Vulnerable Asset Management? The Case of Mutual Funds

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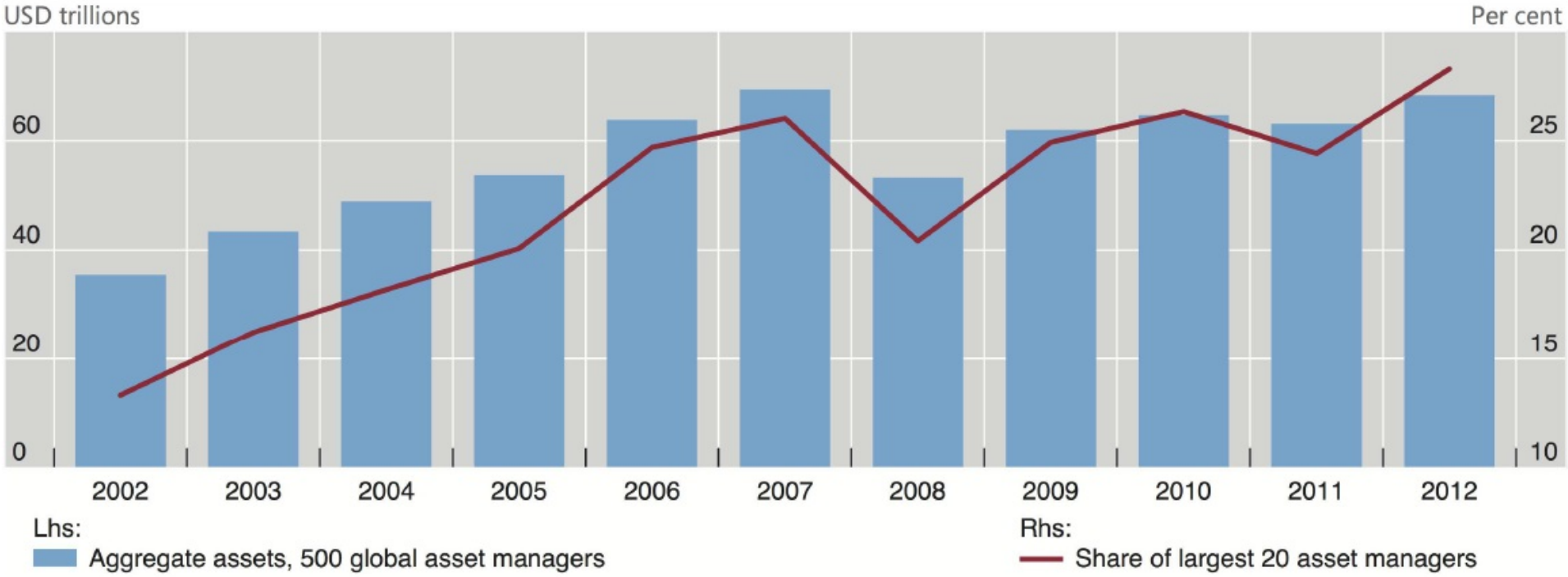
Motivation

The asset management sector grows and becomes more concentrated

Graph VI.6



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
- Vulnerabilites 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

