Flow-Induced Trading: Evidence from the Daily Trading of Municipal Bond Mutual Funds

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Markets

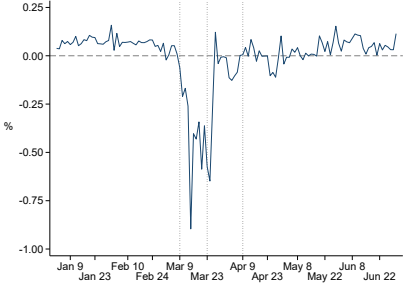
Record Exodus From Muni-Bond Funds Fuels Worst One-Day Rout

By Romy Varghese and Amanda Albright

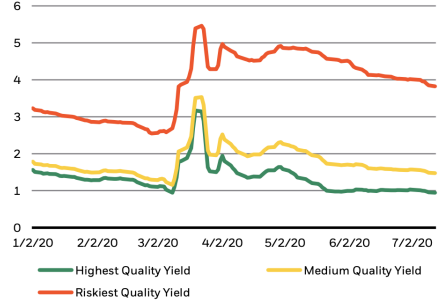
March 19, 2020, 3:45 PM EDT *Updated on March 19, 2020, 5:28 PM EDT*

- Outflow is nearly triple previous record of $4.5 billion
- Pullback comes as sell-off sends yields surging at record pace

Aggregate fund flows



Municipal spreads by credit quality



SEC Proposes Enhancements to Open-End Fund Liquidity Framework

FOR IMMEDIATE RELEASE | 2022-199

Washington D.C., Nov. 2, 2022 —The Securities and Exchange Commission today voted to propose amendments to better prepare open-end funds for stressed conditions and to mitigate dilution of shareholders' interests. The rule and form amendments would enhance how funds manage their liquidity risks, require mutual funds to implement liquidity management tools, and provide for more timely and detailed reporting of fund information.

The Securities and Exchange Commission proposed amendments to better prepare open-end management investment companies ("open-end funds") for stressed conditions and mitigate dilution of shareholders' interests. The rule and form amendments incorporate lessons learned from the market events of March 2020 and would improve on the existing framework by:

- Enhancing how open-end funds other than money market funds ("MMFs") and certain exchange traded funds ("ETFs") classify the liquidity of their investments and requiring a minimum amount of highly liquid assets of at least 10 percent of net assets;
- Requiring any open-end fund, other than a MMF or ETF, to use swing pricing and implementing a "hard close" to operationalize this pricing and to improve order processing more generally; and
- Providing for more frequent, timelier, and more detailed public reporting of fund information, including information about funds' liquidity and use of swing pricing.

Research Questions

- How do open-end funds trade in response to flows? How do market conditions affect trading behavior? How might larger cash buffers affect trading behavior?

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  - Suggests relatively little reliance on cash buffers over 1–3 months horizon.
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- Existing evidence uses quarterly/monthly data.
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  - Limited statistical power to test for how expectations of market conditions may affect trading.
- Short-term reliance could be much greater.
- This paper uses novel data on daily flows, trading, and cash buffers to study the dynamics of flow-induced trading and evaluates the role of cash buffers.
- Approach: Take advantage of infrequent trading in the muni bond market to identify mutual fund trades in MSRB muni transaction data.

Algorithm to Identify Mutual Fund Trades in MSRB

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- Algorithm includes holdings of closed-end funds, non-muni open-end funds, and separately managed accounts. Analysis sample limited to muni open-end funds.
- Types of trades:
  1. **Single fund trade** = Change in fund's holdings matches to a single unique trade in MSRB.
  2. **Split fund trade** = Change in fund's holdings matches to a unique combination of trades in MSRB.
  3. **Single family trade** = Sum of changes in holdings across family funds matches to a single unique trade in MSRB.
  4. **Split family trade** = Sum of changes in holdings across family funds matches to a unique combination of trades in MSRB.
  5. **Larger family trade** = Sum of changes in holdings across family funds matches to a unique larger trade in MSRB.

