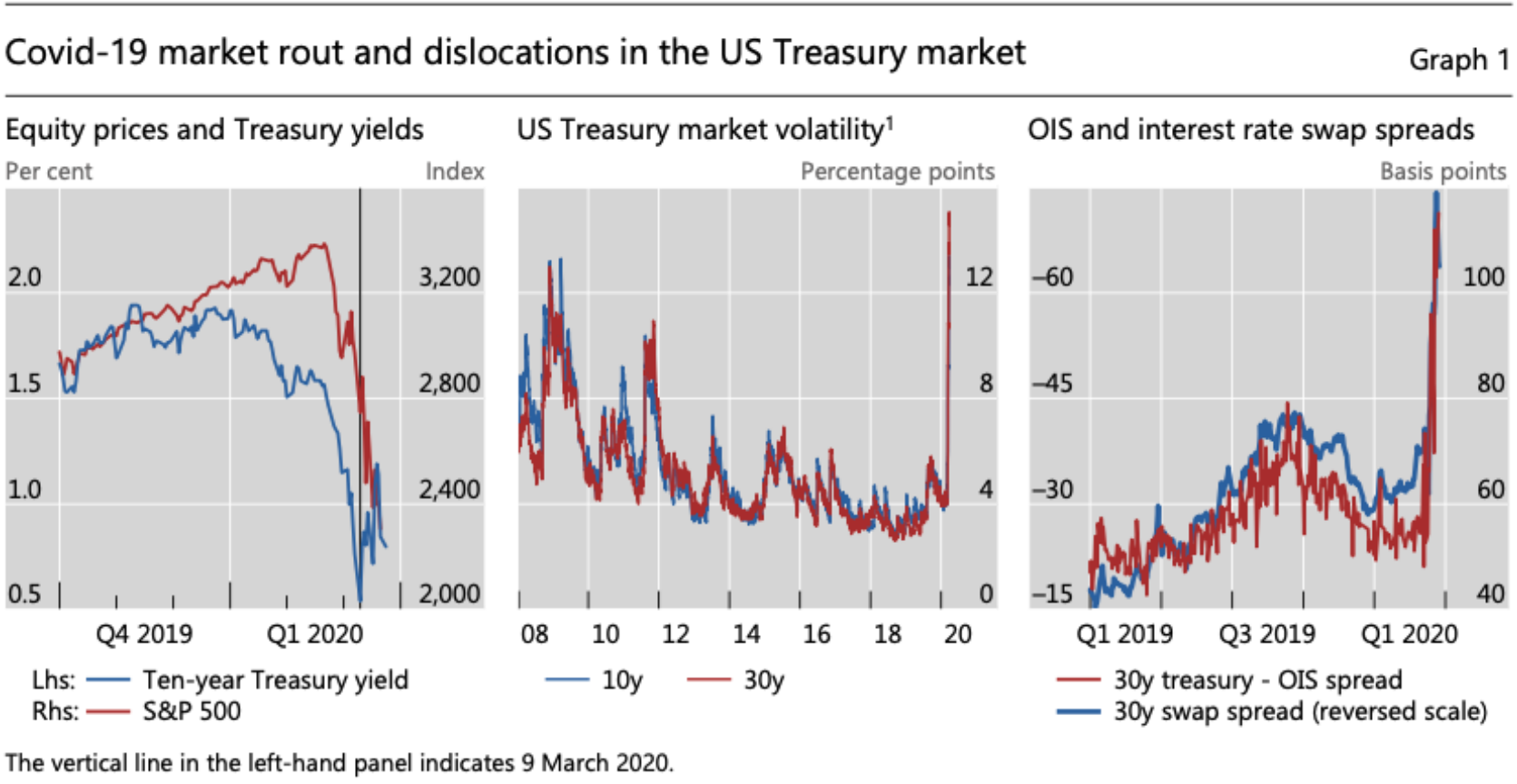
Motivation

- Global investors view the U.S. Treasury market as the safe haven
- until the COVID-19 pandemic



Schrimpf, Shin, and Sushko 2020

Motivation

- Increased fragility in the recent Treasury market.

