LIQUIDITY TRANSFORMATION AND RUNS IN THE FINANCIAL SYSTEM

UNIVERSITY OF SOUTH CAROLINA CONFERENCE ON FIXED INCOME AND FINANCIAL INSTITUTIONS

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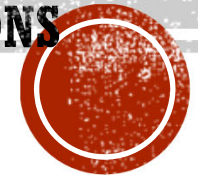


OUTLINE

- Liquidity Transformation and Runs: Theoretical Foundations and Empirical Challenges
- Current Empirical Work
  - Liquidity Transformation and Fragility in the US Banking Sector (Chen, Goldstein, Huang, Vashishtha; 2020)
  - Financial Fragility in the COVID-19 Crisis: The Case of Investment Funds in Corporate Bond Markets (Falato, Goldstein, Hortacsu; 2020)
- Concluding remarks

LIQUIDITY TRANSFORMATION AND RUNS: THEORETICAL FOUNDATIONS AND EMPIRICAL CHALLENGES

LIQUIDITY TRANSFORMATION AND FRAGILITY

- Liquidity transformation is at the core of financial services
  - Banks, and more recently funds, provide liquidity to their depositors/investors and invest in illiquid assets
  - They create liquidity, but end up with liquidity mismatch
- Liquidity mismatch renders financial institutions vulnerable to panic-based runs (Diamond and Dybvig, 1983)
  - Depositors rush to withdraw deposits expecting that others will do so
- Many government policies are enacted to alleviate panic-based runs
  - Deposit insurance, lender of last resort, etc.
- Empirical evidence directly linking depositors'/investors' behavior to liquidity mismatch?

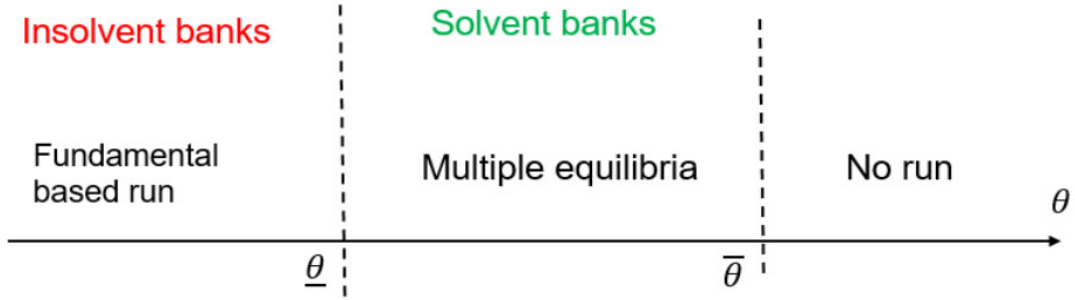
DEFINITIONS AND CHALLENGES

- Fundamental-based vs. panic-based runs:
  - Fundamental-based runs happen when investors withdraw just because of unfavorable news about fundamentals
    - Chari and Jagannathan, 1988; Jacklin and Bhattacharya, 1988; Allen and Gale, 1998
  - Panic-based runs happen when investors withdraw because they believe others will withdraw
    - The belief can be self-fulfilling because of strategic complementarity among investors (Diamond and Dybvig, 1983)
- Separating panic-based run from fundamental based run is important from a policy perspective
  - Many policies, such as deposit insurance, lender of last resort, suspension of convertibility, are premised on the idea that some runs are driven by panics
  - Many believe these policies distort incentives and create more problems than they solve

EMPIRICALLY TESTING FOR PANIC-BASED RUNS

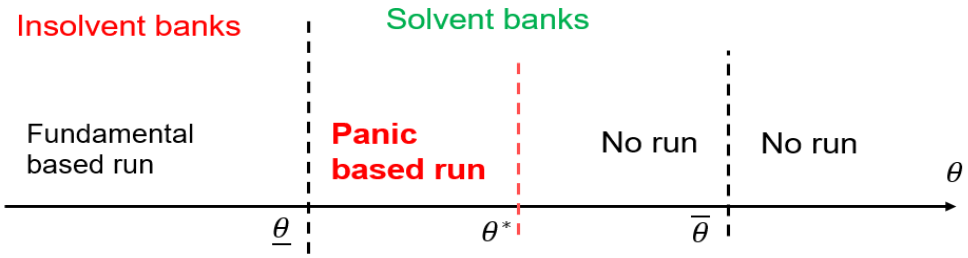
- Early evidence find strong association between bank runs and bank fundamentals (e.g., Gorton, 1988)
  - Such evidence is often interpreted as supporting fundamental based runs and *against* panic-based runs
- However, this interpretation is incorrect (e.g., Goldstein, 2013):
  - A pre-requisite for panic-based run is weaker fundamentals
  - Strategic complementarity among depositors can exacerbate/magnify the effect of fundamentals
  - Association between run and bad fundamental does not rule out the existence of panic-based behaviors