Algorithm to Identify Mutual Fund Trades in MSRB

Single Fund Trades

Fund ID	Month	CUSIP	Par	Value
FSUSA000L8	2015.07	072024MN9	10.000	11.546
FSUSA000L8	2015.08	072024MN9	10.000	11.513
FSUSA000L8	2015.09	072024MN9	10.000	11.478
FSUSA000L8	2015.10	072024MN9	10.000	11.480
FSUSA000L8	2015.11	072024MN9	10.000	11.391
FSUSA000L8	2015.12	072024MN9	10.000	11.354
FSUSA000L8	2016.01	072024MN9	10.000	11.384
FSUSA000L8	2016.02	072024MN9	10.000	11.381
FSUSA000L8	2016.03	072024MN9	0.000	0.000

Trade Date/Time	Settlement Date	Price (%)	Yield (%)	Calculation Date & Price (%)	Trade Amount ($)	Trade Type	Special Condition
03/28/2016 03:41 PM	03/31/2016	112.593	0.98	-	100,000	Customer sold	-
03/14/2016 01:30 PM	03/17/2016	113.123	0.865	-	10,000,000	Customer sold	-
03/09/2016 01:46 PM	03/10/2016	113.317	0.831	-	1,500,000	Customer sold	-

- Require a 1-1 match between holdings data and MSRB.

Algorithm to Identify Mutual Fund Trades in MSRB

Split Fund Trades

Fund ID	Month	CUSIP	Par	Value
FSUSA000CX	2016.06	544646DR0	26.375	27.394
FSUSA000CX	2016.09	544646DR0	26.375	27.097
FSUSA000CX	2016.12	544646DR0	0.000	0.000

Trade Date/Time	Settlement Date	Price (%)	Yield (%)	Calculation Date & Price (%)	Trade Amount ($)	Trade Type	Special Condition
12/13/2016 04:28 PM	12/16/2016	101.748	1.25	-	6,375,000	Customer sold	-
12/13/2016 12:32 PM	12/16/2016	101.4	1.888	07/01/2017 @ 100	40,000	Customer sold	-
12/13/2016 10:31 AM	12/16/2016	101.748	1.25	-	10,000,000	Customer sold	-
12/12/2016 02:14 PM	12/15/2016	100.195	4.13	07/01/2017 @ 100	20,000	Customer sold	-
12/09/2016 01:17 PM	12/14/2016	101.766	1.25	-	10,000,000	Customer sold	-

- Can also identify trades that must be in any plausible combination.
- Limit to combinations of at most 5 trades and to CUSIPs with at most 25 unmatched customer sales.

Algorithm to Identify Mutual Fund Trades in MSRB

Single Family Trades

Fund ID	Fund Name	Month	CUSIP	Par	Value
FSUSA00243	Putnam AMT-Free Municipal Fund	2016.09	01728VTH3	1.500	1.810
FSUSA00254	Putnam Tax Exempt Income Fund	2016.09	01728VTH3	3.750	4.524
FSUSA00255	Putnam Tax-Free High Yield Fund	2016.09	01728VTH3	3.700	4.463
FSUSA00243	Putnam AMT-Free Municipal Fund	2016.12	01728VTH3	0.000	0.000
FSUSA00254	Putnam Tax Exempt Income Fund	2016.12	01728VTH3	0.000	0.000
FSUSA00255	Putnam Tax-Free High Yield Fund	2016.12	01728VTH3	0.000	0.000

Trade Date/Time	Settlement Date	Price (%)	Yield (%)	Calculation Date & Price (%)	Trade Amount ($)	Trade Type	Special Condition
10/27/2016 10:00 AM	11/01/2016	115.764	3.15	-	8,950,000	Customer sold	-

- Algorithm tries alternative definitions of family: branding name from Morningstar, subadviser name from SEC filings.

Algorithm to Identify Mutual Fund Trades in MSRB

Split Family Trades

FundID	Fund Name	Month	CUSIP	Par	Value
FSUSA001V7	Oppenheimer Rochester® California Municipal Fund	2019.08	79739GBY1	0.000	0.000
FSUSA04YSK	Oppenheimer Rochester® Limited Term California Municipal Fund	2019.08	79739GBY1	0.000	0.000
FSUSA001V7	Oppenheimer Rochester® California Municipal Fund	2019.09	79739GBY1	1.560	1.503
FSUSA04YSK	Oppenheimer Rochester® Limited Term California Municipal Fund	2019.09	79739GBY1	1.465	1.600

Trade Date/Time	Settlement Date	Price (%)	Yield (%)	Calculation Date & Price (%)	Trade Amount ($)	Trade Type	Special Condition
09/26/2019 03:28 PM	09/30/2019	103.04	0.936	07/01/2020 @ 100	5,000	Customer bought	-
09/16/2019 11:57 AM	09/18/2019	102.716	1.509	07/01/2020 @ 100	945,000	Customer bought	-
09/16/2019 11:31 AM	09/18/2019	102.716	1.509	07/01/2020 @ 100	2,080,000	Customer bought	-
09/06/2019 04:36 PM	09/10/2019	103.31	0.88	07/01/2020 @ 100	5,000	Customer bought	-
09/06/2019 03:50 PM	09/10/2019	103.31	0.88	07/01/2020 @ 100	50,000	Customer bought	-

- Allocate trades pro-rata across funds.