  'Spikes in volatility and sudden declines in liquidity have become more frequent in both Treasury and equity markets. There is also evidence that liquidity shifts more rapidly and hence is less predictable in these markets.' Jerome Powell (2016)

Our Explanation

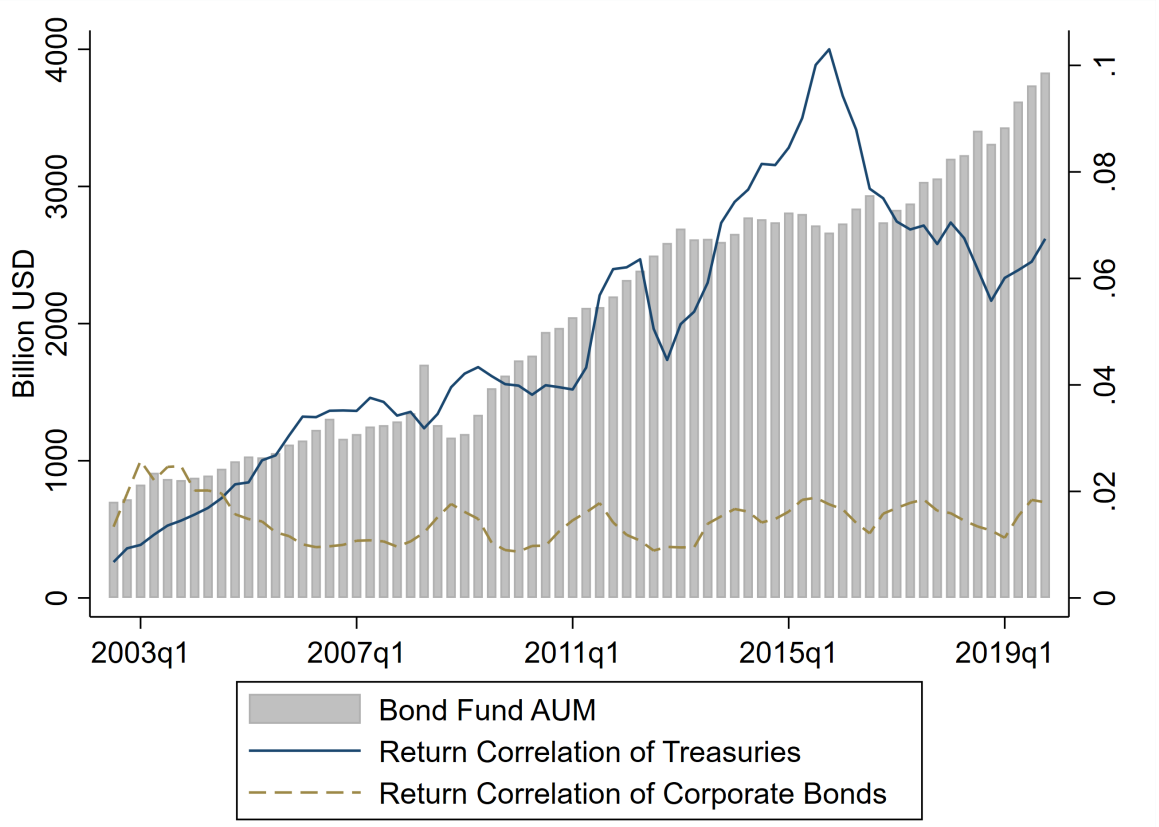
- The rise of open-end mutual funds holding illiquid assets
  - Perform liquidity transformation
  - The strategic complementarity among investors generates fragility (e.g., Chen, Goldstein, & Jiang 2010)
- Liquidity management with Treasuries
  - Hold Treasuries or other cash-like assets to buffer flow shocks
  - Trading-to-flow sensitivity increases for Treasuries, but decrease for corporate bond positions (e.g., Choi et al, 2020; Jiang, Li & Wang 2020)
  - Particularly so for outflows

This Paper: Asset Pricing Implications

- Liquidity management transmit non-fundamental shocks driven by fund flows onto Treasury prices, generating fragility
  - Flow-induced trading generates contemporaneous non-fundamental price pressure which reverts back in weeks
  - Bond funds' ownership induces fragility of Treasury prices
    - ★ Excess return comovement, espeicially during downside markets
    - ★ Commonality in illiquidity
    - ★ Negative skewness
  - Implication: COVID-19
  - Natural experiment: 2003 mutual fund scandal
- Weaker for corporate bond prices
- The mechanism has been more relevant in recent years
  - Total AUM of mutual funds investing illiquid assets grew from 1.3 in 2002 to 7.3 trillion USD in 2019
  - The share of marketable Treasury securities held by long-term mutual funds increased from 3% in 2008 to 8% in 2019, more than the amount held by banks and broker-dealers (Nellie Liang 2020)