$\rightarrow$ 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

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

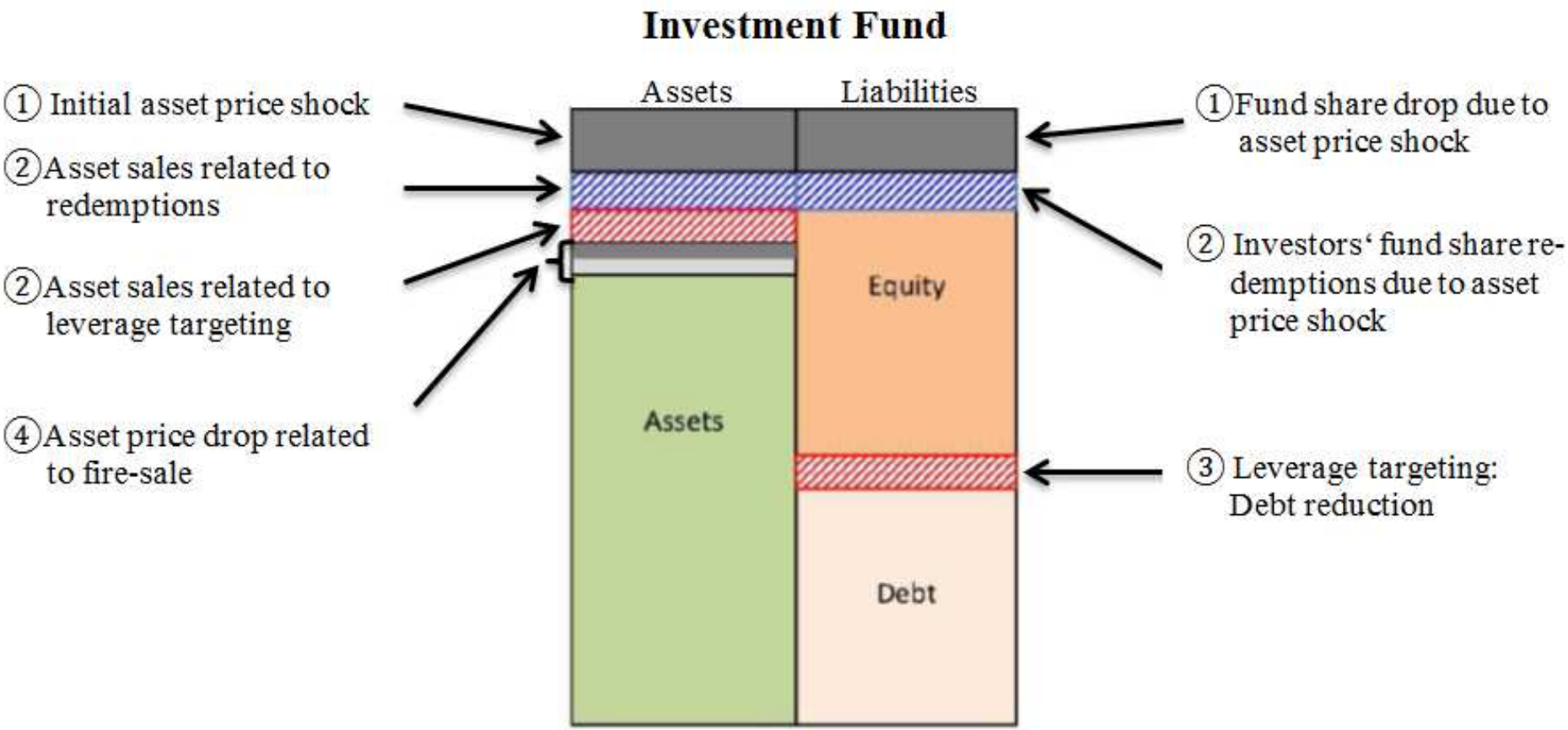
Fund balance sheet:

- 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



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 x 1) vector.
- Funds' updated total assets $A_1 = A_0(1 + R_1)$
- the corresponding equity and debt position
  $E_1 = E_0 + A_0 R_1$
  $D_1 = D_0$

Step 2: Response on the funding side

Funding providers response to asset price shocks:
Shareholders - Flow-Performance-relationship:

$$\frac{\Delta E_2}{E_1} = \gamma^E R_1, \tag{1}$$

Creditors - Credit line adjustments:

$$\Delta D_2 = \gamma^D R_1 D_1 = \gamma^D R_1 D_0, \tag{2}$$

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

$$E_2 = E_1(1 + \gamma^E R_1), \tag{3}$$

and

$$D_2 = D_1(1 + \gamma^D R_1). \tag{4}$$

Incorporating fire sale dynamics

Step 3: Total amount of assets to be liquidated:

$$\tilde{\phi} = \underbrace{\gamma^E \mathbf{M}' \mathbf{E}_1 R_1}_{\text{Net inflow of equity}} + \underbrace{\gamma^D \mathbf{M}' \mathbf{D}_1 R_1}_{\text{Net inflow of debt}} + \underbrace{\mathbf{M}' \mathbf{A}_0 \mathbf{B} \tilde{R}_2}_{\text{Leverage targeting}}, \tag{5}$$

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

$$F_3 = \mathbf{L}\tilde{\phi}, \tag{6}$$

where $\mathbf{L}$ is the matrix of price impact ratios

Measuring Vulnerability Exposures

Definition

Aggregated Vulnerability (AV):
dollar effect of shock F_1 on fund assets through fire-sales
Here, standardized by funds' equity position, E_0

$$\tilde{AV} = \frac{1'_N \mathbf{A}_0 \mathbf{M} \mathbf{L} \mathbf{M}' \left(\left[\mathbf{\Gamma}^{\mathbf{E}} \mathbf{E}_1 + \mathbf{\Gamma}^{\mathbf{D}} \mathbf{D}_1 \right] R_1 + \mathbf{A}_0 \mathbf{B} \tilde{R}_2 \right)}{E_0}. \tag{7}$$

with $\mathbf{A}_0 \mathbf{M} \mathbf{L} \mathbf{M}'$ as the liquidity-weighted asset holdings.

Measuring Vulnerability Exposures

Definition

Systemicness (S):
fund's individual contribution to the aggregated vulnerability

$$S_i = \frac{1'_N \mathbf{A_0 M L M}' \delta_i \delta_i' \left(\left[\mathbf{\Gamma^E E}_1 + \mathbf{\Gamma^D D}_1 \right] R_1 + \mathbf{A_0 B} \tilde{R}_2 \right)}{E_0}, \tag{8}$$

where $\sum_i^N S_i = \tilde{AV}$.