ILLUSTRATION: BASIC MODEL OF BANK RUNS



- Diamond and Dybvig (1983): depositors observe common, perfect signal about bank fundamental θ
- Without strategic complementarity among depositors, only insolvent banks with $\theta < \underline{\theta}$ should experience run
- With strategic complementarity, self-fulfilling panic-based run can take place (or not) for any solvent bank with $\theta \in [\underline{\theta}, \overline{\theta}]$
  - Multiple equilibria render the model empirically vacuous and untestable (Gorton, 1988)

ILLUSTRATION: UPDATED MODEL OF BANK RUNS



- Goldstein and Pauzner (2005): relax the assumption of common knowledge about fundamental
  - Generate unique equilibrium where runs happen for fundamental below a threshold level of θ^*
  - Runs when the fundamental is between $(\underline{\theta}, \theta^*)$ are considered panic-based, because they would not occur in the absence of coordination failure
  - But, they are still linked to fundamentals
- Theory is testable. Comparative statics: panic-run region is larger for banks with greater liquidity mismatch

EMPIRICAL PREDICTIONS AND TESTS

- For the same decline in fundamental, higher liquidity mismatch will generate more outflows
  - Testable implication: stronger sensitivity of outflows to performance when liquidity mismatch is higher
- In previous papers, we have tested this theory for mutual funds:
  - Chen, Goldstein, and Jiang (2010): Stronger sensitivity of outflows to negative performance in illiquid equity funds than in liquid equity funds
  - Goldstein, Jiang, and Ng (2017): Effect is much stronger in corporate-bond funds, where illiquidity of assets is a much bigger problem
- In two recent papers, we take this theory to
  - Banks: This is where liquidity transformation has been most important over the years, and where concerns about fragility started from; yet, no empirical test has been done
  - Corporate bond mutual funds in the Covid-19 crisis: This is the first major stress episode since these institutions came into prominence, so it is a good opportunity to size up the fragility they may impose

LIQUIDITY TRANSFORMATION AND FRAGILITY IN THE US BANKING SECTOR

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CHEN, GOLDSTEIN, HUANG, VASHISHTHA; 2020

OVERVIEW OF ANALYSIS

- Main dimensions of analysis:
  - Effect of liquidity mismatch on depositors' behavior
  - Different effects between insured and uninsured depositors
  - Exploring various explanations: strategic complementarities vs. other
  - Fragility of banks to systematic vs. idiosyncratic shocks
  - Consequences of liquidity mismatch for failure, performance, etc.
- Overall, liquidity mismatch is strongly linked to fragility, pointing to panic-based dynamics and key tradeoffs in bank policies
- Findings are new in the vast empirical literature on bank runs
  - E.g., Iyer and Puri, 2012; Iyer et al., 2016; Egan et al., 2017

OUR MAIN EMPIRICAL SPECIFICATION

$$Y_{i,t} = \beta_0 Perf_{i,t-1} + \beta_1 LiqMismatch_{i,t-1} * Perf_{i,t-1} + \beta_2 LiqMismatch_{i,t-1} + \Gamma X + \varepsilon_{i,t}$$

$Y_{i,t}$ - change in deposits over period *t* for bank *i*, scaled by beginning of period assets

$Perf_{i,t-1}$ - bank performance for period *t-1*; main proxy is *ROE*

$LiqMismatch_{i,t-1}$ - measure of liquidity mismatch on banks' balance sheet

X – controls, including fixed effects, time-varying bank characteristics and macro-conditions (fed fund rate and stock returns)

- When performance declines,
  - $\beta_0 > 0$ indicates depositors withdraw from bad fundamental
  - $\beta_1 > 0$ is consistent with panic-based behaviors (i.e., withdrawals based on beliefs about behaviors of other depositors)
- Our sample: about 8000 unique banks, 290,000 bank-quarter observations from 1994 to 2016

MEASURING BANK LIQUIDITY MISMATCH

- We measure a bank's liquidity mismatch with the liquidity creation measure, *CatFat*, developed by Berger and Bouwman (2009)
  - Banks that create more liquidity are more mismatched themselves.
  - Downloaded from Christa Bouwman's website.
- Three steps
  - Step 1: classify each bank activity (balance sheet account) as liquid, semi-liquid, or illiquid, including both on- and off-balance sheet activities.
  - Step 2a: assign weight of ½ to illiquid assets, 0 to semi-liquid and -1/2 to liquid assets;
  - Step 2b: assign weight of ½ to liquid liabilities, 0 to semi-liquid, ad -1/2 to illiquid liabilities and equity.
  - Step 3: sum up weighted activities, scaled by total gross assets.