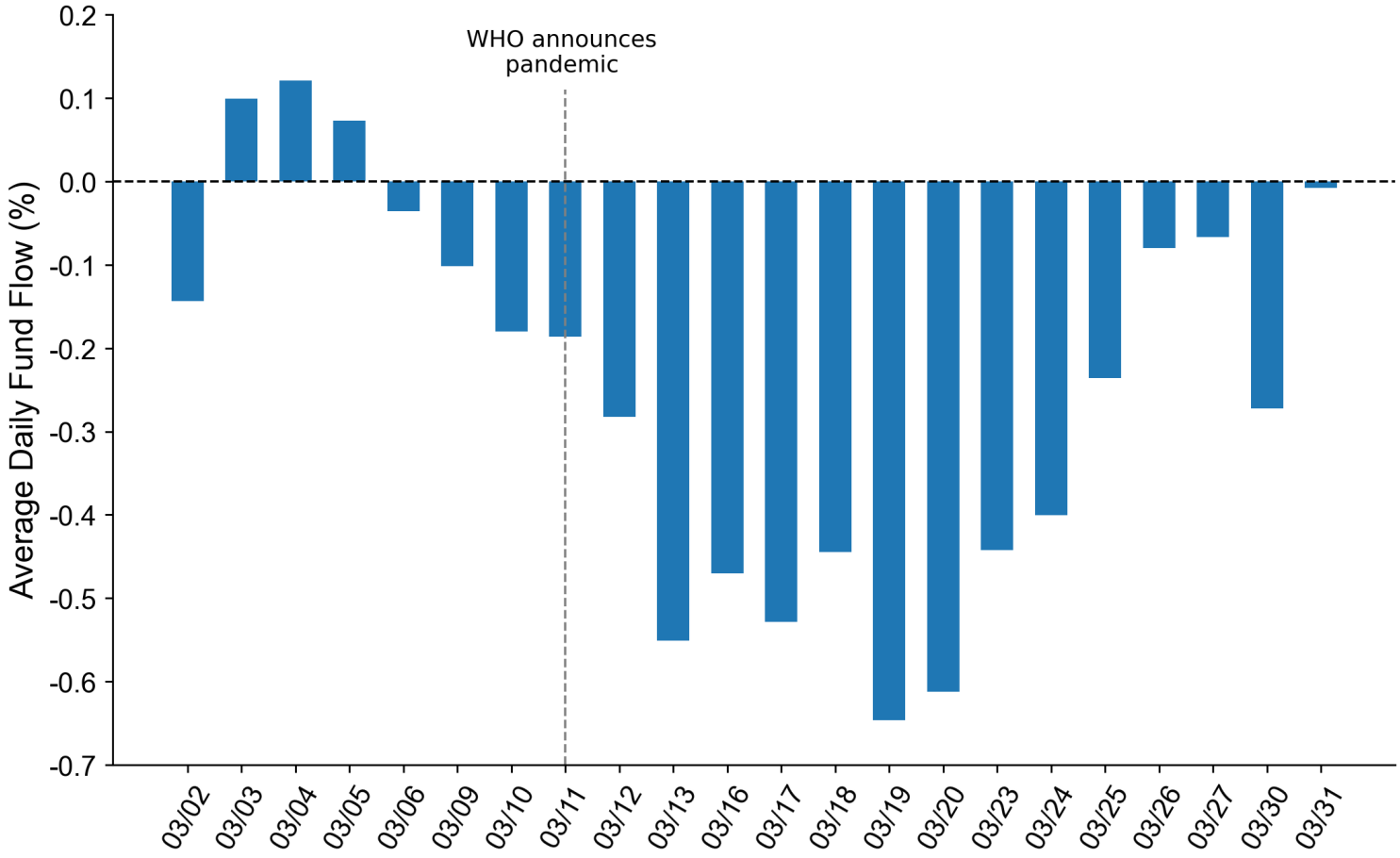
Trends

- The average excess return comovement among Treasuries increases from 1% to 7% between 2002 to 2019