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

$$IV_i = \frac{\delta_i' \mathbf{A}_0 \mathbf{M} \mathbf{L} \mathbf{M}' \left(\left[\mathbf{\Gamma}^{\mathbf{E}} \mathbf{E}_1 + \mathbf{\Gamma}^{\mathbf{D}} \mathbf{D}_1 \right] R_1 + \mathbf{A}_0 \mathbf{B} \tilde{R}_2 \right)}{E_{i,i}}. \tag{9}$$

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 **M**: asset holdings at a quarterly basis
  - Size: sum of asset holdings (assets under management)
  - Flows: $\text{Flow}_{i,t} = \frac{\text{TNA}_{i,t} - \text{TNA}_{i,t-1}(1+\text{Return}_{i,t})}{\text{TNA}_{i,t-1}}$
  - 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

$$\text{Flow}_{i,t} = \alpha + \beta \times \text{Controls}_{i,t-1} + \boxed{\gamma^E} \times \text{Return}_{i,t-1} + \epsilon_{i,t}$$

Return(t-1)	0.0508**	0.0553**	0.0629**	0.1402**	0.1490**	**0.2748****
	(0.0039)	(0.0037)	(0.0036)	(0.0111)	(0.0109)	(0.0268)
⋮	⋮	⋮	⋮	⋮	⋮	⋮
Flows(t-1)	0.0884**	0.0616**	0.0156 *	0.0587**	0.0119	0.0760**
	(0.0050)	(0.0065)	(0.0064)	(0.0064)	(0.0064)	(0.0098)
⋮	⋮	⋮	⋮	⋮	⋮	⋮
log(TNA(t-1))	-0.0032**	-0.0015**	-0.0232**	-0.0016**	-0.0240**	-0.0058
	(0.0001)	(0.0001)	(0.0006)	(0.0001)	(0.0006)	(0.0033)
Fund FE	No	No	Yes	No	Yes	-
Time FE	No	No	No	Yes	Yes	-
Fama-MacBeth	-	-	-	-	-	Yes
adj. R^2	0.014	0.052	0.116	0.056	0.121	0.168
Obs.	417,801	306,570	306,570	306,570	306,570	306,570

