Redemption risk and procyclical cash hoarding by asset managers

Stephen Morris, Ilhyock Shim, Hyun Song Shin

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Background

- Crisis propagation pre 2008: banks, leverage, maturity mismatch, complexity, insolvency.
- Post 2008: asset managers, market liquidity, one-sided markets, liquidity mismatch.
- SEC and FSB proposals on liquidity regulation of asset managers.
- Two issues: (1) concerted redemption flows by investors; (2) fire sale of assets by fund managers
- Cash hoarding by fund managers amplifies fire sale and aggravates market liquidity.

Main results

- A global game model of investor runs identifies that cash hoarding takes place when fire sale haircut to late bond sales is more than twice liquidity discount for pre-emptive bond sales.
- Develop a methodology to calculate investor-driven bond sales and fund manager discretionary sales by global DM and EME bond funds.
- Discretionary sales tend to amplify investor-driven sales: cash hoarding is the rule rather than the exception.
- Mutual funds holding more illiquid bonds tend to have more cash hoarding.
- We find some evidence of asymmetry between bond purchases and sales.
- The more illiquid the underlying bonds, the stronger the flow-performance relationship and the degree of investor flow clustering across funds.

Literature: Theory

- Goldstein and Pauzner (2005): a bank run model using a global games approach.
- Chen, Goldstein and Jiang (2010): a global games model of investors in open-end funds
- Zeng (2016): a dynamic model of the interaction of investor runs and the liquidity management decision of fund managers.
- Huang (2016): Credit Lines

Literature: Empirical

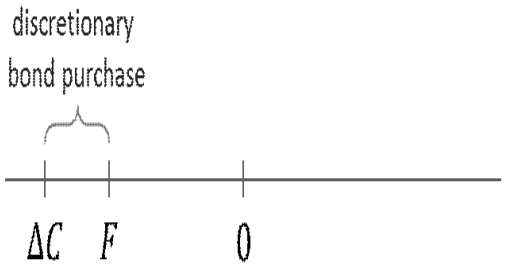
- Chen, Goldstein and Jiang (2010): Equity funds with illiquid assets exhibit stronger sensitivity of outflows to bad past performance than those with liquid assets.
- Goldstein, Jiang and Ng (2016): Corporate bond funds' outflows more sensitive to bad performance than inflows sensitive to good performance. The less liquid the corporate bonds, the greater the flow-performance relationship.
- Chernenko and Sunderam (2016): positive relationship between investor flows and cash holdings.

Distinguishing investor-driven sales and discretionary sales

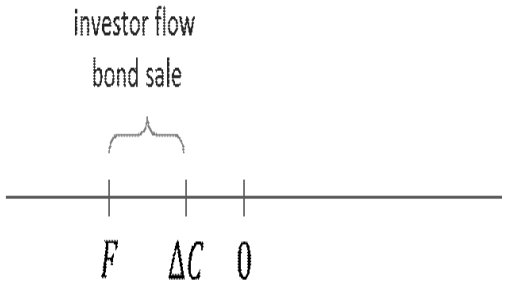
- Compare changes in cash holdings of a fund with net investor flows: if cash holding increases despite investor redemptions, the fund has conducted discretionary sales.
- A conservative definition of discretionary sales.
- Six possible cases depending on the direction of investor flows and the relative size of net flows and changes in cash holdings.
- De-stabilising cases: a fund sell (or buy) bonds due to investor flows and fund manager discretion: more common.
- Stabilising cases: Positive (negative) investor flows and discretionary bond sales (purchases): less common.