Algorithm to Identify Mutual Fund Trades in MSRB

Single Trades for Larger Amount

Fund ID	Fund Name	Month	CUSIP	Par	Value
FS00008KOB	Performance Trust Municipal Bond Fund	2011.12	167505NW2	0.250	0.291
FS00008KOB	Performance Trust Municipal Bond Fund	2012.03	167505NW2	0.250	0.290
FS00008KOB	Performance Trust Municipal Bond Fund	2012.06	167505NW2	0.250	0.298
FS00008KOB	Performance Trust Municipal Bond Fund	2012.09	167505NW2	0.250	0.303
FS00008KOB	Performance Trust Municipal Bond Fund	2012.12	167505NW2	0.000	0.000

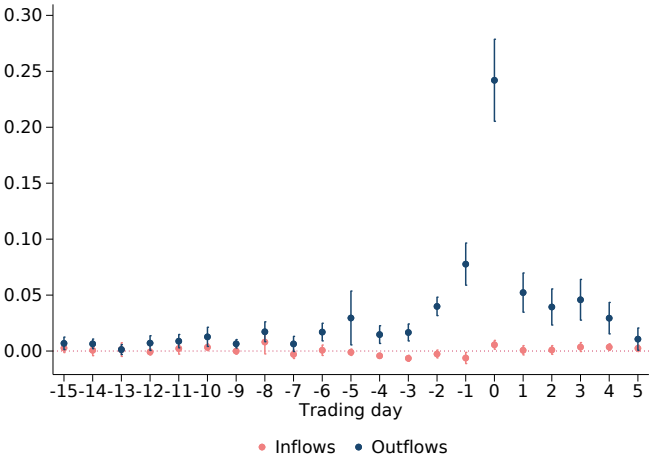
Trade Date/Time	Settlement Date	Price (%)	Yield (%)	Calculation Date & Price (%)	Trade Amount ($)	Trade Type	Special Condition
12/07/2012 10:23 AM	12/12/2012	118.131	2.479	-	50,000	Customer sold	-
10/02/2012 02:58 PM	10/05/2012	119.724	2.33	-	275,000	Customer sold	-

- Require sum of all smaller trades to be smaller than fund's trade.
- Larger trades may reflect a) gaps in holdings data or b) fund adviser's coordination with other assets managed by adviser.

Identification of Changes in Portfolio Holdings

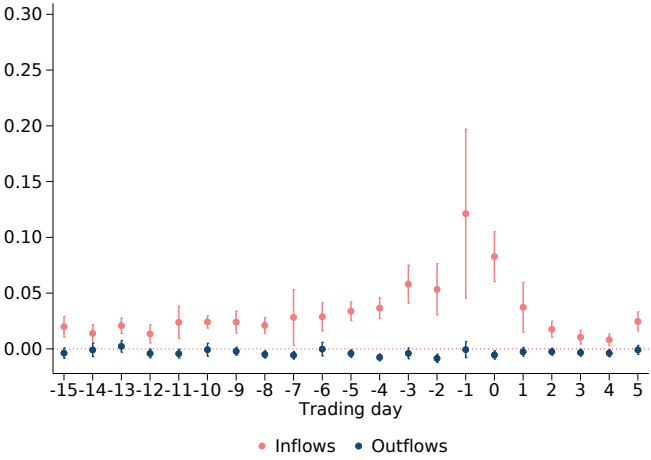
Type	N	Equal-weighted (%)	Par-weighted (%)
Bond events			
Maturities, calls, and redemptions	182,480	23.43	9.86
New issues and remarketing issues	49,636	6.37	9.52
Exchanges	15,497	1.99	1.68
Default distributions	324	0.04	0.04
Fund mergers	11,141	1.43	1.04
Securities never in MSRB	14,041	1.80	3.37
Matched to MSRB			
Single fund trade	325,895	41.85	42.32
Part of a single family trade	51,231	6.58	8.09
Split fund trade	25,772	3.31	5.77
Part of a split family trade	5,479	0.70	1.33
Part of a single larger MSRB trade	26,094	3.35	4.39
Not matched			
Cross trades	1,898	0.24	0.29
Others	69,204	8.89	12.29