$*$ p<0.05; $**$ p<0.01

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

$\rightarrow$ return of -1% $\approx$ -0.30% fund share redemption

Data

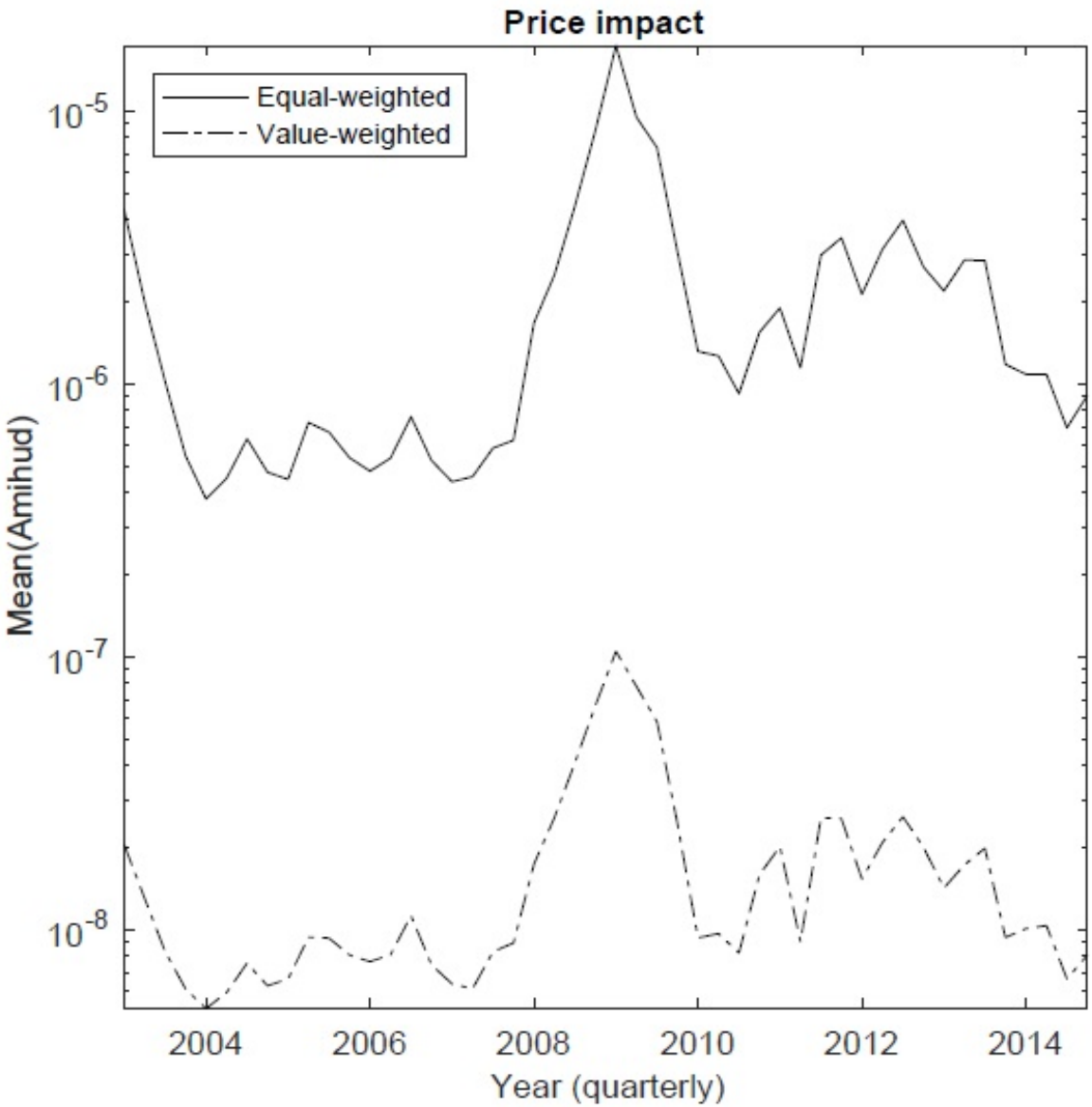
Price Impact – Asset liquidity

- Source: CRSP-Compustat
- Measure: Amihud ratio

$$\text{Amihud}_{k,d} = \frac{|\text{Return}_{k,d}|}{\text{DVolume}_{k,d}} \tag{10}$$

$$\text{PriceImpact}_{k,t} = \frac{1}{D_{k,t}} \sum \text{Amihud}_{k,d}, \tag{11}$$