Identifying cash hoarding

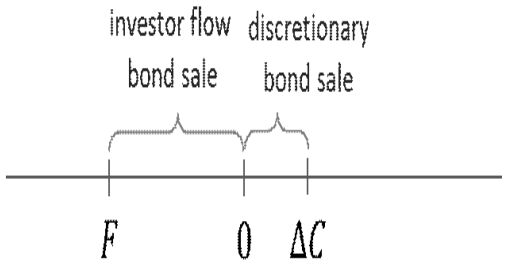
Case 1



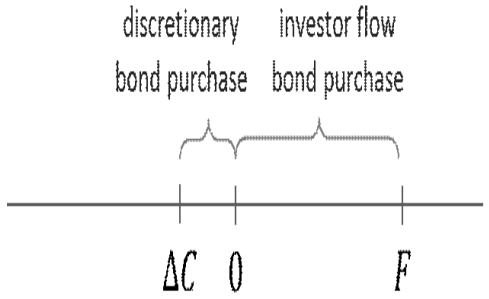
Case 2



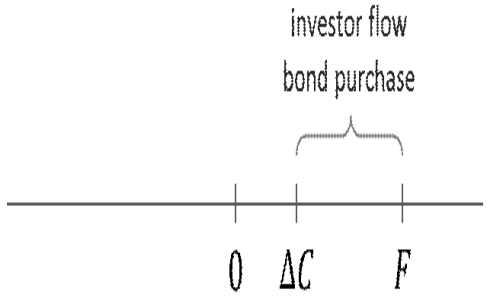
Case 3



Case 4

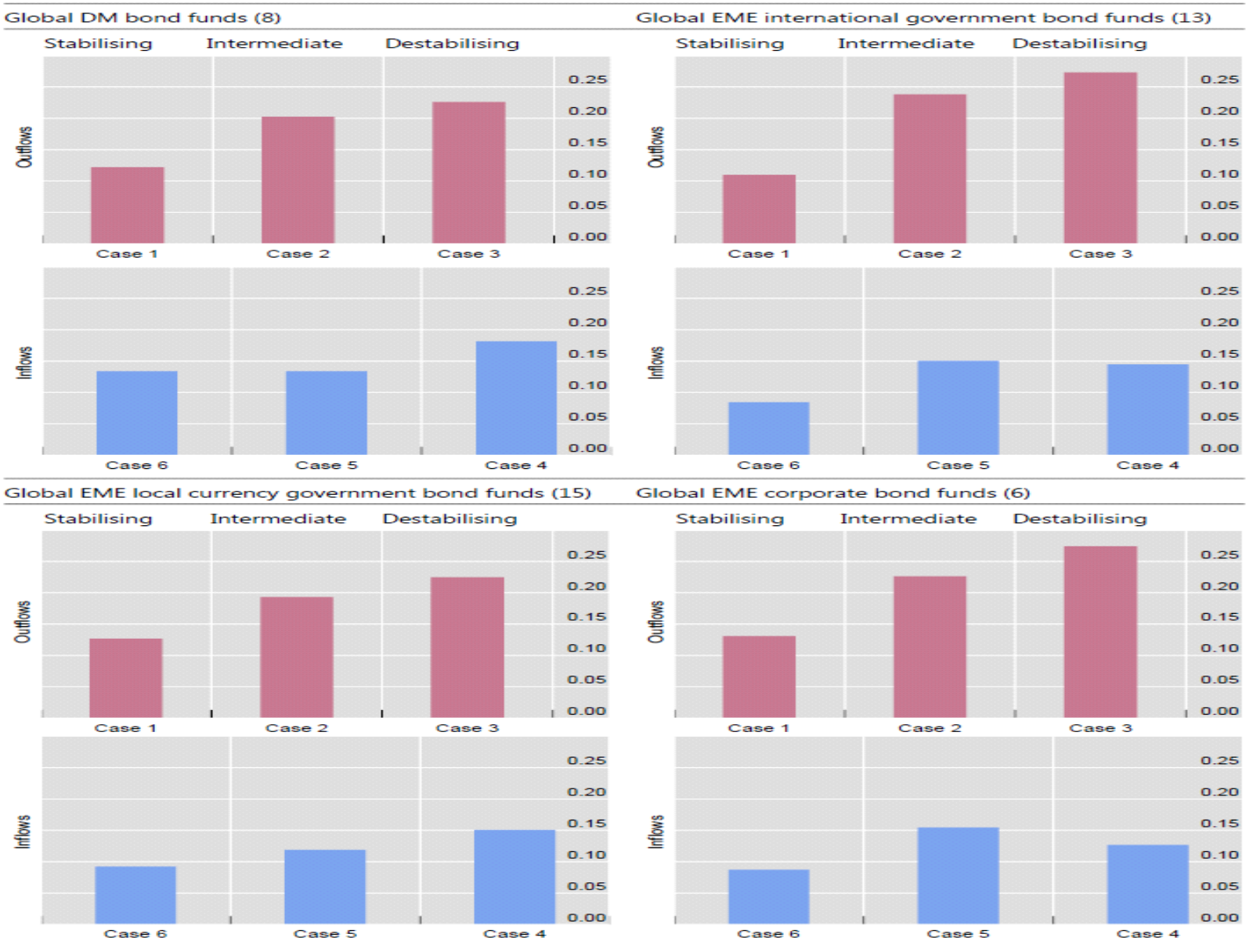


Case 5



Case 6

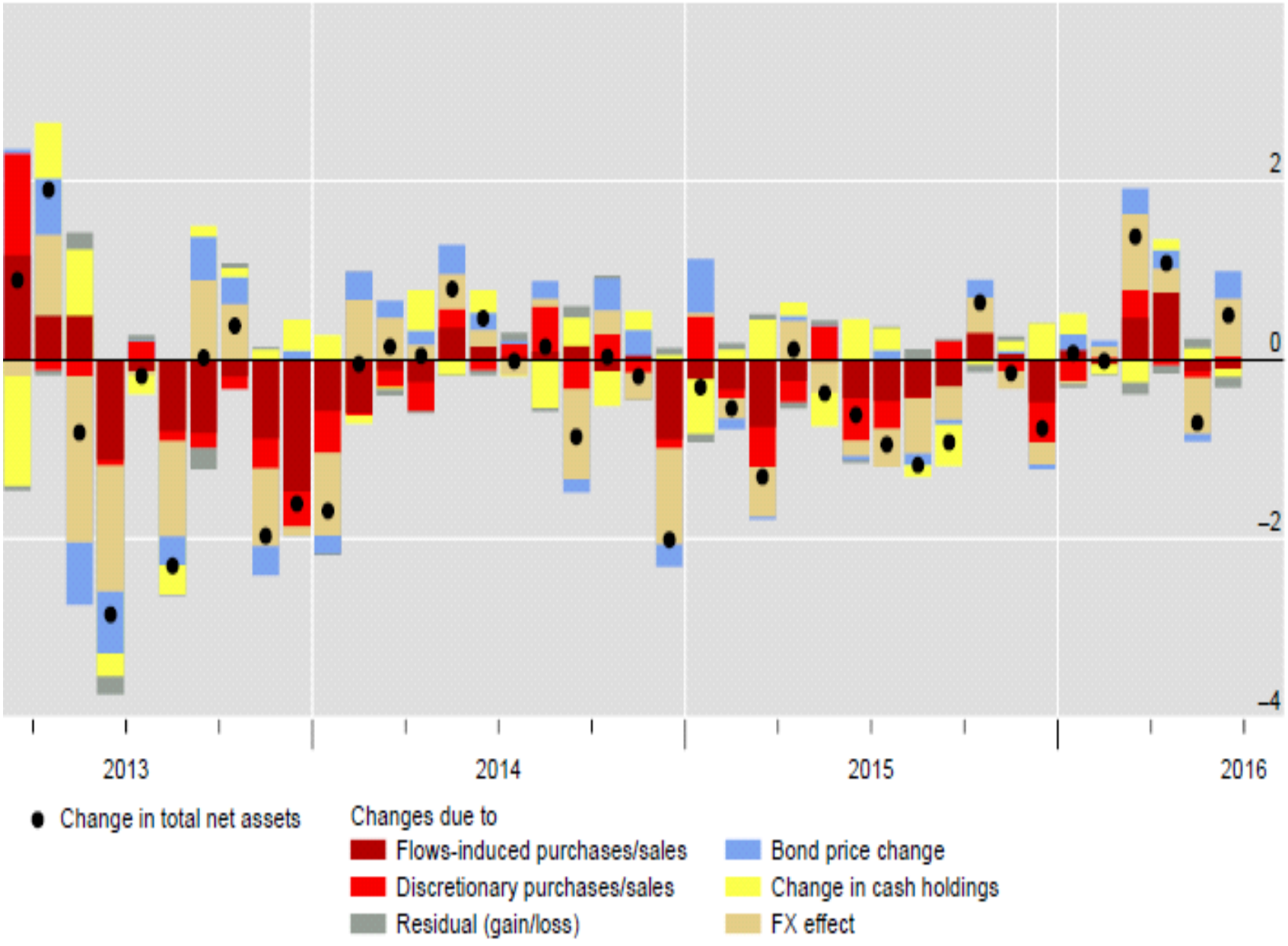
Frequency of stablising/destabilising contempo. sales



Six components of changes in fund NAV

- Investor flow-driven bond purchases/sales
- Discretionary bond purchases/sales
- FX effect: appreciation or depreciation of bond denomination currency against the US dollar
- Bond price effect: bond price changes in the currency of denomination
- Residual: due to data limitations and the resulting discrepancy between the observed NAV and the hypothetical NAV; likely to reflect valuation gains or fire sale losses.

