Mutual Fund Liquidity

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Overview

- The way investors get paid upon redemption in open-end mutual funds might create a **first-mover advantage** or **strategic complementarities**

- This can amplify redemptions following adverse shocks

- The problem gets more severe when the fund holds more **illiquid assets**

- Implications for fund policies and possibly also for regulation

Classic Manifestation in Banks

A run on American Union Bank, 1931

Classic Runs

- Bank runs have plagued the financial system for many years
- The concern of bank runs is a source of vast government intervention and regulation
  - Deposit insurance
  - Bank regulation (capital, liquidity, etc.)
  - Various government authorities involved: FDIC, Federal Reserve System, etc.

Economic Force behind Runs

- Basic economic force behind runs is based on:
  - First-mover advantage
  - Strategic complementarities
    - Banks create liquidity by holding illiquid assets and liquid liabilities (deposits)
    - Depositors are promised a fixed amount if they want to withdraw
    - If many withdraw, the bank will have to liquidate assets at a loss, hurting those who don't withdraw

What about Non-Bank Institutions?

- First-mover advantage and run-type behavior are not limited to banks
- Recent Example provided by money-market funds
  - Major runs experienced by money-market funds in September 2008
  - Funds held illiquid assets with money-like liabilities
  - One fund "breaking the buck" triggered massive outflows across other funds
  - Detailed empirical analysis provided by Schmidt, Timmermann, and Wermers (WP, 2014)
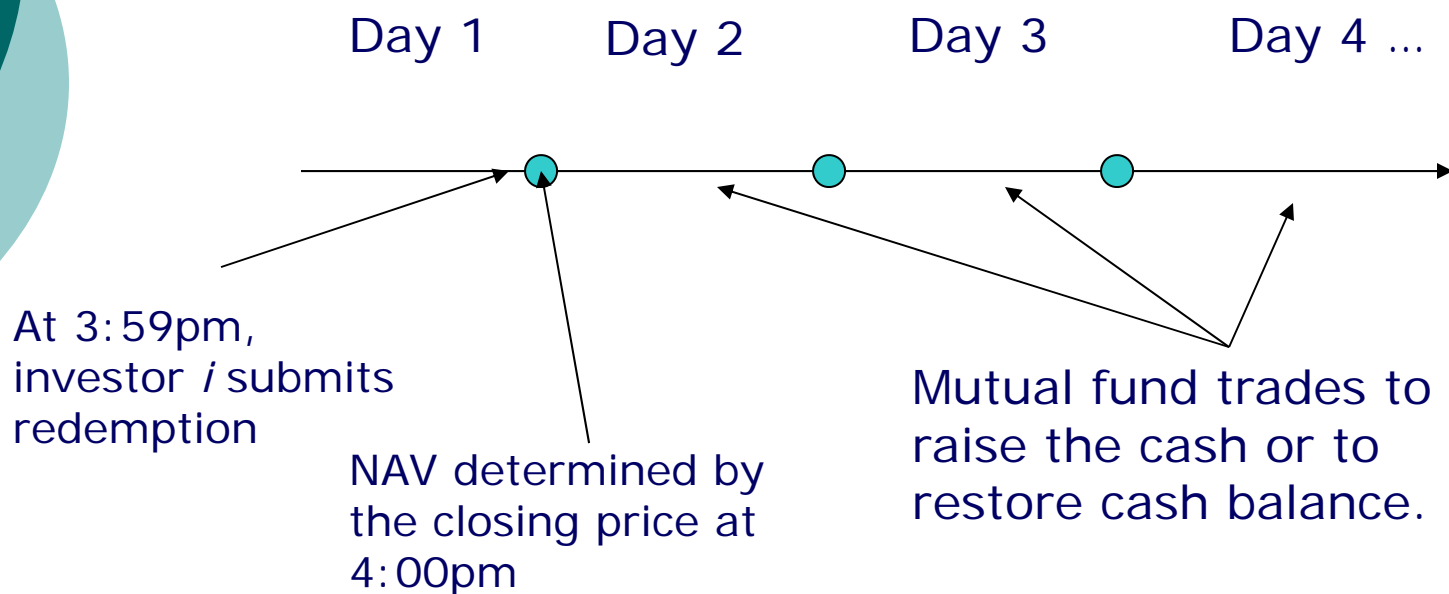
The Role of Fixed Claims

- One feature that is common to money-market funds and banks is that they have fixed claims
  - Bank depositors are entitled to a fixed deposit amount if they wish to withdraw
  - Investors in money-market funds enjoy a fixed Net Asset Value (NAV)
- This clearly enhances the first-mover advantage contributing to run dynamics
- New thinking following the crisis involves moving away from the fixed-NAV model to a floating-NAV model as in other mutual funds

Run Dynamics in a Floating-NAV Model

○ However, moving to a floating-NAV model does not eliminate the first-mover advantage and the potential for run-like behavior

○ In a floating-NAV environment, investors can redeem shares and get the NAV as of the day of redemption

○ But, their redemptions will affect fund trading going forward hurting remaining investors in illiquid funds

○ This is the source of the first-mover advantage (or strategic complementarities)

Complementarities in Mutual Funds Redemptions

Day 1   Day 2   Day 3   Day 4 ...

At 3:59pm,
investor *i* submits
redemption

NAV determined by
the closing price at
4:00pm

Mutual fund trades to
raise the cash or to
restore cash balance.

- Source for complementarities:
  - Redemptions impose costs on remaining investors:
  - Costs include: commissions, bid-ask spread, price impact, forced deviation from desired portfolio, liquidity-based trading.