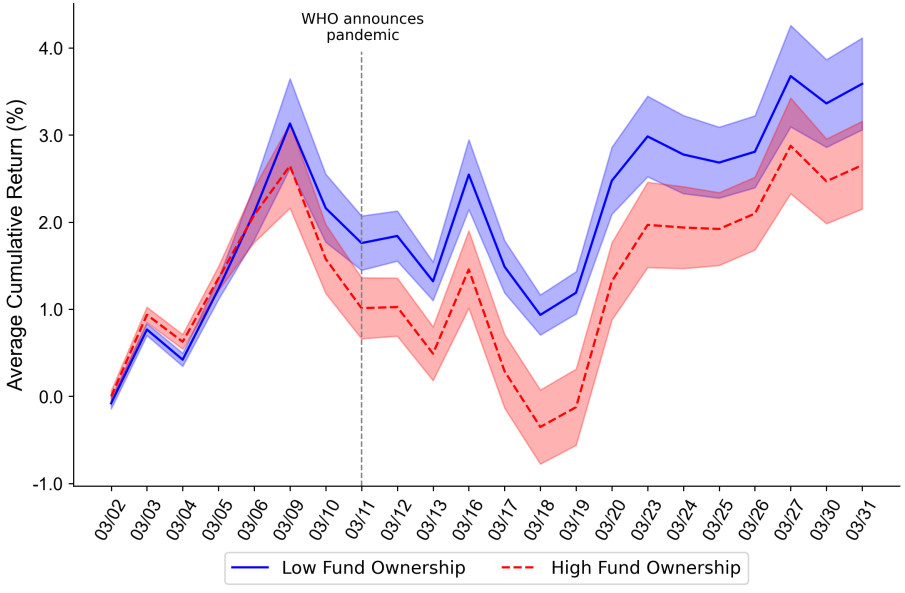


What Happened in March, 2020: Fund Flow

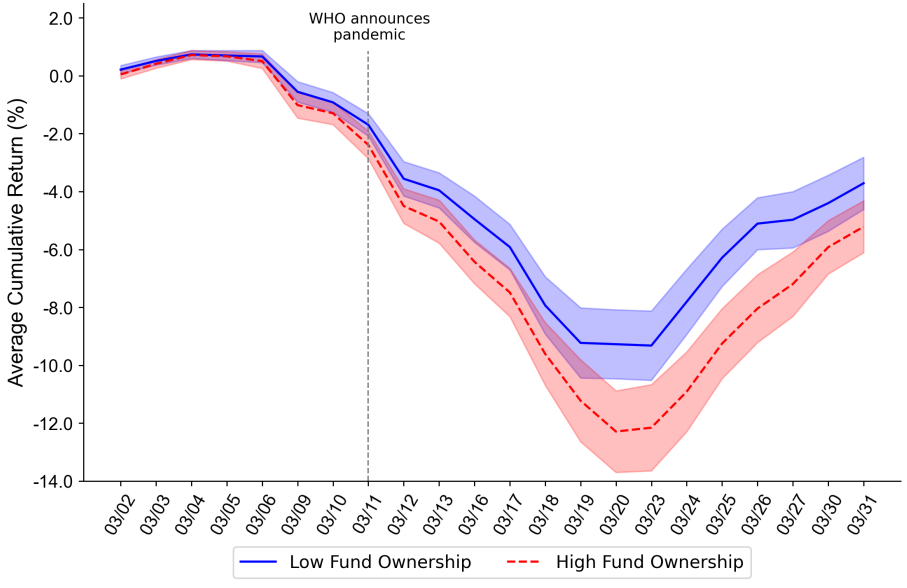
- Totally 5% AUM flow out of bond funds between 03/11 to 03/31



What Happened in March, 2020: Bond Prices



Treasuries



Corporate bonds

Risk-adjusted Bond Return

- Daily bond return

$$Bond\ Ret_{i,t} = \frac{P_{i,t} + AI_{i,t} + C_{i,t}}{P_{i,t-1} + AI_{i,t-1}} - 1.$$

- Daily risk-adjusted return

$$Bond\ Ret - RF_{it} = \alpha_{it} + \sum_{s=0}^{2} \beta_{it-s} TRY_{t-s} + \sum_{s=0}^{2} \gamma_{it-s} IG_{t-s} + \sum_{s=0}^{2} \theta_{it-s} HY_{t-s} + \varepsilon_{it}$$

  - TRY: average daily returns of treasury securities
  - IG: Barclays corporate bond market index LUACTRUU (investment-grade)
  - HY: Barclays corporate bond market index LF98TRUU (junk bond)
  - We include two lags for each factor to take into account of non-synchronized trading.
  - Additional factors for robustness: *VIX*, *TERM*, and *DEF*.

Liquidity Management: Trading-to-Flow Sensitivity

$$NetBuy_{f,q} = \frac{\sum_i^N Share_{i,f,q} P_{i,q-1} - \sum_i^N Share_{i,f,q-1} P_{i,q-1}}{\sum_i^N Share_{i,f,q-1} P_{i,q-1}}$$

$$Fund\ Flow_{f,q} = \frac{TNA_{f,q} - TNA_{f,q-1}(1 + Fund\ Return_{f,q})}{TNA_{f,q-1}}$$

$$NetBuy_{f,q} = \alpha + \beta_1 \cdot Fund\ Flow_{f,q} + \beta_2 \cdot Fund\ Flow_{f,q-1} + \gamma_1 \cdot Fund\ Return_{f,q} + \gamma_2 \cdot Fund\ Return_{f,q-1} + \phi_f + \delta_q + \varepsilon_{f,q}$$

- $\beta_1 > 1$ for Treasuries, $\beta_1 < 1$ for corporate bonds
- $Out_{f,q}$: A dummy variable that equals one if $Flow_{f,q}$ is negative, and zero otherwise