Breakdown of TNA changes (EME LC bond funds)



Pre-emptive cash hoarding

- A fund manager may anticipate future redemptions and try to secure enough cash to meet such redemptions.
- Tradeoff between securing enough cash to meet future redemptions and selling too much into an illiquid market.
- We can redefine the six cases considering investor flows in the current period and changes in cash holdings in the previous period.
- We can similarly define destabilising and stabilising cases
- Destabilising cases are more common than stabilising cases.

Frequency of stablising/destabilising lagged sales

- Fund manager is uncertain about redemptions, believes

$$X \sim U\left[\overline{X} - \frac{1}{2}\sigma, \overline{X} + \frac{1}{2}\sigma\right]$$

  where X is expected redemptions and σ measures uncertainty about redemptions
- Manager faces downward sloping demand curve / fire sale cost with slope δ
- In addition, cost of late liquidation μ
- So if fund manager sell Y units ex ante, realized redemption costs will be

$$\delta Y + \mu \left[X - Y\right]_+$$

- Expected redemption costs will be

$$\int_{X=\overline{X}-\frac{1}{2}\sigma}^{\overline{X}+\frac{1}{2}\sigma} \left(\delta Y + \mu \left[X - Y\right]_+\right) dX$$

- Optimal redemptions are

$$Y^* = \begin{cases} \overline{X} - \frac{1}{2}\sigma, \text{ if } \mu < \delta \\ \overline{X} + \left(\frac{1}{2} - \frac{\delta}{\mu}\right)\sigma, \text{ if } \mu \geq \delta \end{cases}$$

- For sufficiently low cost of late liquidations ($\mu < \delta$), will sell only minimum possible redemptions
- As cost of late liquidation increases ($\mu \uparrow$), will approach sale of maximum possible redemptions
- Cutoff for early sales to exceed expected redemptions is $\mu = 2\delta$

Embedding Fund Manager in Investor Coordination Problem

- Continuum of active investors with mass A decide whether to sell based on return
- Two reinforcing sources of strategic complementary:
  - others selling creates fire sale discount
  - fund manager will be liquidating early in response to investor sales, increasing incentive for investors to sell earlier
- "Global game" model: small amount of investor uncertainty implies that the marginal investor will run when his expected return is equalized under a "Laplacian" belief
- In this case, the critical return from staying invested r^* will solve

$$\left(\int_{x=0}^{1} \frac{1 - \delta Y - \mu \left[xA - Y \right]_+}{1 - xA} dx \right) r^* = 1$$

Empirical Implications

- Model predictions to be tested....
  - High cost of late liquidation justifies cash hoarding as buffer
  - Higher fire sale cost will increase cash hoarding
- Predictions suggested by modelling
  - Model was motivated as investors within fund; same logic arises across funds, suggesting clustering
  - Our model suggests advance liquidation, but how much earlier? Other models make different predictions
- Harder to test...
  - Implications for comparative statics with respect to cost of late liquidation
- Not addressed....
  - Asymmetric implications of purchases

Key question in empirical investigation

- Does cash holding serve as a buffer against redemptions or do asset managers engage in cash hoarding?
- Does cash hoarding occur within the same month or one month in advance?
- Are there systematic variations across funds in terms of cash hoarding depending on the liquidity of underlying assets?
- How strong is the flow-performance relationship and investor flow clustering across different types of bond fund?

Data

- Four types of bond fund

1. Global DM bond funds
2. Global EME international government bond funds
3. Global EME local currency government bond funds
4. Global EME corporate bond funds

- EPFR Global data on monthly investor flows and country allocation weights including cash holdings
- Data on benchmark returns from JPMorgan Chase
- Exclude ETFs, closed-end funds and include only one fund per firm.
- 42 funds with complete info over 42 months (Jan 2013 – Jun 2016)

Contemporaneous cash hoarding

- Panel regression of discretionary purchases in t on investor-driven purchases in t.
- Also include VIX to account for periods of financial market turbulence.
- Asymmetry between bond purchases and bond sales.
- Compare the results across four groups of bond funds.