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Empirical Analysis of Flows in Equity Mutual Funds

- Chen, Goldstein and Jiang (JFE, 2010)
  - Study flows in 4,393 actively-managed equity funds from 1995-2005
  - Find stronger sensitivity of outflows to negative performance in illiquid funds
    - These funds generate greater complementarities
    - Illiquid funds are: small-cap & mid-cap equity funds (domestic or international), or single-country funds excluding US, UK, Japan and Canada.
      - Or continuous measure of liquidity of portfolio
  - Pattern is weaker in funds that are mostly held by institutional investors
    - Externalities are better internalized

Evidence from Chen, Goldstein, and Jiang (JFE, 2010)


Flow Sensitivity by Assets Liquidity
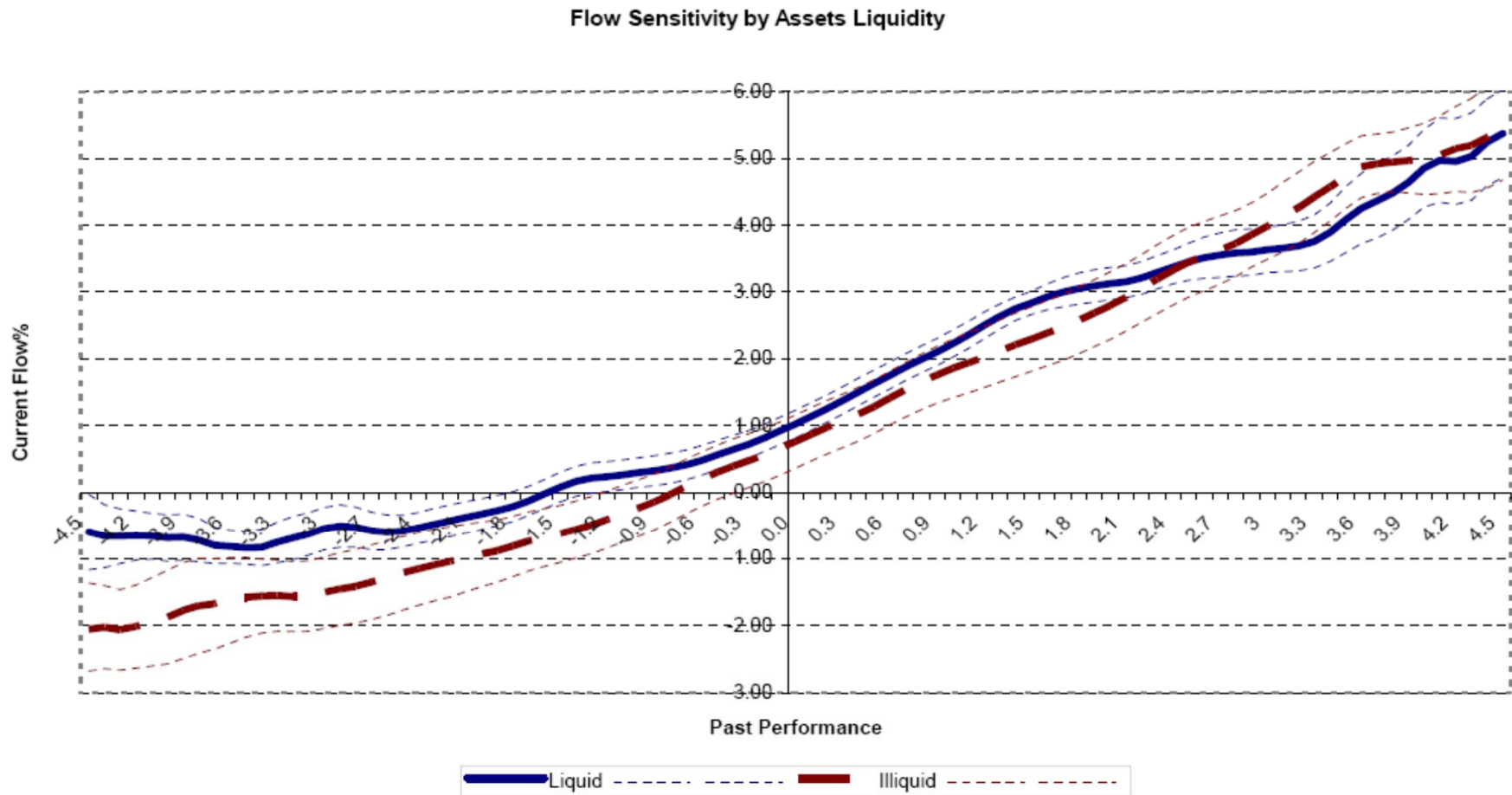
Bond Funds

○ Recently, there is growing interest in bond mutual funds in this context

- Bond funds are growing fast:
  - In 2008-2013, fixed income funds have attracted multiple times more inflows compared to equity, money market, allocation and other funds combined
  - Over this period, their assets roughly doubled
- Their assets can be much more illiquid and so they generate stronger complementarities
- They have a more direct effect on the real economy as firms rely on bonds for financing needs