Result: Liquidity Management

DepVar:	$Net\ Buy_{f,q}$							
	Treasuries				Corporate Bonds			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Fund\ Flow_{f,q}$	1.382***	1.417***	1.197***	1.249***	0.864***	0.859***	0.882***	0.876***
	(23.5)	(22.5)	(15.5)	(15.6)	(23.9)	(23.3)	(16.0)	(16.0)
$Fund\ Flow_{f,q} \times Out_{f,q}$			0.564***	0.509***			-0.055	-0.052
			(4.2)	(4.0)			(-0.7)	(-0.7)
$Fund\ Flow_{f,q-1}$	-0.302***	-0.259***	-0.226***	-0.164***	0.214***	0.206***	0.225***	0.212***
	(-6.3)	(-5.8)	(-3.7)	(-3.2)	(7.2)	(7.0)	(5.4)	(5.1)
$Fund\ Flow_{f,q-1} \times Out_{f,q-1}$			-0.234*	-0.313***			-0.044	-0.025
			(-2.0)	(-3.1)			(-0.5)	(-0.3)
$Fund\ Return_{f,q}$	-0.760***	-0.585*	-0.789***	-0.608**	-0.001	-0.185	0.003	-0.183
	(-3.2)	(-2.0)	(-3.3)	(-2.1)	(-0.0)	(-0.8)	(0.0)	(-0.8)
$Fund\ Return_{f,q-1}$	0.163	0.326	0.145	0.317	-0.552***	-0.693***	-0.547***	-0.689***
	(0.6)	(1.0)	(0.5)	(1.0)	(-3.3)	(-3.9)	(-3.2)	(-3.8)
Fund Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of Obs	34,008	34,008	34,008	34,008	34,008	34,008	34,008	34,008
Adj R^2	0.070	0.190	0.071	0.191	0.097	0.159	0.097	0.159

- 1% inflow $\rightarrow$ a 1.25% (0.88%) increase in Treasury (corporate bond) holdings
- 1% outflow $\rightarrow$ a 1.76% (0.82%) decrease in Treasury (corporate bond) holdings

Flow-induced Trading Impact on Treasury Prices

- Following Lou (2012):

$$FIT_{i,t} = \frac{\sum_i^F Share_{i,f,q-1} * Fund\ Flow_{f,t}}{\sum_i^F Share_{i,f,q-1}}$$

- The asymmetric impact between inflows and outflows:
  - *FIT_Positive*: *FIT* computed from funds with positive flows
  - *FIT_Negative*: *FIT* computed from funds with negative flows
- Fama-MacBeth (1973) regressions:

$$Return_{i,t} = \alpha + \beta \cdot FIT_{i,t} + \theta \cdot X_{i,t} + \varepsilon_{i,t}$$