Regression results for contempo. cash hoarding

Dependent variable: Discretionary purchases in month t						
Global DM bond funds						
	(1)	(2)	(3)	(4)	(5)	(6)
Flow-driven purchases in month t (FP_t)	0.030**	0.030**	0.087*	0.087*		
	(3.09)	(3.33)	(1.94)	(2.02)		
Max{0, FP_t}			−0.071	−0.070		
			(−1.44)	(−1.47)		
Total investor flows in month t (TF_t)					0.014**	0.047
					(2.56)	(1.38)
Max{0, TF_t}						−0.042
						(−0.96)
$\Delta\log(VIX_t)$		−0.113		−0.063	−0.159	−0.139
		(−0.17)		(−0.10)	(−0.24)	(−0.22)
N	8	8	8	8	8	8
N x T	336	336	336	336	336	336
Adjusted R^2	−0.009	−0.012	−0.007	−0.010	−0.018	−0.019
Global EME international government bond funds						
	(1)	(2)	(3)	(4)	(5)	(6)
Flow-driven purchases in month t (FP_t)	0.074***	0.076***	0.074*	0.075*		
	(3.18)	(3.35)	(1.99)	(2.05)		
Max{0, FP_t}			0.000	0.001		
			(0.00)	(0.02)		
Total investor flows in month t (TF_t)					0.026	0.033
					(1.25)	(0.96)
Max{0, TF_t}						−0.016
						(−0.36)
$\Delta\log(VIX_t)$		−0.026		−0.026	−0.008	−0.008
		(−0.47)		(−0.47)	(−0.13)	(−0.13)
N	13	13	13	13	13	13
N x T	546	546	546	546	546	546
Adjusted R^2	0.036	0.034	0.034	0.032	0.011	0.009

Regression results for contempo. cash hoarding (cont'd)

Dependent variable: Discretionary purchases in month t						
Global EME local currency government bond funds						
	(1)	(2)	(3)	(4)	(5)	(6)
Flow-driven purchases in month t	0.062	0.060	0.132**	0.130**		
(FP_t)	(1.69)	(1.68)	(2.47)	(2.50)		
Max{0, FP_t}			−0.106*	−0.105*		
			(−1.98)	(−1.99)		
Total investor flows in month t					0.041*	0.080**
(TF_t)					(1.77)	(2.29)
Max{0, TF_t}						−0.062
						(−1.64)
$\Delta\log(VIX_t)$		0.034		0.032	0.037	0.035
		(1.37)		(1.40)	(1.38)	(1.41)
N	15	15	15	15	15	15
N x T	630	630	630	630	630	630
Adjusted R^2	0.015	0.034	0.034	0.032	0.011	0.009
Global EME corporate bond funds						
	(1)	(2)	(3)	(4)	(5)	(6)
Flow-driven purchases in month t	0.095**	0.092**	0.106*	0.101*		
(FP_t)	(2.68)	(2.73)	(2.21)	(2.08)		
Max{0, FP_t}			−0.017	−0.013		
			(−0.35)	(−0.25)		
Total investor flows					0.058**	0.020
(TF_t)					(2.68)	(0.66)
Max{0, TF_t}						0.055
						(0.86)
$\Delta\log(VIX_t)$		0.040		0.039	0.049	0.055
		(0.40)		(0.38)	(0.46)	(0.52)
N	6	6	6	6	6	6
N x T	252	252	252	252	252	252
Adjusted R^2	0.036	0.034	0.034	0.032	0.011	0.009

Lagged cash hoarding

- Panel regression of discretionary purchases in $t-1$ on investor-driven purchases in t.
- Also include VIX_{t-1} to account for periods of financial market turbulence.
- Asymmetry between bond purchases and bond sales.
- Compare the results across four groups of bond funds.

Regression results for lagged cash hoarding

Dependent variable: Discretionary purchases in month $t-1$						
Global DM bond funds						
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
Flow-driven purchases in month t	0.003	0.003	−0.011	−0.010		
(FP_t)	(0.22)	(0.21)	(−0.34)	(−0.32)		
Max$\{0, FP_t\}$			0.016	0.015		
			(0.51)	(0.48)		
Total investor flows in month t					0.016	0.029
(TF_t)					(1.63)	(0.84)
Max$\{0, TF_t\}$						−0.016
						(−0.52)
$\Delta\log(VIX_{t-1})$		0.021		0.020	0.020	0.020
		(0.75)		(0.71)	(0.72)	(0.77)
N	8	8	8	8	8	8
N x T	328	328	328	328	328	328
Adjusted R^2	−0.012	−0.015	−0.015	−0.018	−0.013	−0.016
Global EME international government bond funds						
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
Flow-driven purchases in month t	0.001	0.001	0.005	0.005		
(FP_t)	(0.11)	(0.09)	(0.21)	(0.19)		
Max$\{0, FP_t\}$			−0.010	−0.010		
			(−0.28)	(−0.26)		
Total investor flows					0.018	0.021
(TF_t)					(1.38)	(0.93)
Max$\{0, TF_t\}$						−0.008
						(−0.26)
$\Delta\log(VIX_{t-1})$		0.005		0.004	−0.003	−0.003
		(0.08)		(0.06)	(−0.04)	(−0.05)
N	13	13	13	13	13	13
N x T	533	533	533	533	533	533
Adjusted R^2	0.008	0.006	0.006	0.005	0.008	0.007