Price Impact

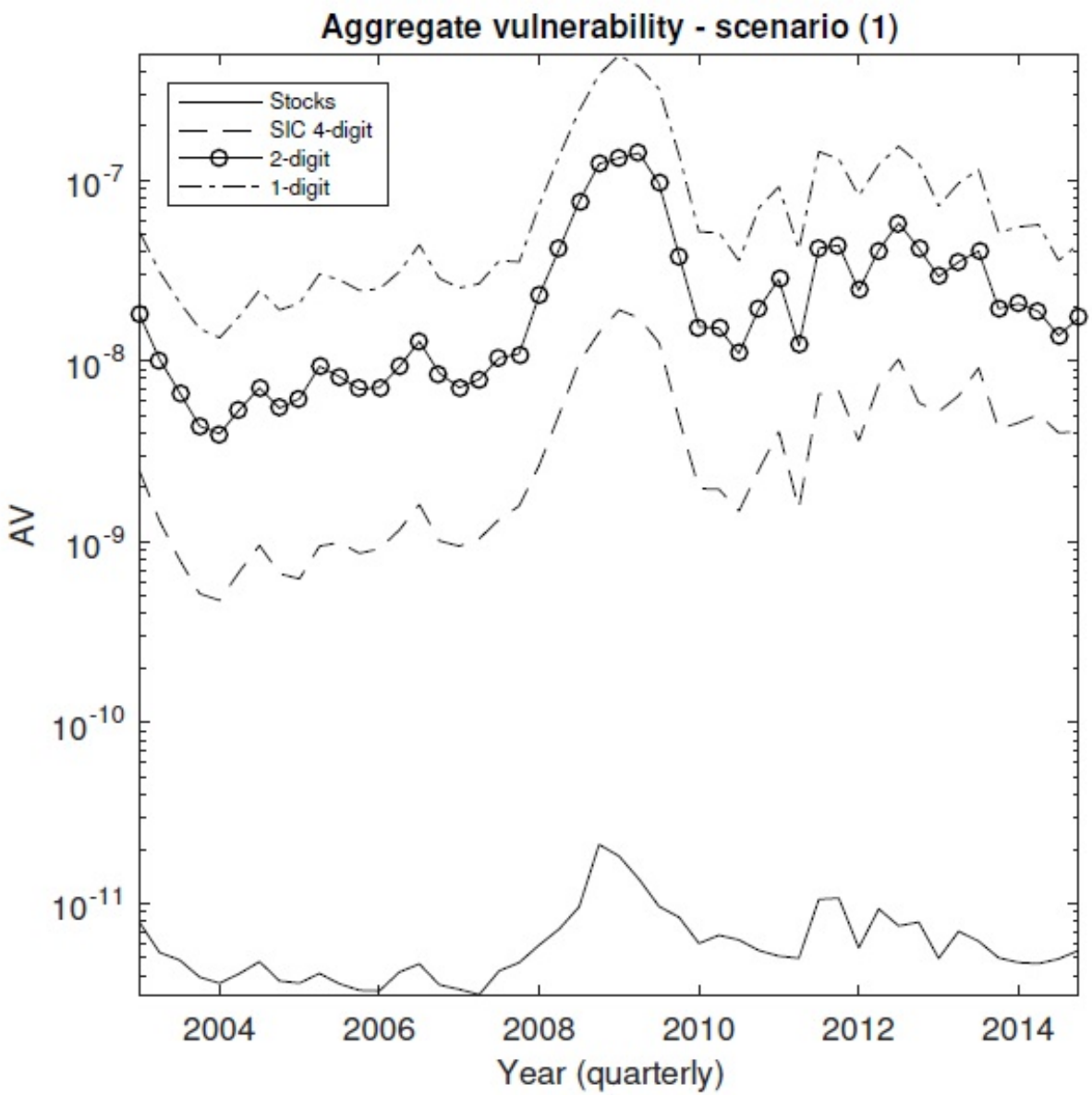


Stress scenario

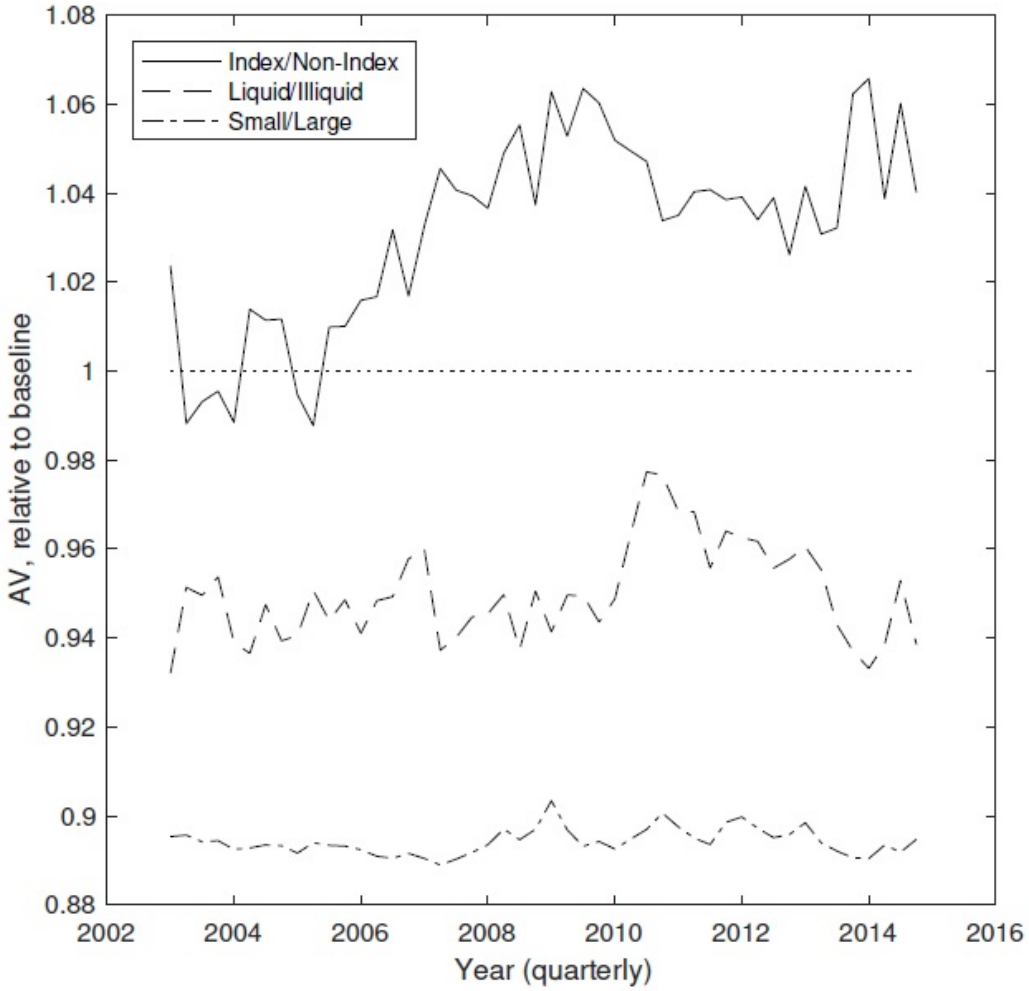
Input parameters:

- Asset price shock
  - Initial shock of -5% on all assets; $F_1 = -0.05$
- 3 price impact scenarios
  1. Price impact time-varying and asset-specific.
  2. Price impact asset-specific but constant over time.
  3. Homogeneous price impact of 4.77×10^{-6} for all assets in all quarters (the typical value of the equal-weighted average price impact).