MAIN RESULTS: LIQUIDITY TRANSFORMATION AND DEPOSIT-FLOW SENSITIVITY

	ΔDep_{it}^{U}	ΔDep_{it}^{I}	ΔDep_{it}^{Total}	ΔDep_{it}^{U}	ΔDep_{it}^{I}	ΔDep_{it}^{Total}
	(1)	(2)	(3)	(4)	(5)	(6)
ROE_{it-1}	0.101***	0.024***	0.126***	0.094***	0.007**	0.106***
	(35.458)	(7.628)	(34.967)	(28.275)	(2.124)	(29.736)
$ROE_{it-1} \times CatFat_{it-1}$	**0.120*** **	-0.218***	-0.093***	**0.211*** **	-0.176***	0.030
	(7.032)	(-11.628)	(-4.182)	**(10.114)**	(-8.058)	(1.282)
$CatFat_{it-1}$	3.204***	7.298***	10.228***	3.144***	11.550***	14.033***
	(12.389)	(25.984)	(30.117)	(6.555)	(22.450)	(26.071)
Controls	Y	Y	Y	Y	Y	Y
Bank fixed effects	N	N	N	Y	Y	Y
Observations	287,018	287,018	287,018	286,831	286,831	286,831
Adj. R-squared	0.064	0.055	0.066	0.102	0.102	0.166

- Uninsured deposit flows are more sensitive to performance of banks that create more liquidity
- 1 σ increase in CatFat (0.17) increases uninsured flow-performance sensitivity by 20% (=0.17*0.12/0.101). Equivalent to 44%=(1.2*1.2-1) higher deposit flow volatility for the same change in ROE volatility
- Sensitivity of insured deposit flows to performance decreasing in CatFat, consistent with banks managing insured flows to offset impact of uninsured flows (Martin et al., 2018; Chen et al., 2020)

SYSTEMATIC VS. IDIOSYNCRATIC PERFORMANCE: RESULTS

	(1)	(2)	(3)
	ΔDep_{it}^{U}	ΔDep_{it}^{I}	ΔDep_{it}^{Total}
ROE_Systematic $_{it-1}$	**0.561*** **	-0.519***	0.063***
	(60.068)	(-49.670)	(5.761)
ROE_Systematic $_{it-1}$ **CatFat* $_{it-1}$	**0.593*** **	-0.222***	0.409***
	(13.052)	(-4.907)	(7.293)
ROE_Idiosyncratic $_{it-1}$	**0.060*** **	0.045***	0.108***
	(18.344)	(13.850)	(29.991)
ROE_Idiosyncratic $_{it-1}$ **CatFat* $_{it-1}$	**0.121*** **	-0.131***	-0.022
	(5.730)	(-6.111)	(-0.896)
Bank fixed effects	Y	Y	Y
Macro controls	Y	Y	Y
Observations	286,831	286,831	286,831
R-squared	0.118	0.124	0.167

- Systematic component: average bank ROE in the same quarter
- A decline in systematic component of ROE is associated with 9 (=0.561/0.06) times of deposit outflows as the same amount of decline in idiosyncratic component
- Effect of mismatch is almost 5 times as strong when decline is from systematic component