Distribution of Bond Fund Assets
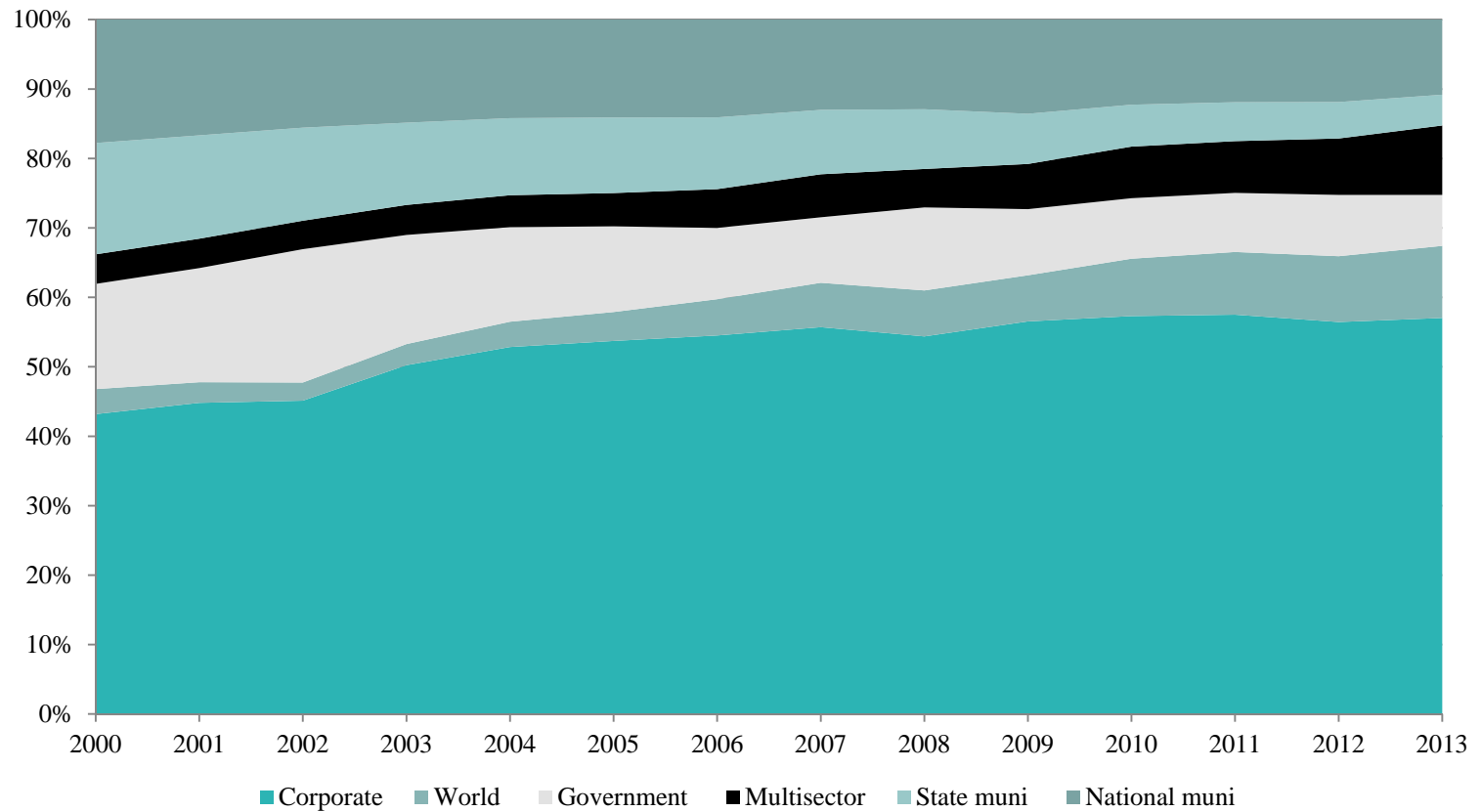
Total Net Assets and Flows of Active Corporate Bond Funds
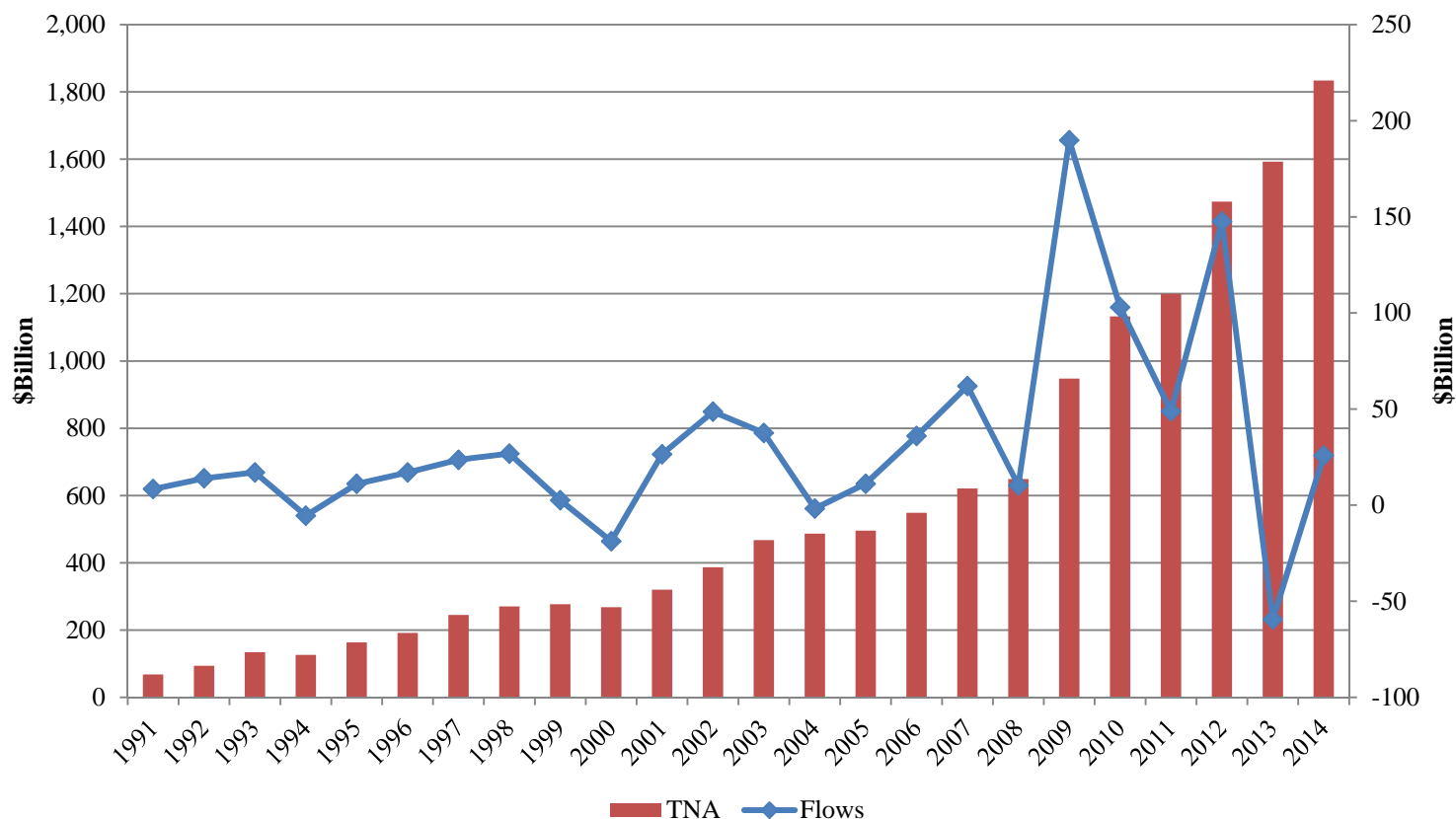
Empirical Analysis of Flows in Corporate Bond Mutual Funds

- Goldstein, Jiang and Ng (WP, 2015)
  - Study flows in 1,660 actively-managed corporate bond funds from 1992-2014
  - Compare the pattern with that of equity funds
  - Link pattern to illiquidity

- Large literature on the flow-to-performance relation in equity funds, finding convex relation
  - See recent review by Christoffersen, Musto, and Wermers (ARFE, 2014)

- We provide the first study in the context of corporate bond funds

Flow-Performance Relationship in Corporate Bond Funds

- We find that corporate bond funds are different:
  - There is no convexity in flow-performance relation
    - Outflows are at least as sensitive to bad performance as inflows are sensitive to good performance (relation is linear or concave)
  - Pattern strengthens with illiquidity

Motivation: Corporate Bonds Are Illiquid

- Corporate bonds trade infrequently
  - Corporate bonds trade OTC; individual bond issues do not trade on 48% of days in their sample
  - Corporate bonds comprise ~20% of outstanding U.S. bonds but account for only ~ 2.5 to 3.0% of trading volume in U.S. bonds.
  - U.S. Treasuries comprise 16% of U.S. bonds outstanding but account for 59% of volume.
- More difficult to get up-to-date price for corporate bonds
- Price impact and other illiquidity costs are high

➔ Corporate bonds can generate stronger complementarities

Hypotheses Associated with Strategic Complementarities

- **I:** Corporate bond funds should exhibit a more concave flow-to-performance relationship than equity funds.
- **II:** During periods of higher illiquidity, corporate bond funds exhibit greater sensitivity of outflows to low past performance.
- **III:** Corporate bond funds with more illiquid assets exhibit greater sensitivity of outflows to low past performance.
- **IV:** The effect of illiquidity on the sensitivity of outflows to bad performance is weaker in funds that are held mostly by institutional investors.