Response of Daily Sales to Inflows and Outflows



- \$1 of outflows is associated with 24 cents in day t sales.
- Rest accommodated with **cash**.
- Another 27 cents in sales over the next 15 trading days.
- Anticipation of outflows: \$1 of outflows over days $[t+1, t+5]$ is associated with 18 cents in day t sales.
- Over 21 trading days, \$1 of outflows is associated with 69 cents in sales, 31 cents in cash.

Response of Daily Purchases to Inflows and Outflows



- Similar response over 21 trading days: \$1 of inflows associated with 70 cents in purchases, 30 cents in cash.
- But different dynamics: more delayed and gradual response.
- \$1 of inflow associated with only 8 cents in day t purchases.

Daily Cash Buffers

		Purchases			
	Sales	Total	Primary	Secondary	Net sales
	(1)	(2)	(3)	(4)	(5)
$\text{Outflows}_{f,t}$	0.383***	−0.004	−0.002	−0.002	0.386***
	(0.035)	(0.003)	(0.002)	(0.002)	(0.037)
$\text{Outflows}_{f,t} \times \text{Cash}_{f,t-1}$	−0.018***	−0.000	−0.000	−0.000	−0.018***
	(0.004)	(0.000)	(0.000)	(0.000)	(0.004)
$\text{Inflows}_{f,t}$	0.003	0.071***	0.027*	0.044***	−0.068***
	(0.003)	(0.017)	(0.014)	(0.011)	(0.017)
$\text{Inflows}_{f,t} \times \text{Cash}_{f,t-1}$	0.001	0.002	0.001	0.001	−0.001
	(0.000)	(0.002)	(0.002)	(0.002)	(0.002)
$\text{Cash}_{f,t-1}$	0.002**	0.007***	0.006***	0.002***	−0.005***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Adjusted R^2	0.071	0.071	0.052	0.044	0.081
Date FEs	✓	✓	✓	✓	✓

- Day $t-1$ cash $\uparrow$ 1pp $\implies \approx$ 5% lower sensitivity of sales to outflows.
- Funds without cash immediately sell 38 cents of bonds in response to \$1 of outflows.
- Funds with 10% cash buffer sell 20 cents.
- Cash buffers do not affect the response of purchases to flows or the response to sales to inflows.

Monthly Cash Buffers

Using cash buffers as of last monthly/quarterly reporting period would underestimate the effect of cash buffers by more than 50%

		Purchases			
	Sales	Total	Primary	Secondary	Net sales
	(1)	(2)	(3)	(4)	(5)
$\text{Outflows}_{f,t}$	0.282^{***}	-0.008^{***}	-0.004^{*}	-0.004^{**}	0.290^{***}
	(0.031)	(0.003)	(0.002)	(0.001)	(0.031)
$\text{Outflows}_{f,t} \times \text{Cash}_{f,m-1}$	-0.008^{**}	0.000	0.000	0.000	-0.008^{**}
	(0.004)	(0.000)	(0.000)	(0.000)	(0.004)
$\text{Inflows}_{f,t}$	0.002	0.079^{***}	0.017^{***}	0.062^{***}	-0.077^{***}
	(0.003)	(0.012)	(0.005)	(0.012)	(0.012)
$\text{Inflows}_{f,t} \times \text{Cash}_{f,m-1}$	0.000	0.000	0.001	-0.001	0.000
	(0.000)	(0.002)	(0.001)	(0.001)	(0.001)
$\text{Cash}_{f,m-1}$	0.003^{***}	0.006^{***}	0.004^{***}	0.002^{***}	-0.003^{***}
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Adjusted R^2	0.065	0.069	0.050	0.043	0.076
Date FEs	✓	✓	✓	✓	✓

Other Analyses

1. Cross-sectional differences in the propensity to trade in response to fund flows.
   - Larger funds sell less in response to outflows.
   - Funds holding longer maturity bonds also sell less in response to outflows.
2. Analysis of which bonds funds trade in response to fund flows.
   - When trading in response to fund flows, funds trade higher rated and shorter maturity bonds, which are likely to be more liquid.
   - Economic magnitudes however suggest that cash buffers are the main margin of adjustment.
3. Robustness.