EFFECTS OF MISMATCH DURING THE FINANCIAL CRISIS OF 2007-2009

Dependent Variable	ΔDep_{it}^{U}	ΔDep_{it}^{I}	ΔDep_{it}^{Total}	*Core Deposits rate*	*Large Time Deposits*	$\Delta Loan$	$\Delta Commit$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Crisis	-10.612***	17.535***	5.846***	0.464***	0.703***	5.230***	9.332***
	(-9.450)	(16.045)	(4.427)	(5.608)	(6.706)	(4.284)	(14.122)
Crisis × $CatFat_{it-1}$	-5.424***	1.314***	-3.950***	0.511***	0.317***	-0.020	-5.965***
	(-9.789)	(2.578)	(-6.483)	(13.126)	(6.838)	(-0.035)	(-20.689)
$Catfat_{it-1}$	8.220***	8.525***	16.074***	-0.983***	0.066	17.400***	1.960***
	(21.936)	(22.160)	(32.317)	(-23.223)	(1.359)	(35.866)	(10.785)
Controls	Y	Y	Y	Y	Y	Y	Y
Controls*Crisis	Y	Y	Y	Y	Y	Y	Y
Bank fixed effects	Y	Y	Y	Y	Y	Y	Y
Observations	287,018	287,018	287,018	281,816	281,798	287,018	287,018
Adj. R-squared	0.204	0.211	0.188	0.892	0.813	0.275	0.099

Mismatched banks experienced more deposit outflow, offered higher deposit rates and extend less commitment during crisis

FINANCIAL FRAGILITY IN THE COVID-19 CRISIS: THE CASE OF INVESTMENT FUNDS IN CORPORATE BOND MARKETS

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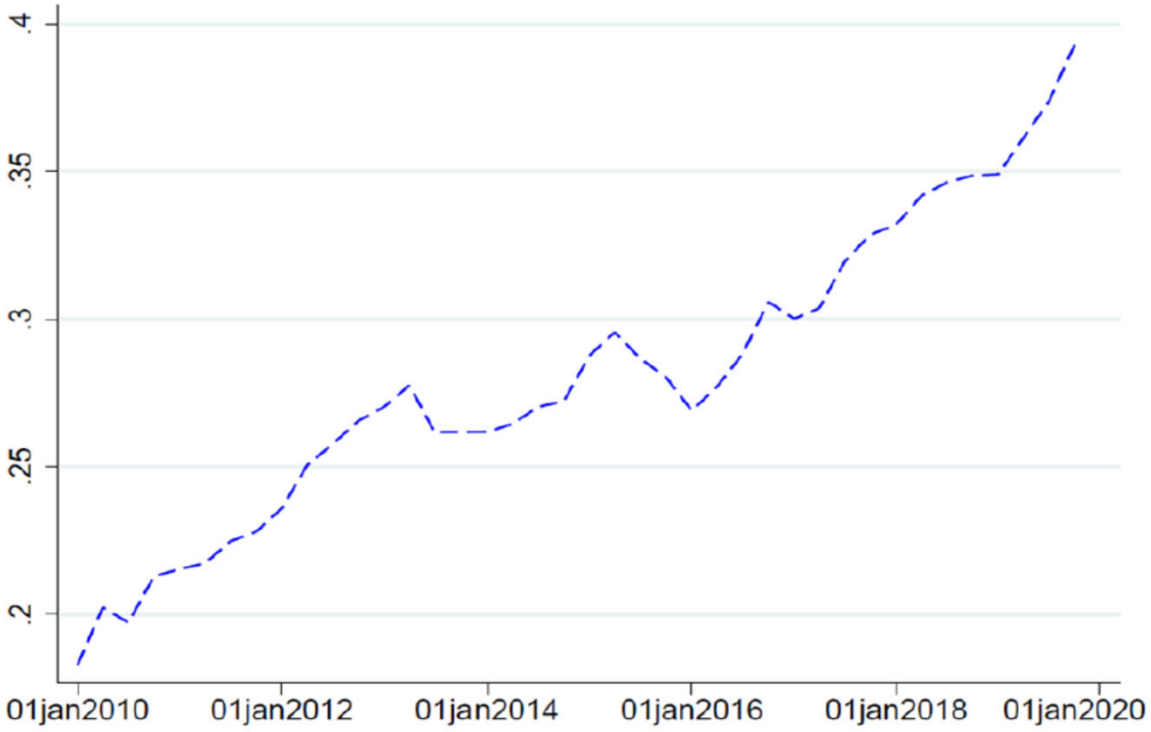
FALATO, GOLDSTEIN, HORTACSU; 2020