Constructing flows

○ CRSP survivorship bias free mutual fund data set from 1991 to 2014

○ Each fund share class-month is one observation

○ Back out net flows from the total net asset of each fund share-class.

$$Flow_{k,t} = \frac{TNA_{k,t} - TNA_{k,t-1}(1 + R_{k,t})}{TNA_{k,t-1}}$$

○ where $R_{k,t}$ is the return of fund k during quarter t, and $TNA_{k,t}$ is the total net asset value at the end of quarter t. Fund flows are windsorized at the 1% and 99% percentiles.

Constructing alphas

- Use aggregate market (stock and bond) returns as benchmark.
- The two factors are CRSP VW for stocks and Vanguard Total Bond Index Fund Return for Bonds
- Compute past alpha by regressing excess bond fund returns on the two market excess returns from a time-series regression from month t-12 to t-1

Analyzing Flow-Performance Relationship

$$Flows_{i,t} = \beta_1 Alpha_{i,t-12,t-1} + \beta_2 Alpha_{i,t-12,t-1} * 1(Alpha_{i,t-12,t-1} < 0) + \sum_j \beta_j controls_{i,j,t} + \varepsilon_{i,t}$$

- Regress fund flows in month t on past fund alphas from month t-12 to month t-1
- Panel data regression
- Month fixed effect, fund share-class clustered SE
- Focus on interaction term to detect convexity vs. concavity

Table 2 Flow-Performance Relations: Corporate Bond Funds versus Stock Funds – Panel A

	(1) Corporate Bond Funds	(2) Stock Funds
Alpha	0.621***	1.462***
	(6.95)	(47.41)
Alpha× (Alpha<0)	0.507***	-0.626***
	(2.77)	(-14.18)
Lagged Flow	0.154***	0.117***
	(21.63)	(29.67)
Log(TNA)	0.000893***	0.000421***
	(7.06)	(4.95)
Log(Age)	-0.0157***	-0.0184***
	(-31.96)	(-71.37)
Expense	-0.284***	-0.0232
	(-3.66)	(-0.34)
Rear Load	-0.00245***	-0.152***
	(-3.21)	(-6.22)
Observations	307,242	1,578,506
Adj. R^2	0.0627	0.0591

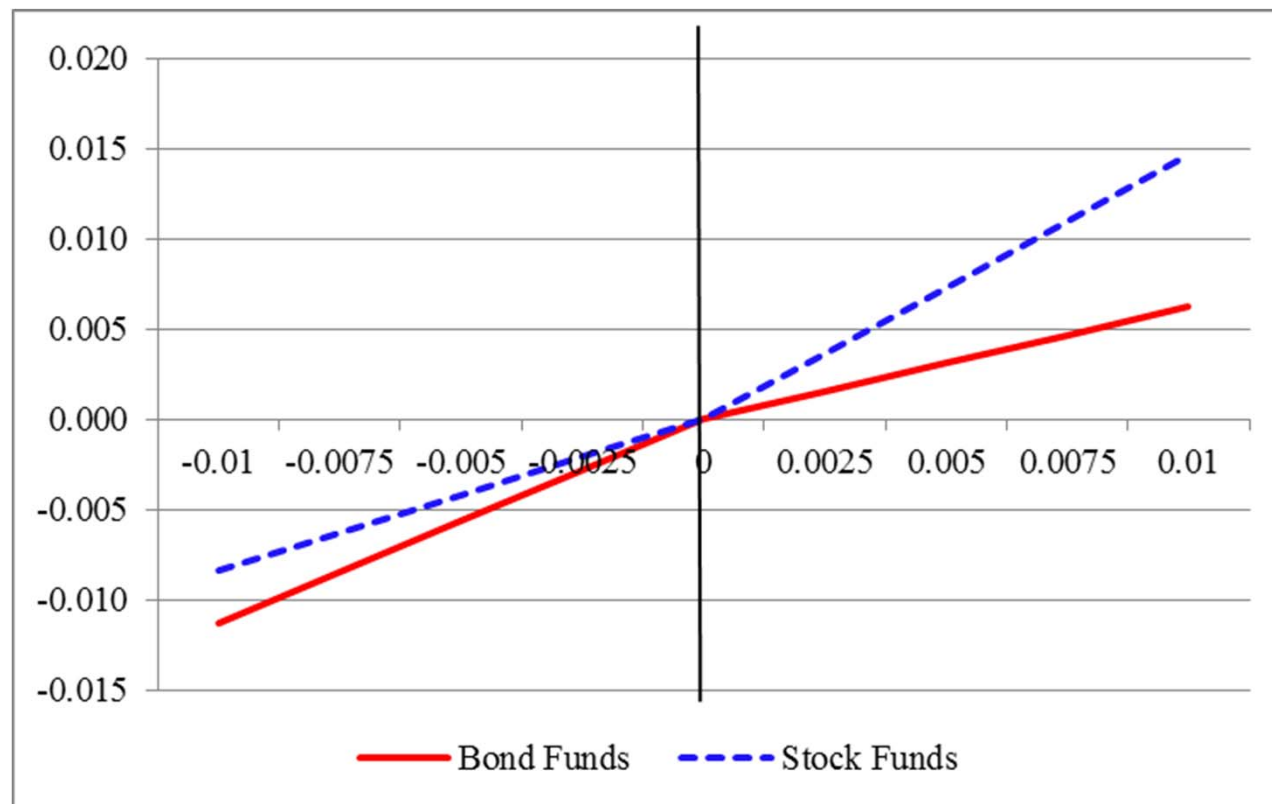# Flow Performance Relation of Corporate Bond vs. Equity Funds