Flow-Induced Sales and Market Conditions

	(1)	(2)	(3)	(4)
$\text{Outflows}_{f,t}$	0.519***	0.510***	0.514***	0.514***
	(0.073)	(0.070)	(0.070)	(0.070)
$\text{Outflows}_{f,t} \times$ Market markup$_t$	−0.218***	−0.242***	−0.240***	−0.238***
	(0.035)	(0.035)	(0.036)	(0.036)
$\text{Outflows}_{f,t} \times \Delta$ Yield spread$_t$	−0.110	−0.109*	−0.130**	−0.133**
	(0.070)	(0.059)	(0.064)	(0.064)
$\text{Outflows}_{f,t} \times \text{VIX}_t$	−0.001	0.000	0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)
$\text{Outflows}_{f,t} \times$ Aggregate net outflows$_t$				0.083
				(0.228)
$\text{Outflows}_{f,t} \times$ Realized aggregate net outflows$_{t+1}$	0.556***		0.187	0.157
	(0.156)		(0.197)	(0.233)
$\text{Outflows}_{f,t} \times$ Expected aggregate net outflows$_{t+1}$		0.856***	0.712**	0.655**
		(0.228)	(0.296)	(0.292)
Adjusted R^2	0.080	0.080	0.080	0.080
Cash × Flows interactions	✓	✓	✓	✓
Date FEs	✓	✓	✓	✓

- Market markup declines 106 bps over 2009–2020.
- $\approx$ doubling in the sensitivity of sales to outflows.
- Expected aggregate net outflow $\uparrow$ 10bps $\implies$ 36% increase the sensitivity of day t sales to outflows.
- Actual future aggregate net outflows matter only to the extent they are predictable.
- Past aggregate net outflows matter because they help predict future aggregate net outflows.

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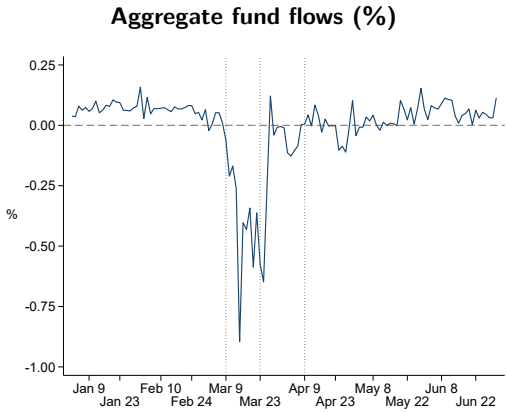
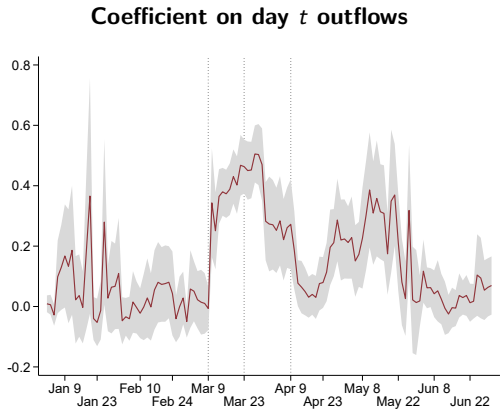
Flow-Induced Trading Around the Start of COVID-19





Estimating the Effect of Larger Cash Buffers

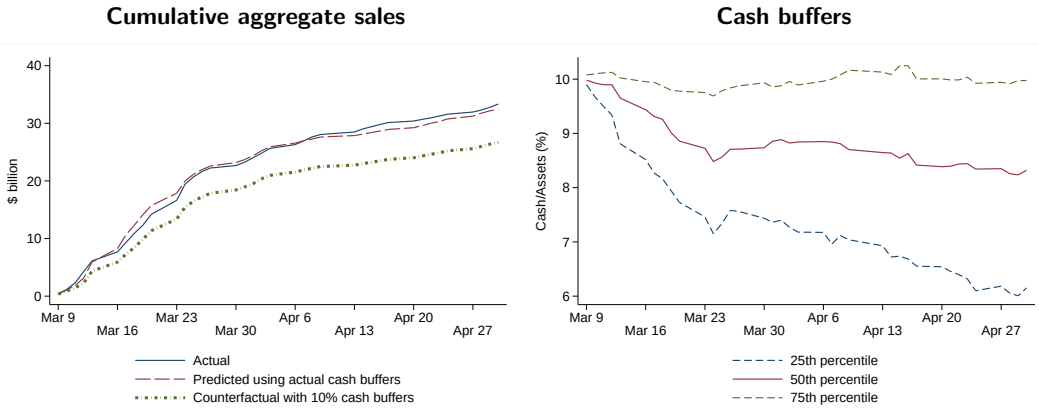
- Use data through February 2020 to estimate