Regression results for lagged cash hoarding (cont'd)

Dependent variable: Discretionary purchases in month $t-1$						
Global EME local currency government bond funds						
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
Flow-driven purchases in month t	0.007	0.004	0.035	0.031		
(FP_t)	(0.49)	(0.35)	(0.95)	(0.90)		
Max$\{0,\ FP_t\}$			−0.043	−0.040		
			(−1.10)	(−1.08)		
Total investor flows in month t					0.024	0.088
(TF_t)					(0.98)	(1.47)
Max$\{0,\ TF_t\}$						−0.101
						(−1.55)
$\Delta\log(VIX_{t-1})$		0.046		0.043	0.040	0.035
		(1.42)		(1.44)	(1.31)	(1.25)
N	15	15	15	15	15	15
N x T	615	615	615	615	615	615
Adjusted R^2	−0.016	−0.014	−0.015	−0.014	−0.009	0.006
Global EME corporate bond funds						
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
Flow-driven purchases in month t	0.035*	0.029	−0.007	−0.016		
(FP_t)	(2.19)	(1.56)	(−0.47)	(−0.61)		
Max$\{0,\ FP_t\}$			0.068**	0.071**		
			(2.88)	(2.65)		
Total investor flows					0.055**	0.049
(TF_t)					(3.64)	(1.02)
Max$\{0,\ TF_t\}$						0.009
						(0.15)
$\Delta\log(VIX_{t-1})$		0.061		0.064	0.043	0.043
		(0.56)		(0.59)	(0.40)	(0.40)
N	6	6	6	6	6	6
N x T	246	246	246	246	246	246
Adjusted R^2	−0.009	−0.011	−0.010	−0.011	0.002	−0.002

Comparison across four types of fund

	Global DM bond funds		Global EME international government bond funds		Global EME local currency government bond funds		Global EME corporate bond funds	
Dependent variable: discretionary purchases in the same month								
Explanatory variables	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Flow-driven purchases	0.030**		0.076***		0.060		0.092**	
in month t	(3.33)		(3.35)		(1.68)		(2.73)	
Total investor flows		0.014**		0.026		0.041*		0.058**
in month t		(2.56)		(1.25)		(1.77)		(2.68)
$\Delta\log(VIX_t)$	−0.113	−0.159	−0.026	−0.008	0.034	0.037	0.040	0.049
	(−0.17)	(−0.24)	(−0.47)	(−0.13)	(1.37)	(1.38)	(0.40)	(0.46)
N	8	8	13	13	15	15	6	6
N x T	336	336	546	546	630	630	252	252
Adjusted R^2	−0.012	−0.018	0.034	0.011	0.034	0.011	0.034	0.011
Dependent variable: discretionary purchases in the previous month								
Explanatory variables	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Flow-driven purchases	0.003		0.001		0.004		0.029	
in month t	(0.21)		(0.09)		(0.35)		(1.56)	
Total investor flows		0.016		0.018		0.024		0.055**
in month t		(1.63)		(1.38)		(0.98)		(3.64)
$\Delta\log(VIX_{t-1})$	0.021	0.020	0.005	−0.003	0.046	0.040	0.061	0.043
	(0.75)	(0.72)	(0.08)	(−0.04)	(1.42)	(1.31)	(0.56)	(0.40)
N	8	8	13	13	15	15	6	6
N x T	328	328	533	533	615	615	246	246
Adjusted R^2	−0.015	−0.013	0.006	0.008	−0.014	−0.009	−0.011	0.002

Correlation bet investor flows and discretionary purchases

Fund type	Average correlation between total investor flows in t and		Average correlation between flow-driven purchases in t and	
	discretionary purchases in t	discretionary purchases in $t-1$	discretionary purchases in t	discretionary purchases in $t-1$
Global DM bond funds	0.076	−0.005	0.168	−0.073
Global EME international government bond funds	0.179	0.112	0.303	0.028
Global EME local currency government bond funds	0.214	0.149	0.297	0.084
Global EME corporate bond funds	0.175	0.168	0.254	0.112
All funds	0.171	0.111	0.268	0.041