MAIN FINDINGS

- Corporate-bond markets in the U.S. suffered severe stress in March 2020
- Investment funds in the corporate-bond market experienced massive outflows, far greater than anything seen since they became a major player
  - See comparison to previous biggest stress, the taper-tantrum episode, analyzed by Feroli, Kashyap, Schoenholtz, and Shin (2014)
- Outflows were sustained for several weeks and widespread across different types of funds
- Previously identified fragility factors – illiquidity of fund assets and vulnerability to fire sales – prove to be important factors in explaining outflows
- It seems that a couple of policy announcements by the Federal Reserve about direct interventions in corporate-bond markets were crucial for alleviating the stress
  - March 23: PMCCF and SMCCF; purchase of investment-grade bonds on primary and secondary markets
  - April 9: Extend PMCCF and SMCCF to $850bn (from less than $300bn); extend SMCCF to purchase high-yield bonds if they were investment-grade as of March 22

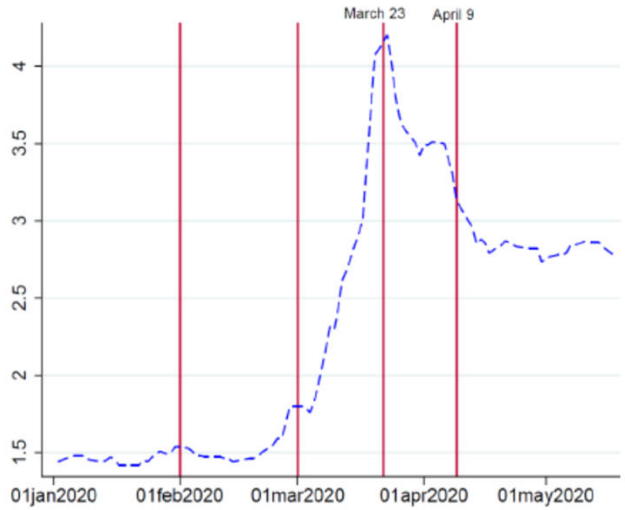
THE GROWING IMPORTANCE OF INVESTMENT FUNDS IN THE CORPORATE BOND MARKET



Aggregate Net Asset Value divided by Size of Market (from Fed Flow of Funds Z.1)