$$\begin{aligned} Sales_{f,t} &= \alpha_t + \sum_{s=0}^{15} \left(\beta_s^{out} Outflows_{f,t-s} + \beta_s^{in} Inflows_{f,t-s} \right) \\ &+ Outflows_{f,t} \times \left(\gamma_1 Cash_{f,t-1} + \gamma_2 E_t \left(AggOutflows_{t+1} \right) + \gamma_3 \overline{Markup}_t \right) + \varepsilon_{f,t} \end{aligned}$$

- To better match aggregate dynamics, weight observations by lagged log TNA.
- Initialize each fund's cash buffer as of March 8, 2020 to 10%.
- For each trading day between March 9 and April 30, use the estimated coefficients along with the fund's lagged cash buffer, realized fund flows, expected aggregate outflows and market markup to predict each fund's sales on day t.
- Update the cash buffer according to

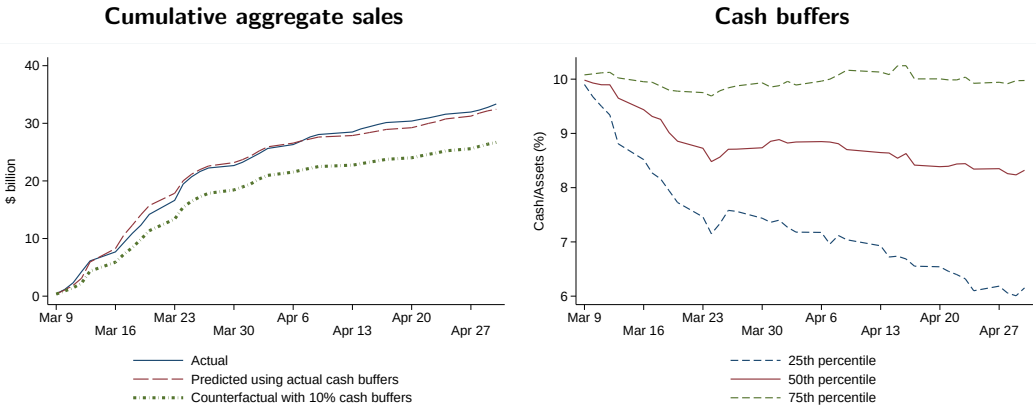
$$Cash_{f,t} = Cash_{f,t-1} + Net\ flows_{f,t} + Net\ sales_{f,t-2} + Principal_{f,t} + Interest_{f,t}$$

Counterfactual Flow-Induced Sales During COVID-19



- When using actual cash buffers, predicted sales closely match actual sales.

Counterfactual Flow-Induced Sales During COVID-19



- When using actual cash buffers, predicted sales closely match actual sales.
- When funds start with a 10% buffer, cumulative aggregate sales are 18% lower.
  $\Longrightarrow$ Requiring funds to hold at least 10% cash and highly liquid assets may have limited effects on flow-induced sales during stressed periods like COVID-19.

Caveats

1. Assuming relationship between sales, outflows, and cash does not change.
2. Not accounting for the potential effect of cash buffers on redemptions due to strategic complementarities.
   - Table B5: no evidence that larger cash buffers are associated with smaller outflows during COVID-19.

Conclusion

- Analysis of daily trading and flows indicates much greater reliance on cash buffers than suggested by the existing evidence using monthly/quarterly data.
- Nevertheless, requiring funds to hold larger cash buffers may have limited effect on flow-induced sales during stressed periods.
- Managing expectations of aggregate fund flows may be more effective.
- Daily data on fund trading holds great promise for many other research questions: value of mutual fund liquidity creation, fund-dealer relationships in the municipal bond market, informed trading ...

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Thank you!