  - $X_{i,j,q-1}$: *On-the-run*, *Coupon*, and *Time-to-maturity*

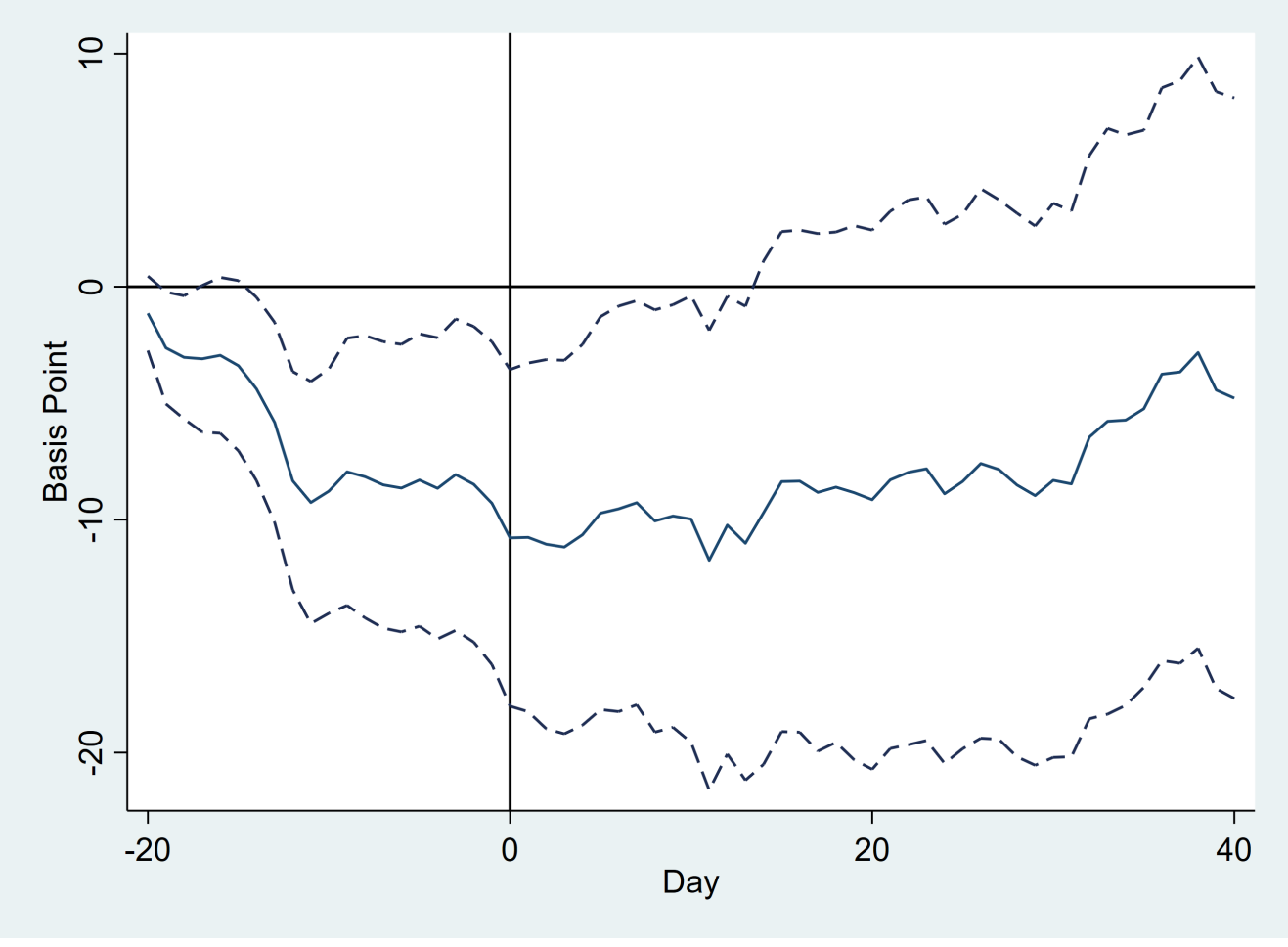
Flow-induced Trading Impact on Treasury Prices

$$Return_{i,t} = \alpha + \beta \cdot FIT_{i,t} + \theta \cdot X_{i,t} + \varepsilon_{i,t}$$

DepVar:	Risk-adjusted Return		Excess Return	
	(1)	(2)	(3)	(4)
FIT	4.801***		2.833***	
	(3.9)		(3.0)	
FIT_Pos		3.618**		0.955
		(2.3)		(0.8)
FIT_Neg		7.755***		6.544***
		(3.0)		(3.5)
On-the-run			3.717	3.904
			(1.5)	(1.6)
Coupon Rate			21.307***	20.987***
			(9.1)	(9.0)
Time-to-maturity			12.247	12.410*
			(1.6)	(1.7)
# of Obs	57,521	57,521	57,521	57,521

- A one SD increase in *FIT* is associated with a 4.8 bp increase in the risk-adjusted return in the contemporaneous month.
- The price impact is about two times stronger for outflows than for inflows.

Flow-induced Trading Impact on Treasury Prices



- Cumulative return spread between a portfolio with negative FIT and a portfolio with positive FIT, where $t = 0$ is the end of the formation month.

Common Ownership and Return Comovement

- Common ownership (Anton and Polk, 2014) for each Treasury pair, i and j, at quarter q,

$$\textit{Common Ownership}_{i,j,q} = \frac{\sum_{f=1}^{F}(\textit{Shares}_{i,f,q} \times P_{i,q} + \textit{Shares}_{j,f,q} \times P_{j,q})}{\textit{SharesOutstanding}_{i,q} \times P_{i,q} + \textit{SharesOutstanding}_{j,q} \times P_{j,q}}$$

- Fama-MacBeth (1973) regressions

$$\begin{aligned} \textit{Corr}_{i,j,q} = &\quad \alpha + \beta \cdot \textit{Common Ownership}_{i,j,q-1} + \theta \cdot X_{i,j,q-1} + \varepsilon_{i,j,q} \\ \textit{Down-minus-up}_{i,j,q} = &\quad \alpha + \beta \cdot \textit{Common Ownership}_{i,j,q-1} + \theta \cdot X_{i,j,q-1} + \varepsilon_{i,j,q} \end{aligned}$$

  - *Corr*: The pairwise return correlation of daily risk-adjusted returns
  - *Down-minus-up*: The difference in the pairwise return correlation between downside and upside markets
    - ★ Upside (downside) markets: daily aggregate Treasury market return above (below) quarter median

