Vulnerable Asset Management?
The Case of Mutual Funds

Christoph Fricke\textsuperscript{1} Daniel Fricke\textsuperscript{2,3,4}

\textsuperscript{1}Deutsche Bundesbank
\texttt{christoph.fricke@bundesbank.de}

\textsuperscript{2}University College London
\textsuperscript{3}London School of Economics, Systemic Risk Centre
\textsuperscript{4}Saïd Business School, Oxford
\texttt{d.fricke@ucl.ac.uk}

\textit{26\textsuperscript{th} September 2017}

The views expressed here are the authors’ and do not necessarily represent the views of Deutsche Bundesbank or the Eurosystem.
The asset management sector grows and becomes more concentrated

Graph VI.6

Lhs:
- Aggregate assets, 500 global asset managers

Rhs:
- Share of largest 20 asset managers

Sources: Towers Watson; BIS estimates.
Motivation - Are funds systemic?

History:
- Role of portfolio insurers in the market crash of 1987
- LTCM’s asset fire-sales in 1998 and followed bailout

Regulators view: (FSB, ESRB)
- Identifying structural sources of vulnerabilities in the asset management sector
- Vulnerabilities due to asset liquidations forced by liquidity transformation and leverage
- Identify NBNI-GSIFIs to develop an adequate regulatory framework

Industry view:
- Tight leverage regulation of mutual funds

→ Microprudential regulation mitigates systemic risk in the fund sector
Motivation - Are funds systemic?

Academia:

Evidence on fragility:
- Goldstein et al. (2015)
  Funding fragility of bond funds might cause fire-sales
- Zeng (2016)
  Inherent run incentives in the fund sector

Systemic risk:
- IMF (2015)
  - Fund style and size related to fund’s contribution to systemic risk (CoVaR)
  - Investment style more important than size
  - Equity funds contribute more to systemic risk than bond funds
- Danielsson & Zigrand (2015)
  Focusing on negative externalities stemming from funds
Contribution:  
- macroprudential stress-test on systemic risk in the mutual fund sector  
- incorporation of funding fragility overcomes industry’s "leverage-argument"  
- fire-sales as a source of systemic risk  
- estimation of systemic risk contribution at fund level addresses the negative externalities (Danielsson & Zigrand, 2015)  
- reveal indicators potentially useful for regulators  
  - size  
  - portfolio diversification  
  - portfolio (il)liquidity
Measuring vulnerabilities
(Extending Greenwood, Landier, and Thesmar (2015))
Model

Fund balance sheet:

- Assets under management: $A$
- Asset portfolio weights: $M$
- Fund shares (Equity): $E$
- Credit lines (Leverage): $D$
- Leverage-ratio: $B = \frac{D}{E}$

4-Step approach:

1. Initial shock on the value of funds’ asset holdings.
2. Investors withdraw some of their money (flow-performance relationship).
3. Asset liquidation decision of funds for liquidity generation and leverage targeting.
4. Asset liquidations have price impact.
4-step stress-test: Illustration

- **Initial asset price shock**
- **Asset sales related to redemptions**
- **Asset sales related to leverage targeting**
- **Asset price drop related to fire-sale**

**Investment Fund**

- **Assets**
- **Liabilities**

- **Fund share drop due to asset price shock**
- **Investors’ fund share redemptions due to asset price shock**
- **Leverage targeting: Debt reduction**
Step 1: Initial Shock – Asset price return

- Assume asset price returns \( F_1 \)
- Obtain funds’ portfolio returns: \( R_1 = MF_1 \)
  with \( R_1 \) being a \((N \times 1)\) vector.
- Funds’ updated total assets \( A_1 = A_0(1 + R_1) \)
- the corresponding equity and debt position
  \( E_1 = E_0 + A_0R_1 \)
  \( D_1 = D_0 \)
Step 2: Response on the funding side

Funding providers response to asset price shocks:

Shareholders - Flow-Performance-relationship:

\[ \frac{\Delta E_2}{E_1} = \gamma^E R_1, \]  

(1)

Creditors - Credit line adjustments:

\[ \Delta D_2 = \gamma^D R_1 D_1 = \gamma^D R_1 D_0, \]  

(2)

With these additional adjustments on the liability side of the balance sheet, updated equity and debt can be written as

\[ E_2 = E_1(1 + \gamma^E R_1), \]  

(3)

and

\[ D_2 = D_1(1 + \gamma^D R_1). \]  

(4)
**Step 3**: Total amount of assets to be liquidated:

\[ \tilde{\phi} = \gamma^E M'E_1 R_1 + \gamma^D M'D_1 R_1 + M'A_0 B \tilde{R}_2, \]  

(5)

- Net inflow of equity
- Net inflow of debt
- Leverage targeting

**Step 4**: Asset fire-sales generate linear price impact:

\[ F_3 = L\tilde{\phi}, \]  