SIGNS OF STRESS IN CORPORATE BOND MARKET OVER THE CRISIS PERIOD

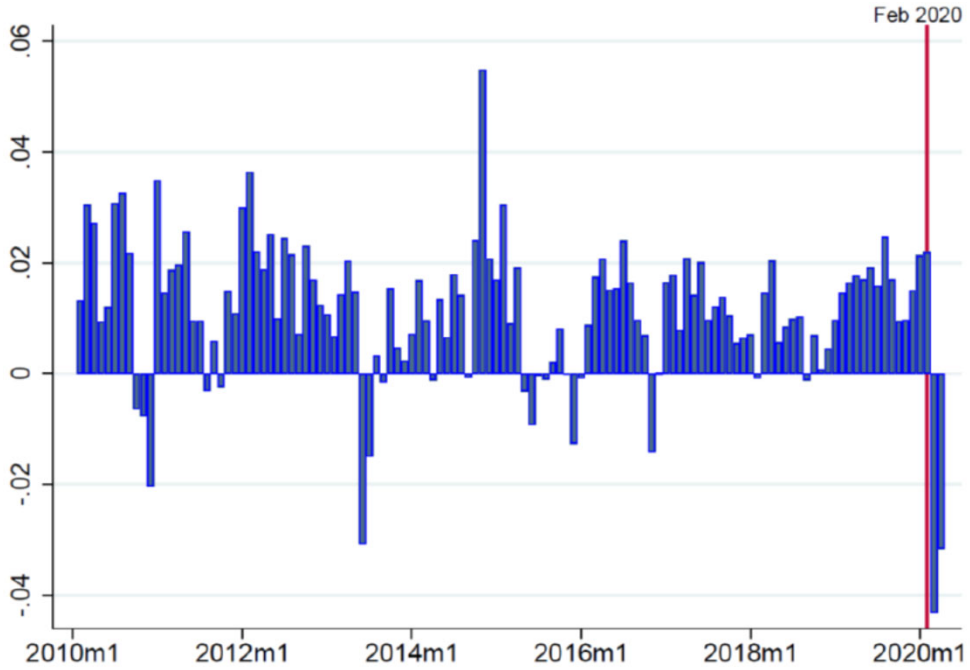
Panel A: Investment-Grade Bond Spreads



Panel B: High-Yield Bond Spreads

LONG TERM PERSPECTIVE ON MONTHLY AGGREGATE NET FLOWS

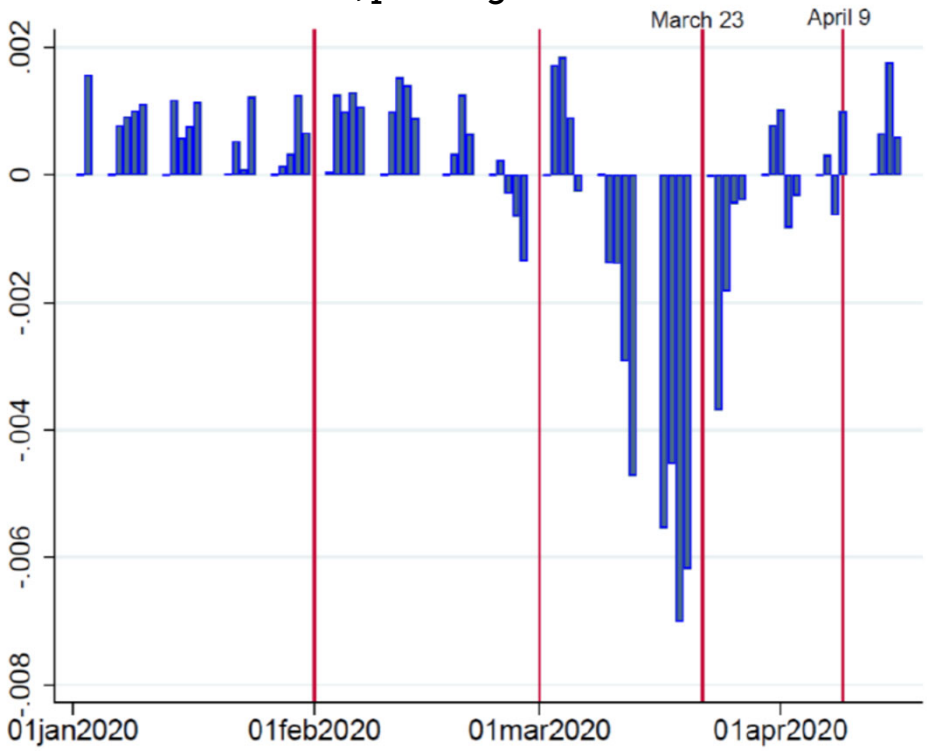
Mutual funds in corporate bond markets saw massive outflows during the COVID-19 crisis



Aggregate Net Flows as a Fraction of Lagged Net Asset

EVOLUTION OF FLOWS OVER THE CRISIS

Daily outflows started in the last week of February and accelerated in the second and third weeks of March, peaking at almost 1% of net assets



Daily Aggregate Net Flows (Fraction of Lagged Net Asset)

TRACKING THE EVOLUTION OF FLOWS ACROSS ILLIQUID VS. LIQUID FUNDS

- Evidence that illiquidity played an important role in the crisis; initially, outflows mostly affect illiquid funds
- While the effect reverses for both liquid and illiquid funds, lower-rated funds benefitted the most from the April 9 policy announcement

Panel C: Evolution of the Crisis and Policy Response

	Roll		Bid-Ask		Ratings	
	Illiq	Liq	Illiq	Liq	Illiq	Liq
	(1)	(2)	(3)	(4)	(5)	(6)
Crisis (Feb-Mar 23, 2020)	-0.30***	0.14**	-0.41***	0.16**	-0.54***	0.28***
	(0.06)	(0.07)	(0.06)	(0.06)	(0.06)	(0.07)
First Response (Mar 23-Apr 9, 2020)	-0.63***	-0.67***	-0.53***	-0.55***	-0.48***	-0.37***
	(0.07)	(0.10)	(0.07)	(0.09)	(0.08)	(0.10)
Second Response (Apr 9-, 2020)	-0.01	0.08	0.05	-0.03	0.45***	0.06
	(0.10)	(0.13)	(0.11)	(0.13)	(0.13)	(0.15)
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes
N obs	86,954	87,134	88,600	86,599	100,923	86,795
R^2 (%)	13.1	8.1	11.3	7.1	13.0	7.7

CONCLUDING REMARKS

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- Liquidity transformation creates fragility
  - Empirical distinction between fundamentals and panic is difficult
  - But, building on theory, panic can be detected in the data, and it acts to amplify the effect of fundamentals
  - Channel exists in banks and mutual funds, and acted to amplify response of outflows from corporate-bond mutual funds in the Covid-19 episode
- Policy implications across the financial system, as various policies can be used to reduce fragility
- There is clearly a tradeoff, and we need better understanding of the key issue: Why is liquidity transformation so desirable and at what cost?