Result: Common Ownership and Return Comovement

$$Corr_{i,j,q} = \alpha + \beta \cdot Common\ Ownership_{i,j,q-1} + \theta \cdot X_{i,j,q-1} + \varepsilon_{i,j,q}$$

Panel A: Treasury			Panel B: Corporate Bonds		
DepVar:	Corr		DepVar:	Corr	
	(1)	(2)		(3)	(4)
Common Onwership	0.103***	0.079***	*Common Ownership*	0.007***	0.005***
	(36.8)	(19.8)		(9.9)	(9.1)
On-the-run Difference		0.016***	*Liquidity Difference*		-0.004***
		(4.3)			(-13.4)
Coupon Rate Difference		-0.056***	*Coupon Rate Difference*		-0.002***
		(-20.7)			(-4.3)
Time-to-maturity Difference		-0.176***	*Rating Difference*		-0.003***
		(-21.6)			(-7.5)
			Time-to-maturity Difference		-0.003***
					(-7.3)
# of Obs	2,185,735	2,185,735	# of Obs	11,528,871	11,528,871

- A one SD increase in *Common Ownership* is associated with a 7.9% increase in the return correlation between two Treasuries (sample mean = 6.2%)
- A one SD increase in *Common Ownership* is associated with a 0.5% increase in the return correlation between two corporate bonds (sample mean = 1.4%)

Result: Upside vs. Downside Markets

$$\textit{Down-minus-up}_{i,j,q} = \alpha + \beta \cdot \textit{Common Ownership}_{i,j,q-1} + \theta \cdot X_{i,j,q-1} + \varepsilon_{i,j,q}$$

Panel A: Treasury			Panel B: Corporate Bonds		
DepVar:	Down-minus-up		DepVar:	Down-minus-up	
	(1)	(2)		(3)	(4)
Common Onwership	0.011***	0.008***	*Common Ownership*	0.0005	0.0004
	(5.3)	(2.9)		(1.3)	(1.3)
On-the-run Difference		-0.012***	*Liquidity Difference*		-0.0000
		(-5.2)			(-0.1)
Coupon Rate Difference		0.008	*Coupon Rate Difference*		0.0000
		(1.5)			(0.0)
Time-to-maturity Difference		-0.065***	*Rating Difference*		-0.0004
		(-7.5)			(-1.1)
			Time-to-maturity Difference		0.0006
					(1.2)
# of Obs	2,185,735	2,185,735	# of Obs	11,528,871	11,528,871

- A one standard deviation increase in *Common Ownership* is associated with a 0.8% increase *Down-minus-up* (sample mean = 0.3%)

Result: COVID-19

$$Corr_{i,j,m} = \alpha + \beta \cdot Treat_{i,j} \times After_m + \theta_1 \cdot Treat_{i,j} + \theta_2 \cdot After_m + \theta_3 \cdot X_{i,j,2019} + \varepsilon_{i,j,m}$$

- $Treat_{i,j} = 1$ if the security pair i and j has common ownership (at the end of 2019) above the median, and zero otherwise.
- $After_m = 1$ if $Corr_{i,j,m}$ is computed on and after March 11, 2020, zero otherwise.

DepVar:	Corr			
	Treasuries		Corporate Bonds	
	(1)	(2)	(3)	(4)
Treat × *After*	0.042***	0.042***	0.009***	0.009***
	(7.2)	(10.7)	(2.6)	(2.6)
Treat	0.210***	0.134***	0.017***	0.010***
	(47.6)	(48.0)	(8.8)	(4.7)
After	0.015***	0.015***	-0.009***	-0.009***
	(4.0)	(5.7)	(-3.5)	(-3.5)
Controls	No	Yes	No	Yes
# of Obs	97,006	97,006	126,186	126,186
Adj R^2	0.063	0.567	0.001	0.003

Natural Experiment: 2003 Mutual Fund Scandal

- Regulatory inquiry in September 2003 resulted in litigation in which 25 mutual fund families were implicated in illegal trading practices
- The natural experiment
  - The scandal had a negative impact on affected funds' flows from 2003Q4 to 2006Q4 (McCabe, 2009; Anton and Polk, 2014; Koch, Ruenzi, and Starks, 2016)
  - It was unlikely to be related to the characteristics of bonds the funds hold
- Following Koch, Ruenzi, and Starks (2016), a difference-in-differences regression:

$$\begin{aligned} \textit{Down-minus-up}_{i,j,q} =& \alpha + \beta \cdot \textit{Treat}_{i,j} \times \textit{Event} + \theta_1 \cdot \textit{Treat}_{i,j} \\ & + \theta_2 \cdot X_{i,j,q-1} + \textit{year-quarter dummies} + \varepsilon_{i,j,q}, \end{aligned} \tag{1}$$