Table 2 Flow-Performance Relations: Corporate Bond Funds versus Stock Funds – Panel B (Piece wise Linear Regression)

	Corporate Bond Funds	Stock Funds
Alpha×Bottom	1.117***	0.827***
	(8.22)	(30.72)
Alpha×Q2	1.686***	1.681***
	(7.61)	(35.55)
Alpha×Q3	1.577***	2.376***
	(6.54)	(27.79)
Alpha×Q4	0.526***	1.637***
	(4.44)	(31.23)
Alpha×Top	0.708***	1.402***
	(8.13)	(46.32)
Lagged Flow	0.154***	0.116***
	(21.62)	(29.58)
Log(TNA)	0.000887***	0.000413***
	(7.03)	(4.88)
Log(Age)	-0.0157***	-0.0184***
	(-31.92)	(-71.51)
Expense	-0.271***	-0.0235
	(-3.50)	(-0.34)
Rear Load	-0.00245***	-0.152***
	(-3.22)	(-6.24)
Observations	307,242	1,578,506
Adj. R^2	0.0629	0.0599

Robustness: other measures of fund performance

Based on
1. alpha from a one-factor model
2. alpha based on predetermined fund betas
3. style-adjusted fund returns
4. fund returns in excess of the risk-free rate

- Corporate bond fund flow-performance relation is <u>never</u> convex. It is either concave or linear.
- Equity funds consistently exhibit convex flow-performance relations in all specifications.

Aggregate Illiquidity and Flows in Corporate Bond Mutual Funds

- Aggregate illiquidity is measured by:
  - VIX
  - the TED spread
  - Federal Funds rate
  - Dick-Nielsen, Feldhutter and Lando (2012)'s illiquidity measure based on corporate bond TRACE data
- Show that sensitivity of outflow to negative performance is greater when aggregate illiquidity is higher.

Liquid versus Illiquid Periods (VIX)

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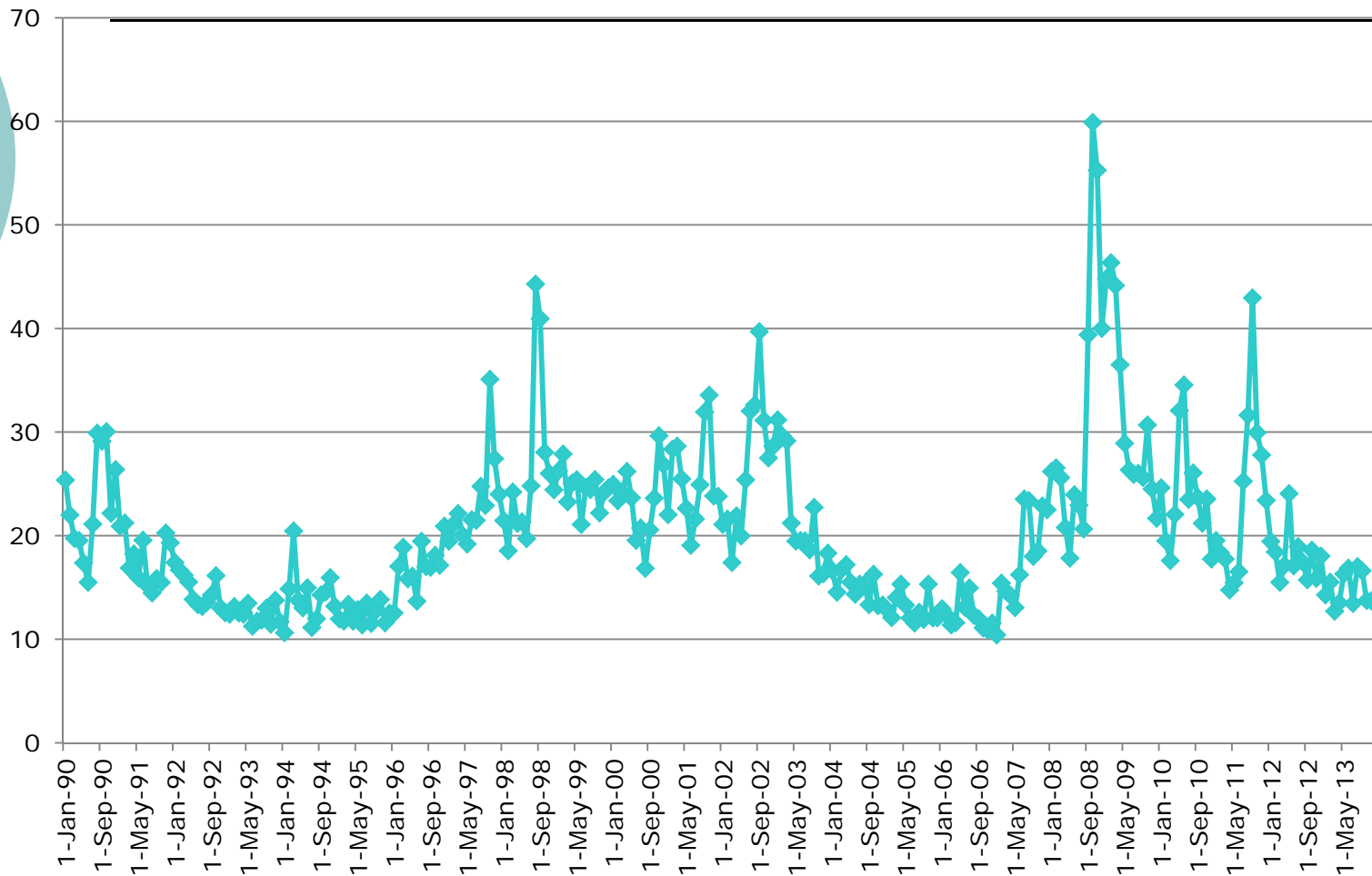
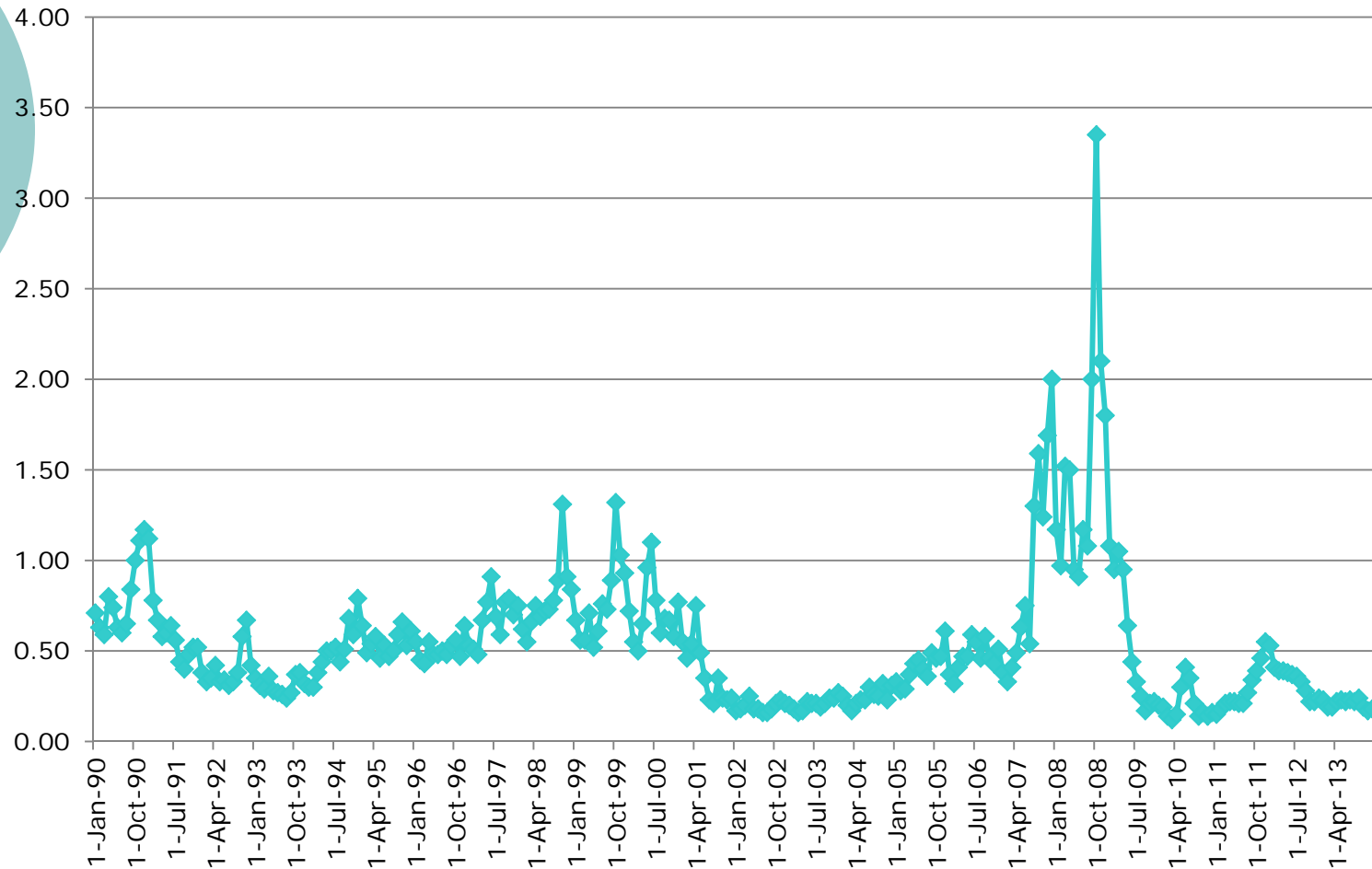# Liquid versus Illiquid Periods (TED)