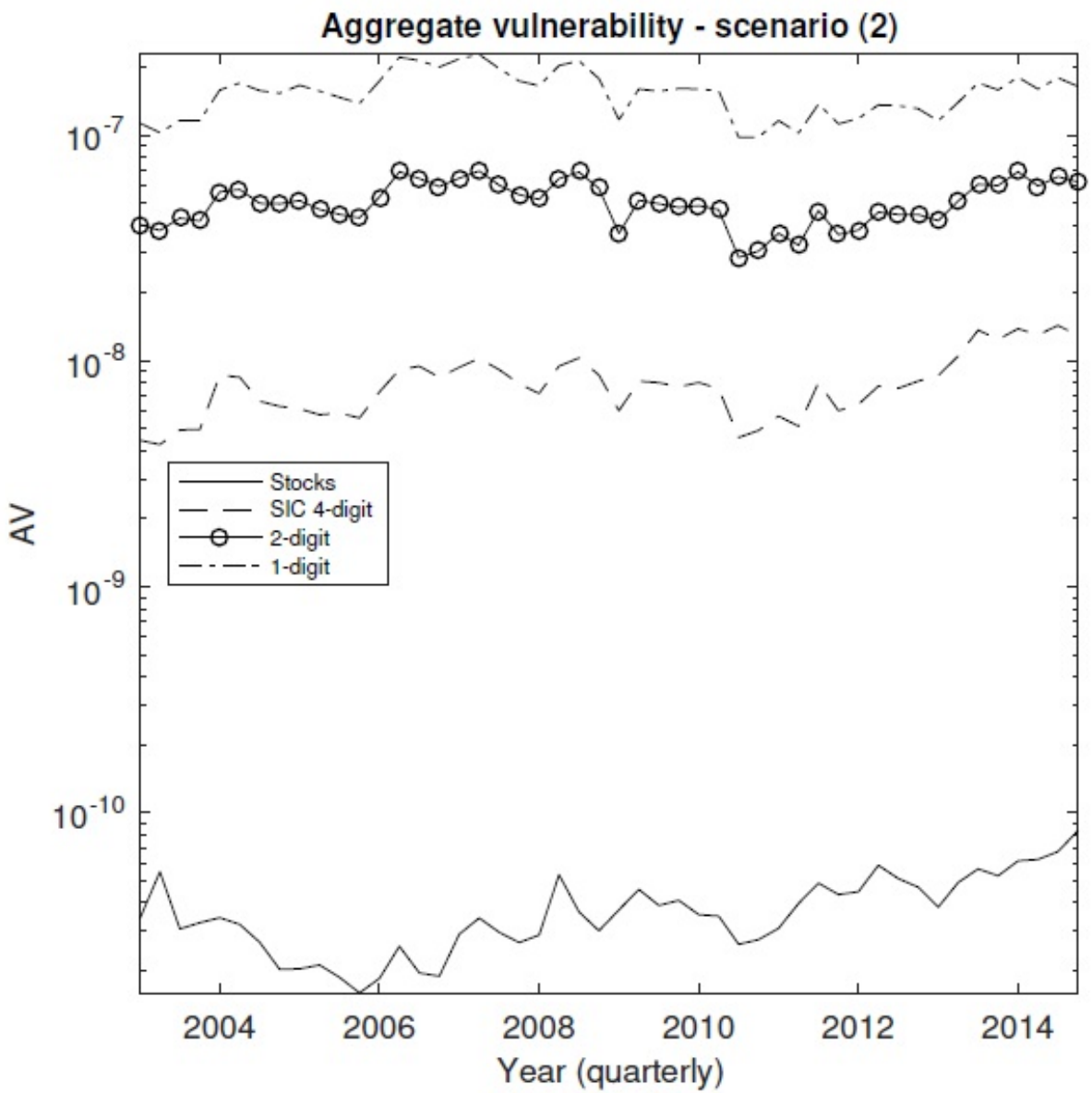
Aggregated Vulnerabilities - Scenario 1



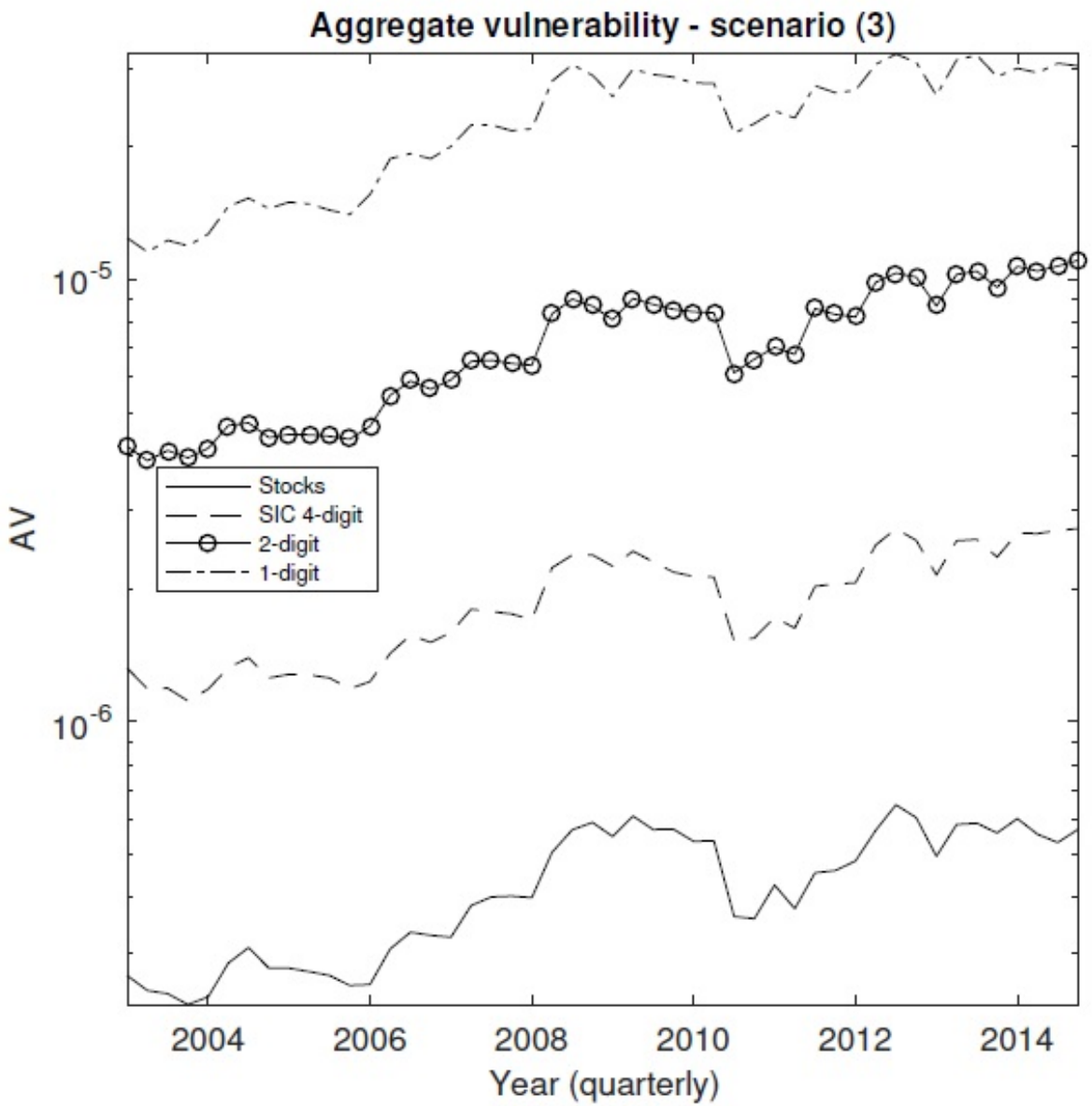
Aggregated Vulnerabilities - Scenario 1 - Fund split