Natural Experiment: 2003 Mutual Fund Scandal

DepVar:	Down-minus-up			
	(1)	(2)	(3)	(4)
Treat × *Event*	-0.005*	-0.005*	-0.005**	-0.007***
	(-1.8)	(-1.8)	(-2.0)	(-2.6)
Treat	0.005**	0.005**	0.003	-0.002
	(2.3)	(2.4)	(1.5)	(-0.8)
On-the-run Difference		-0.012***	-0.012***	-0.006
		(-3.7)	(-3.6)	(-0.8)
Coupon Rate Difference			-0.007***	-0.007***
			(-11.4)	(-11.9)
Time-to-maturity Difference				-0.051***
				(-89.6)
# of Obs	128,818	128,818	128,818	128,818

Result: Outflow Funds versus Inflow Funds

DepVar:	Corr			
	Treasuries		Corporate Bonds	
	(1)	(2)	(3)	(4)
Common Ownership	0.075***	0.075***	0.004***	0.004***
	(10.5)	(10.6)	(4.5)	(4.6)
Common Ownership × *Ratio of Outflow*	0.039**	0.038**	-0.000	-0.000
	(2.3)	(2.3)	(-0.2)	(-0.0)
Ratio of Outflow	0.015	0.015	-0.002*	-0.002*
	(1.3)	(1.3)	(-1.7)	(-1.8)
Control	Yes	Yes	Yes	Yes
Control × *Ratio of Outflow*	No	Yes	No	Yes
# of Obs	1,836,161	1,836,161	5,820,845	5,820,845

- *Ratio of Outflow*: holding-weighted proportion of the security pair's common funds whose fund flow is negative.
- The effect of fund common ownership on Treasury return comovement is stronger when more funds experience redemption.

Liquidity Commonality and Skewness

- Recent studies document a deterioration in the liquidity conditions in the treasury market
  - Schrimpf, Shin, and Sushko (2020), Fleming and Ruela (2020)
  - Liquidity dry-up in Treasuries during the COVID-19 crisis
  - Another indicator for market fragility
- The negative skewness of risk-adjusted returns
  - A widely used measure of the likelihood of price crashes (e.g., Chen, Hong, and Stein, 2001; Brunnermeier, Nagel, and Pedersen, 2008)
- We use the sample spanning a long period and conduct cross-sectional tests to study whether fund common ownership can generate liquidity commonality and decreasing skewness in Treasuries.
  - Liquidity dry-up event: days with bid-ask spreads exceeding the top quartile of bid-ask spreads in the previous four quarters.
  - *Common Dry-ups*: A dummy variable that equals one if these two Treasuries have experienced liquidity dry-ups in the same day.

Liquidity Commonality and Skewness

$$\textit{Common Dry-ups}_{i,j,q} = \alpha + \beta \cdot \textit{Common Ownership}_{i,j,q-1} + \theta \cdot X_{i,j,q-1} + \varepsilon_{i,j,q}$$

$$\textit{Skewness}_{i,j,q} = \alpha + \beta \cdot \textit{Ownership}_{i,j,q-1} + \theta \cdot X_{i,j,q-1} + \varepsilon_{i,j,q}$$

Panel A: Full Sample				
DepVar:	Common Dry-ups		Skewness	
	(1)	(2)	(3)	(4)
Common Ownership	0.025***	0.027***		
	(3.6)	(3.6)		
Ownership			-0.587***	-0.441***
			(-9.9)	(-10.9)
Controls	No	Yes	No	Yes
# of Obs	2,185,735	2,185,735	16,477	16,477
Panel B: Mutual Fund Scandal				
DepVar:	Common Dry-ups		Skewness	
	(1)	(2)	(3)	(4)
Treat × *Event*	-0.002***	-0.002***	0.238**	0.269**
	(-3.3)	(-3.2)	(2.0)	(2.2)
Treat	0.002***	0.002***	-0.184**	-0.260***
	(4.1)	(3.3)	(-2.0)	(-2.7)
Controls	No	Yes	No	Yes
# Obs	128,818	128,818	3,082	3,082

Conclusion

- Liquidity management contributes to the increasing fragility in the Treasury market
  - Non-fundamental-driven flow-induced trading generates contemporaneous price impacts and subsequent reversal.
  - Excess return comovement, especially during downside markets.
  - Liquidity commonalities
  - Skewness

- Our findings call for regulatory actions to stabilize the most liquid asset market
  - e.g., Liang (2020) advocates to match the liquidity of bond funds' assets to the liquidity that funds offer
  - Swing pricing, e.g., Jin, Kacperczyk, Kahraman, & Suntheim (2019)