Table 3 Flow-Performance Relations of Underperforming Corporate Bond Funds during Illiquid Periods (Alpha < 0)

	(1) VIX	(2) TED	(3) FED	(4) DFL
Alpha	-0.131	-0.121	0.272***	-0.746***
	(-0.77)	(-1.11)	(4.03)	(-3.22)
Alpha*IlliqPeriod	0.753***	0.749***	0.421***	1.412***
	(3.89)	(5.37)	(3.81)	(5.21)
IlliqPeriod	0.00690***	0.00148**	-0.00174***	0.00745***
	(9.81)	(2.44)	(-2.85)	(8.11)
Lagged Flow	0.121***	0.123***	0.123***	0.152***
	(15.37)	(15.47)	(15.48)	(14.90)
Log(TNA)	0.000552***	0.000558***	0.000674***	0.000533***
	(3.78)	(3.82)	(4.58)	(2.98)
Log(Age)	-0.0134***	-0.0136***	-0.0141***	-0.0124***
	(-26.78)	(-26.70)	(-26.69)	(-17.88)
Expense	-0.175**	-0.185**	-0.136	-0.284**
	(-1.98)	(-2.10)	(-1.53)	(-2.45)
Rear Load	-0.00294***	-0.00285***	-0.00288***	-0.00611***
	(-3.40)	(-3.29)	(-3.32)	(-5.87)
Observations	171,006	171,006	171,006	100,215
Adj. R^2	0.0339	0.0330	0.0330	0.0429

fund clustered SE
No fixed effect for month

Cash holdings as bond fund liquidity

○ When faced with large, abrupt net redemptions, cash provides fund managers with the most reliable source of liquidity.

○ Endogeneity issue:

- Level of cash holdings can reflect fund managers' anticipation of the fund's foreseeable liquidity needs, and could be endogenous.
- This biases the results against finding evidence for the hypothesis.

Table 4 Different Cash Holdings

	Alpha< 0
Alpha	0.727***
	(6.87)
Alpha*LowCash	0.653***
	(4.08)
Low Cash	-0.000322
	(-0.50)
Lagged Flow	0.111***
	(14.17)
Log(TNA)	0.000548***
	(3.60)
Log(Age)	-0.0143***
	(-25.84)
Expense	-0.144
	(-1.60)
Rear Load	-0.00228**
	(-2.54)
Observations	171,006
Adj. R^2	0.0478

Institutional vs. Individual Investors

 o Large institutional investors hold larger positions in the funds and so they are more likely to internalize the negative externalities generated by their outflows.

 o They serve as a constraining force in reducing coordination problems that lead to runs on funds.

   o See full argument in Chen, Goldstein, and Jiang (2010).

 o We find the effect of illiquidity on sensitivity of outflow to bad performance to be weaker in institutional-oriented funds.