Flow-performance relationship

	Global DM bond funds		Global EME international government bond funds		Global EME local currency government bond funds		Global EME corporate bond funds	
Dependent variable: Investor flows in month t								
Exp. variable	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
FR_t	−0.084		0.404		0.493***		0.981**	
	(−0.18)		(0.77)		(4.37)		(3.28)	
Max$\{0, FR_t\}$	0.060		0.112		−0.512***		−0.859	
	(0.13)		(0.16)		(−5.17)		(−1.25)	
$\Delta\log(VIX_t)$	−2.216		−2.964		−0.816		0.224	
	(−1.32)		(−1.61)		(−0.51)		(0.21)	
FR_{t-1}		0.653**		0.622		0.361**		0.396**
		(2.56)		(1.57)		(2.46)		(3.09)
Max$\{0, FR_{t-1}\}$		−0.657**		−0.304		−0.223		0.538
		(−2.64)		(−0.65)		(−0.84)		(1.86)
$\Delta\log(VIX_{t-1})$		2.471**		0.323		−2.900*		0.830
		(2.67)		(0.26)		(−1.91)		(1.09)
N	8	8	13	13	15	15	6	6
N x T	336	328	546	533	630	615	252	246
Adjusted R^2	0.002	0.013	0.094	0.071	0.034	0.048	0.096	0.116

Investor flow clustering

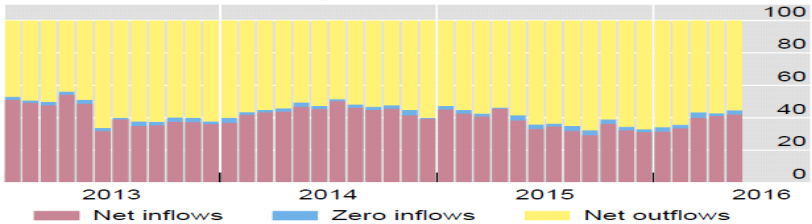
- Investor clustering (directional co-movement of investor flows across funds) expected when the returns of the bond funds are affected by common components.
- For given global game run thresholds, we expect clustering in investor redemptions across funds and the extent of clustering will depend on the underlying bond characteristics.
- The degree of investor clustering can be measured by:

1. The share of funds facing investor net inflows, funds facing zero net inflows and funds facing investor net outflows;
2. The dollar amount of the sum of investor net inflows (positive value) over the funds facing net inflows and the dollar amount of the sum of investor net outflows (negative value) over the fund facing net outflows; and
3. The share of the sum of investor net inflows over the funds facing net inflows and the sum of investor net outflows (absolute value) over the fund facing net outflows.

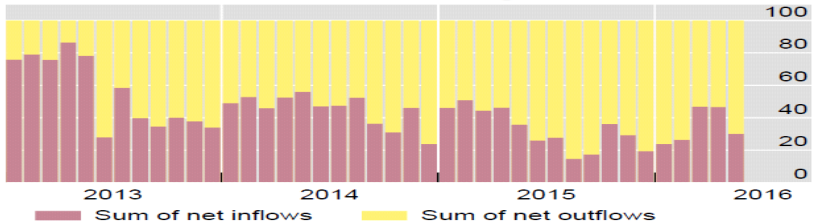
Investor flow clustering

Global DM bond funds (478)

Share of the number of funds facing net inflows and the number of funds facing net outflows

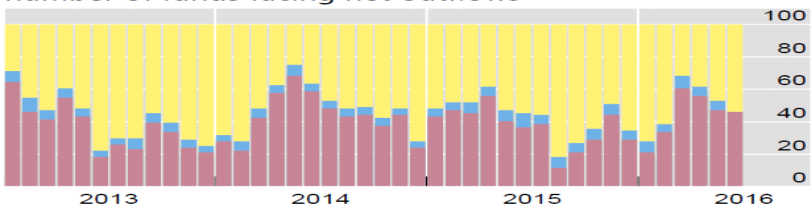


Share of sum of inflows for funds facing net inflows and the sum of outflows for funds facing net outflows