Aggregated Vulnerabilities - Scenario 2



Aggregated Vulnerabilities - Scenario 3



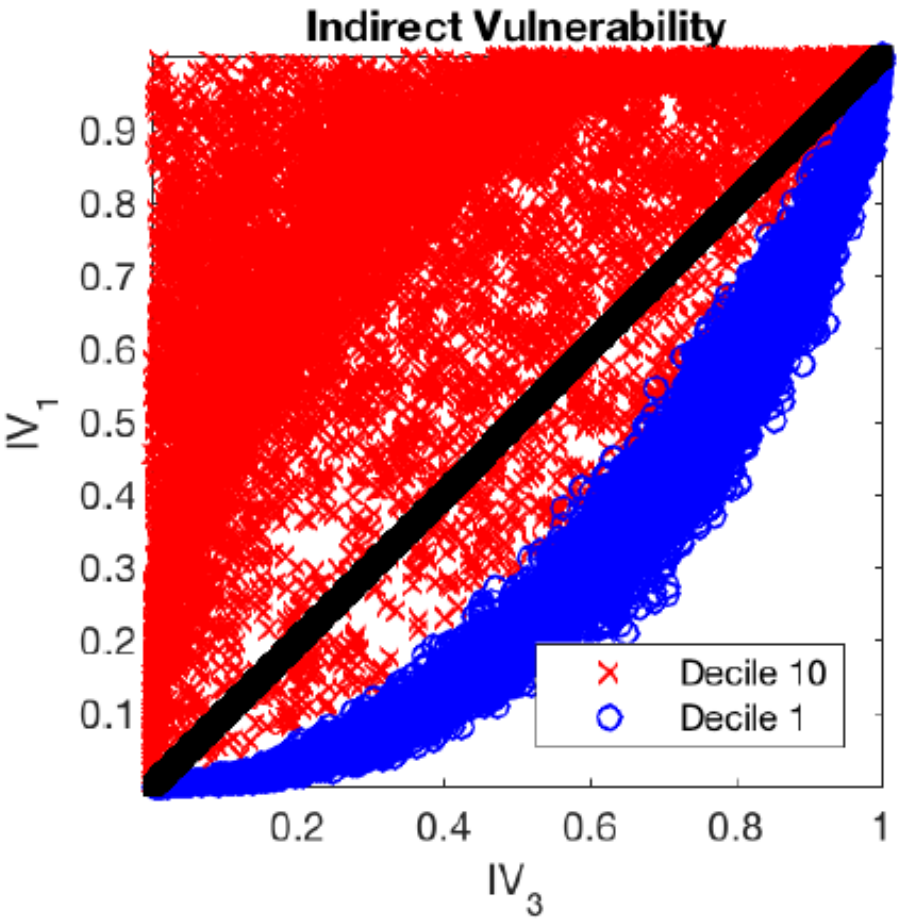
Vulnerability Determinants – Alternative measures