Table 5 The Role of Institutional Investors

	Institutional-Oriented Funds (Alpha<0)		Retail-Oriented Funds (Alpha<0)	
	(1)	(2)	(3)	(4)
Alpha	1.827***	1.821***	0.916**	0.955**
	(3.29)	(3.26)	(2.12)	(2.21)
Alpha*LowCash	-0.499	-0.496	1.231***	1.207***
	(-0.63)	(-0.63)	(2.76)	(2.72)
Low Cash	-0.00248	-0.00247	-0.000678	-0.000893
	(-1.23)	(-1.22)	(-0.51)	(-0.68)
Lagged Flow	0.105***	0.105***	0.106***	0.106***
	(5.22)	(5.22)	(5.14)	(5.12)
Log(TNA)	0.000208	0.000229	0.000397	0.000601*
	(0.57)	(0.61)	(1.14)	(1.67)
Log(Age)	-0.0161***	-0.0161***	-0.0133***	-0.0129***
	(-9.50)	(-9.37)	(-10.60)	(-10.31)
Expense	0.0261	0.00277	-0.527***	-0.368**
	(0.08)	(0.01)	(-2.95)	(-2.03)
Rear Load	-0.00392	-0.00397	-0.00621***	-0.00595***
	(-1.40)	(-1.42)	(-4.03)	(-3.85)
Inst		-0.000441		0.00463***
		(-0.18)		(3.47)
Observations	19,545	19,545	40,521	40,521
Adj. R^2	0.0377	0.0376	0.0489	0.0494

Is it Illiquidity or Payoff Structure

- The difference between equity finds and corporate bond funds could be coming from different payoff structure.

- We look at Treasury bond funds:
  - Similar payoff structure to other bond funds
  - But hold much more liquid assets
    - Treasuries do not suffer from the problem of corporate bonds mentioned above

- Treasury bond funds exhibit a convex flow-performance relation just like equity funds.

Table 6 Flow Performance Relations for Treasury Bond Funds

	(1)	(2)
Alpha	1.785***	
	(2.77)	
Alpha× (Alpha<0)	-1.690*	
	(-1.90)	
Alpha×Bottom		0.199
		(0.45)
Alpha×Q2		-0.827
		(-1.28)
Alpha×Q3		3.047**
		(2.50)
Alpha×Q4		3.939***
		(3.25)
Alpha×Top		1.638***
		(2.65)
Lagged Flow	0.117***	0.117***
	(5.69)	(5.69)
Log(TNA)	0.000372	0.000372
	(1.03)	(1.03)
Log(Age)	-0.0148***	-0.0148***
	(-11.14)	(-11.14)
Expense	-0.699***	-0.699***
	(-2.85)	(-2.85)
Rear Load	-0.0102***	-0.0102***
	(-3.95)	(-3.95)
Observations	34,565	34,565
Adj. R^2	0.0664	0.0664

Broader Effects of Funds Fragility

○ One view may be that this is just a secondary market and so it should not generate wide concerns

○ But, complementarities and fragility in corporate-bond funds might generate broader concerns due to various channels:

- Abnormal flows can cause long-lasting price impact: Coval and Stafford (JFE, 2007); Manconi, Massa and Yasuda (JFE, 2012), and Ellul, Jotikasthira and Lundblad (JFE, 2012)

- These price impacts can have real effects on firms' activities: Edmans, Goldstein and Jiang (JF, 2012) and Hau and Lai (JFE, 2013)

Broader Effects of Funds Fragility – Cont'd

○ The effects are likely magnified in the context of bond funds (relative to equity funds) due to their greater illiquidity and the direct reliance of firms on bond financing

○ Gilchrist and Zakrajcek (AER, 2012) show an effect of market-driven credit spread on real economic outcomes

○ Fragility can amplify real shocks due to tightening of monetary policy: Feroli, Kashyap, Schoenholtz, and Shin (WP, 2014)

Exploratory Analysis

- Do outflows in bond funds have significant implications on market prices and the real economy?
- Exploratory evidence
  - Evaluate how corporate bond fund flows are related to Gilchrist and Zakrajsek (2012)'s excess bond premium.
  - Conduct a bivariate VAR with quarterly corporate bond fund outflows and excess bond premium on a quarterly basis, and estimate the response of EBP to shocks to the corporate bond fund outflow.
  - Estimate the effect of corporate bond fund outflows on real-economy variables.
  - Sample period is from 1991Q1 to 2010Q3 with two lags of the endogenous variables.

Figure 3: Impact of Corporate Bond Fund Outflows on Excess Bond Premium
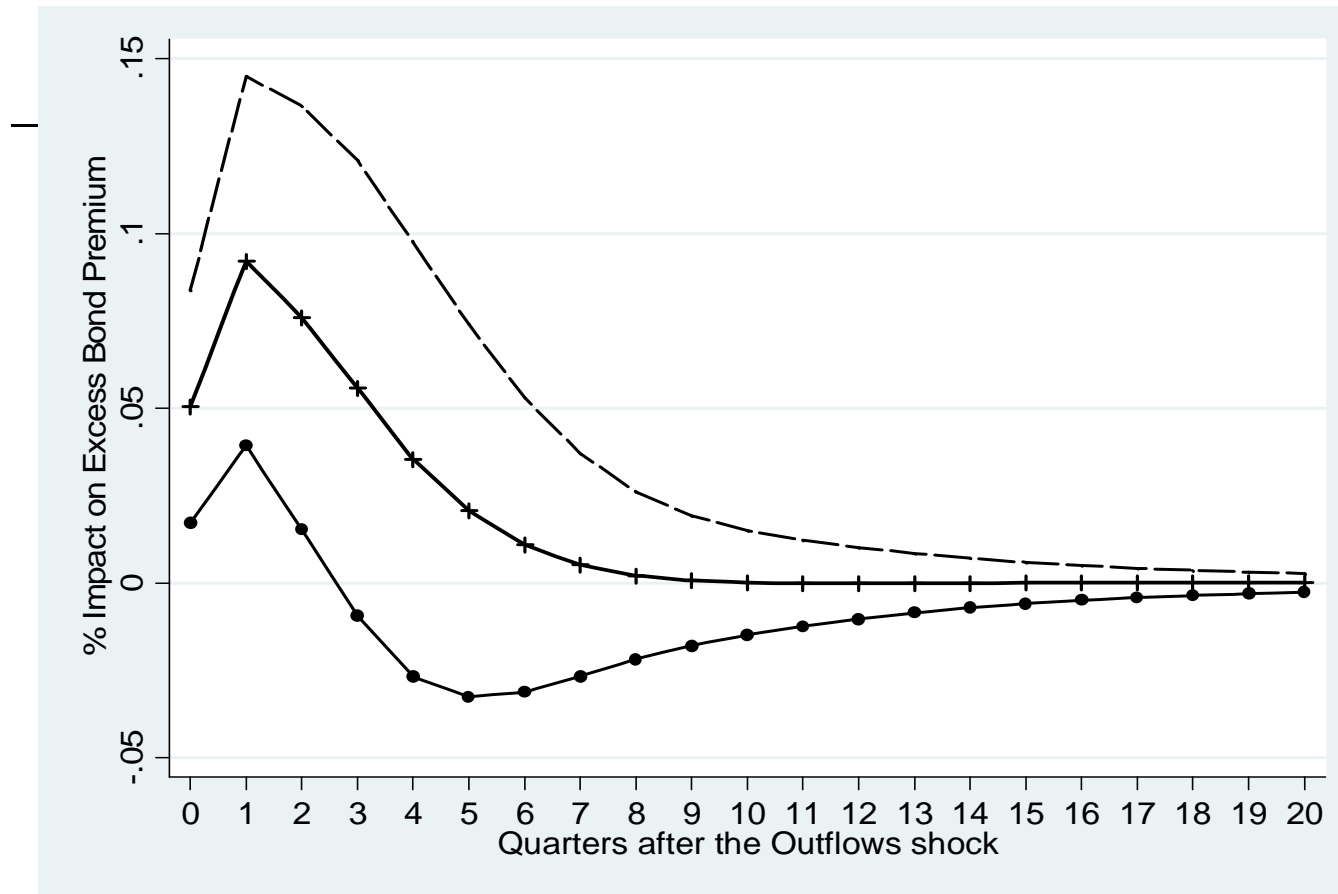
Following 1% increase in corporate bond fund outflows during a quarter, the excess bond premium rises during the contemporaneous quarter, and jumps up further by 9.2 and 7.6 basis points in next two quarters.