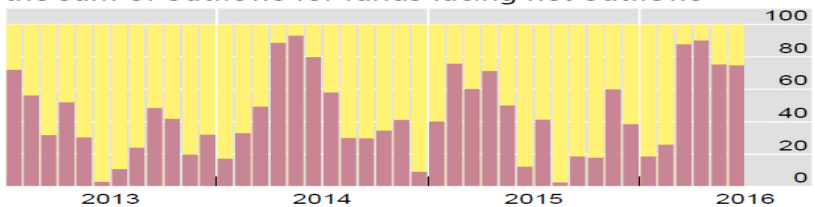


Global EME international government bond funds (104)

Share of the number of funds facing net inflows and the number of funds facing net outflows

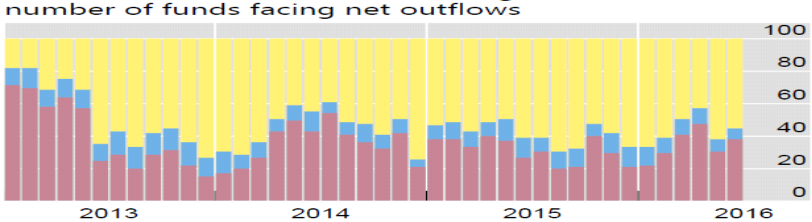


Share of sum of inflows for funds facing net inflows and the sum of outflows for funds facing net outflows

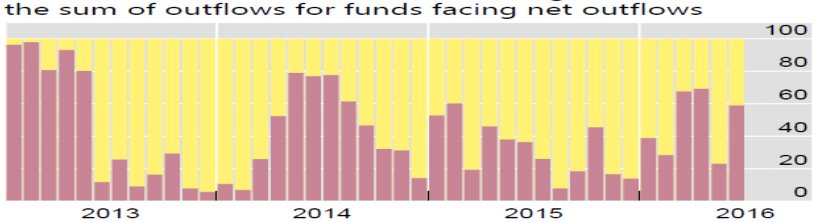


Global EME local currency government bond funds (105)

Share of the number of funds facing net inflows and the number of funds facing net outflows

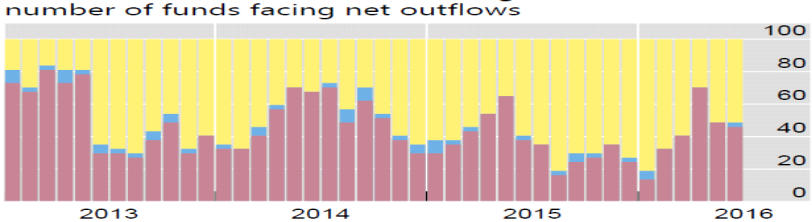


Share of sum of inflows for funds facing net inflows and the sum of outflows for funds facing net outflows

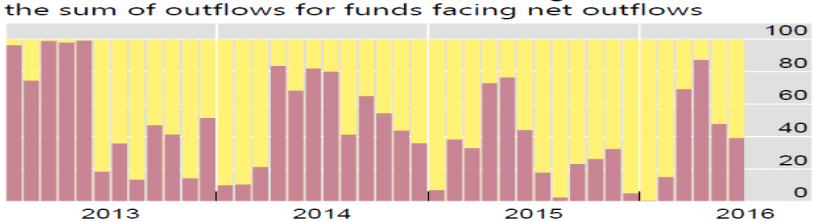


Global EME corporate bond funds (37)

Share of the number of funds facing net inflows and the number of funds facing net outflows



Share of sum of inflows for funds facing net inflows and the sum of outflows for funds facing net outflows



Investor flow clustering (cont'd)

- Investors in the four groups of bond funds exhibit strong directional co-movement in their choice of investment into or redemptions from funds.
- Such evidence supports the model's prediction that mutual fund investors tend to alternate between two states: in one state, all investors commit new funds; and in the other state, they all redeem.

1. The degree of investor clustering (ie one-sidedness) across funds in each group is higher when we look at the dollar amount than when we look at the number of funds.
2. Investors tend to abruptly switch from inflow-side clustering to outflow-side clustering, and often continue to redeem heavily for a few or several consecutive months before they switch to relatively more inflows than outflows.
3. The more illiquid the underlying assets, the greater degree of investor clustering at a point in time.

Conclusion

- Cash hoarding is the rule rather than the exception for global bond mutual funds.
- Procyclical cash hoarding choices of bond fund managers have the potential to amplify fire sales associated with investor redemptions.
- Incidence of cash hoarding is more severe for those funds investing in more illiquid bonds.
- Ongoing policy discussions:
  welfare effects of liquidity rules on asset managers;
  asset liquidity and investor behaviour during normal and stressed times; and
  firm-level and system-level stress testing.