(6)

where \( L \) is the matrix of price impact ratios
**Definition**

*Aggregated Vulnerability (AV)*:

dollar effect of shock $F_1$ on fund assets through fire-sales

Here, standardized by funds’ equity position, $E_0$

\[
\tilde{AV} = 1'_{N} A_0 MLM' \left( [\Gamma^E E_1 + \Gamma^D D_1] R_1 + A_0 B \tilde{R}_2 \right) \frac{1}{E_0}.
\]  

(7)

with $A_0 MLM'$ as the liquidity-weighted asset holdings.
**Definition**

**Systemicness ($S$):** fund’s individual contribution to the aggregated vulnerability

\[
S_i = \frac{1_N^t A_0 M M' \delta_i \delta_i^t \left( \Gamma^E E_1 + \Gamma^D D_1 \right) R_1 + A_0 B \tilde{R}_2}{E_0},
\]

where \( \sum_i^N S_i = \tilde{A}V \).
Measuring Vulnerability Exposures

**Definition**

*Indirect Vulnerability (IV):* fund’s indirect vulnerability with respect to shock $F_1$ as the impact of the shock on its equity through the deleveraging of other funds

\[
IV_i = \frac{\delta_i'A_0MLM' \left( [\Gamma^E E_1 + \Gamma^D D_1] R_1 + A_0 B\tilde{R}_2 \right)}{E_{i,i}}.
\] (9)
Model Application
Data

U.S. domestic equity funds

- **Source**: CRSP Survivor-Bias-Free Mutual Fund Database
- **Sample**: 2003-Q1 and 2014-Q4
- **Sample Size**: 7,914 unique funds and 98,054 fund-quarter observations

**Balance sheet**:
- Portfolio Weights $\mathbf{M}$: asset holdings at a quarterly basis
- Size: sum of asset holdings (assets under management)
- Flows: $\text{Flow}_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}(1+\text{Return}_{i,t})}{TNA_{i,t-1}}$
- Leverage: Maximum allowed leverage (Investment Company Act of 1940)
  $\rightarrow$ maximum value of $\frac{D}{A}$ is 0.33 $\rightarrow \bar{B} = 0.5$
- Equity: $E = A - D$
Parameter: Flow-Performance Relationship

\[ \text{Flow}_{i,t} = \alpha + \beta \times \text{Controls}_{i,t-1} + \gamma \text{Return}_{i,t-1} + \epsilon_{i,t} \]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>Coefficient</th>
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<td>adj. R²</td>
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* p<0.05; ** p<0.01

Table: Monthly data; Newey-West standard errors in parentheses.

→ return of -1% ≈ -0.30% fund share redemption
Price Impact – Asset liquidity

- **Source:** CRSP-Compustat
- **Measure:** Amihud ratio

\[
Amihud_{k,d} = \frac{|\text{Return}_{k,d}|}{\text{DVolume}_{k,d}} \quad (10)
\]

\[
\text{PriceImpact}_{k,t} = \frac{1}{D_{k,t}} \sum \text{Amihud}_{k,d}, \quad (11)
\]
Price Impact

![Price impact graph]

- Equal-weighted
- Value-weighted
Stress scenario

Input parameters:

- Asset price shock
  - Initial shock of -5% on all assets; $F_1 = -0.05$

- 3 price impact scenarios
  2. Price impact asset-specific but constant over time.
  3. Homogeneous price impact of $4.77 \times 10^{-6}$ for all assets in all quarters (the typical value of the equal-weighted average price impact).
Aggregated Vulnerabilities - Scenario 1 - Fund split
Aggregated Vulnerabilities - Scenario 2

Aggregate vulnerability - scenario (2)

- Stocks
- SIC 4-digit
- 2-digit
- 1-digit

AV

Year (quarterly)

## Determinants of Fund-Specific Vulnerabilities (Scenario 1)

<table>
<thead>
<tr>
<th></th>
<th>Panel A</th>
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<th>Panel B</th>
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<th>Panel C</th>
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<td>Flows^{6M}(t-1)</td>
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<td><strong>Fama-MacBeth</strong></td>
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<td>Yes</td>
<td>Yes</td>
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<td>59,430</td>
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<td>46,440</td>
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* p<0.05; ** p<0.01
Vulnerabilities according to liquidity assumptions
Implications

Policy implications

**Microprudential:**
Focus on resilience of a fund to a market-wide shock
→ *Indirect vulnerability (IV)*
  → larger and more diversified funds **more robust** to other funds deleveraging

**Macroprudential:**
Concerned with negative externalities imposed by funds (Danielsson & Zigrand, 2015)
→ *Systemicness (S)*
  → larger and more diversified funds **contribute more** to the vulnerabilities in the fund sector

**Commonality:**
*Illiquidity* contributes to both IV & S
→ Better understanding of liquidity transformation in the fund sector
→ Improve monitoring of funds’ liquidity profiles
Questions & Comments