Figure 4: Impact of Corporate Bond Fund Outflows on GDP growth
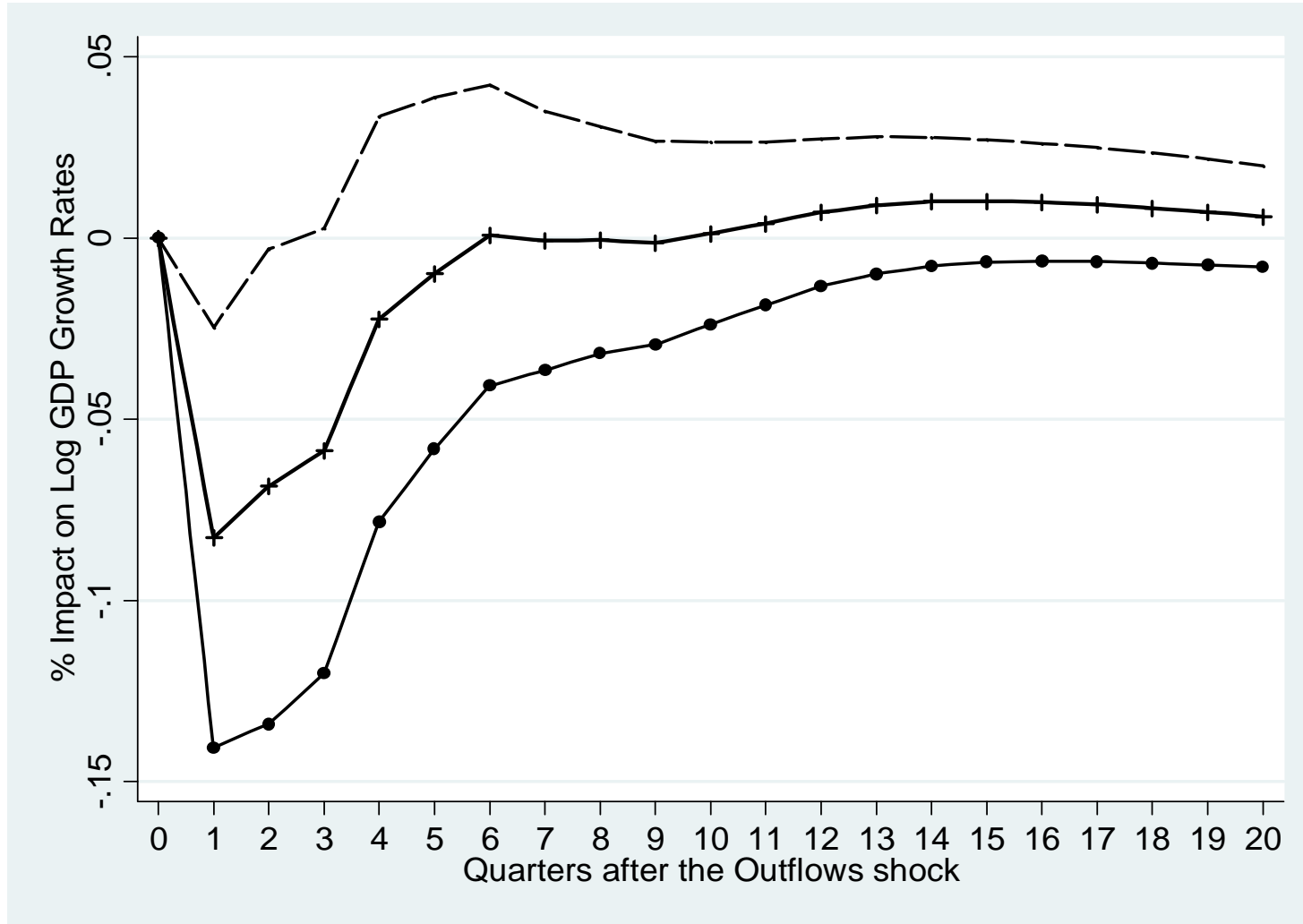
Some Lessons

- We need to pay attention to the liquidity mismatch created by mutual funds
- Measures to reduce 'first-mover advantage' should be considered/implemented more prominently:
  - Fund holding more liquidity/cash reserves (but, costly to performance)
  - Restriction on redemption frequency (but, compromising liquidity to investors)
  - Emergency rules: suspension of redemption; redemption in kind…(but, seldom used, hard to implement)
  - Forward looking NAV calculation (but, hard to implement)

Some Lessons – Cont'd

- Regulation may be needed if there are externalities going beyond the individual fund
  - Fire-sale pricing leading to real implications
- More broadly, regulating one part of the financial system will change the operation of other parts and create new risks
  - Money market funds were largely a response to tightened bank regulation
  - Large activity in bond markets and bond funds is also motivated by the need that cannot be easily filled by traditional banks
  - 'Shadow banking' more generally