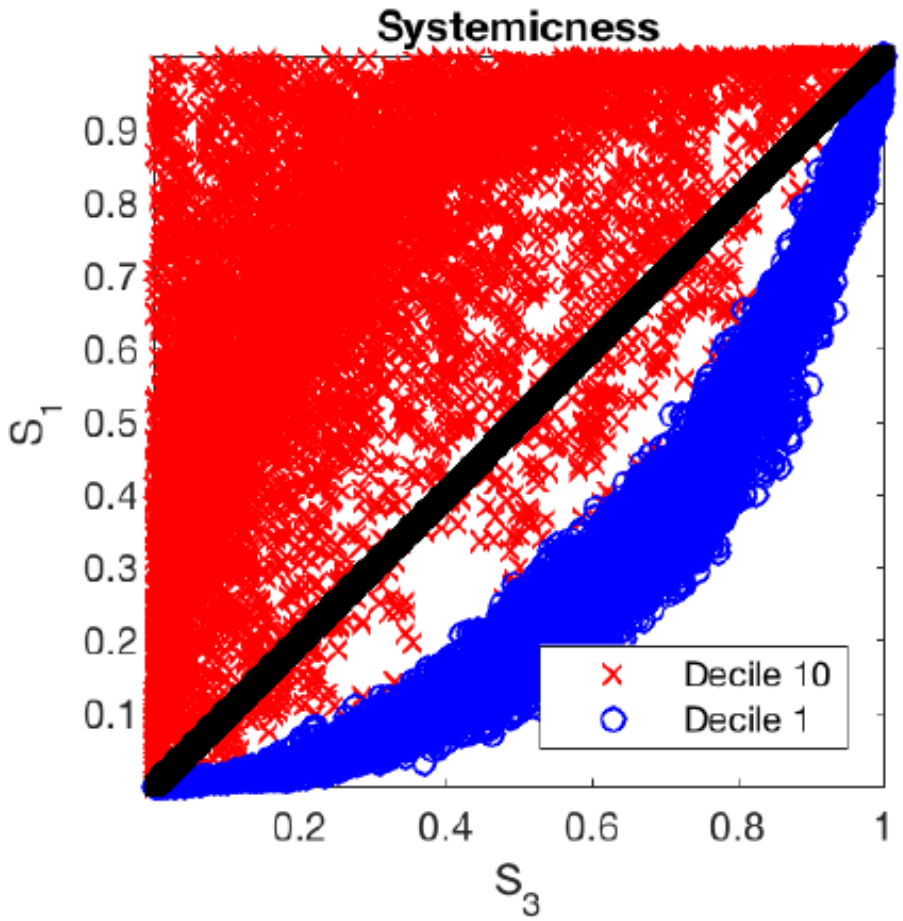
Determinants of Fund-Specific Vulnerabilities (*Scenario 1*)

	Panel A Full Sample		Panel B Full Sample		Panel C No Crisis	
	$\log(IV_1)$	$\log(S_1)$	$\log(IV_1)$	$\log(S_1)$	$\log(IV_1)$	$\log(S_1)$
Model-inherent measures						
log(TNA(t-1))	-0.5832**	0.5898**				
	(0.0541)	(0.0548)				
log(MeanOverlap(t-1))	-0.3409**	0.1676**				
	(0.0606)	(0.0564)				
$\log(Illiq^{Amihud}(t\text{-}1))$	0.0772**	0.3245**				
	(0.0133)	(0.0143)				
Alternative measures						
log(1+Age(t-1))			-0.9402**	0.9657**	-0.9320**	0.9577**
			(0.0197)	(0.0160)	(0.0237)	(0.0191)
$Flows^{6M}(t\text{-}1)$			-0.6697**	0.4111 *	-0.5889 *	0.3447
			(0.2204)	(0.2000)	(0.2582)	(0.2338)
log(HHI(t-1))			0.4674**	-0.4995**	0.4818**	-0.5074**
			(0.0210)	(0.0132)	(0.0242)	(0.0149)
$\log(Illiq^{Spread}(t\text{-}1))$			1.0425**	0.6690**	0.9868**	0.5858**
			(0.0370)	(0.0444)	(0.0365)	(0.0413)
Fama-MacBeth	Yes	Yes	Yes	Yes	Yes	Yes
Mean R^2	0.561	0.536	0.281	0.254	0.282	0.255
Obs.	72,872	72,872	59,430	59,430	46,440	46,440

$*$ $p<0.05$; $**$ $p<0.01$

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