LASH Risk and Interest Rates

Laura Alfaro
Harvard Business School & NBER

Saleem Bahaj
University College London

Robert Czech
Bank of England

Jonathon Hazell
London School of Economics

Ioana Neamțu
Bank of England

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Motivation: Liquidity Crises from Hedging Instruments

Liquidity crises in the non-bank financial sector (e.g. pension funds, insurers)

- "Dash for Cash" in 2020
- Ukraine War-related commodity market turmoil in 2022
- UK "mini-budget" crisis in 2022

Liquidity needs came from instruments often used for hedging (e.g. variation margin on swaps)
(Czech et al. 2023, Avalos & Huang 2024, Pinter 2023)

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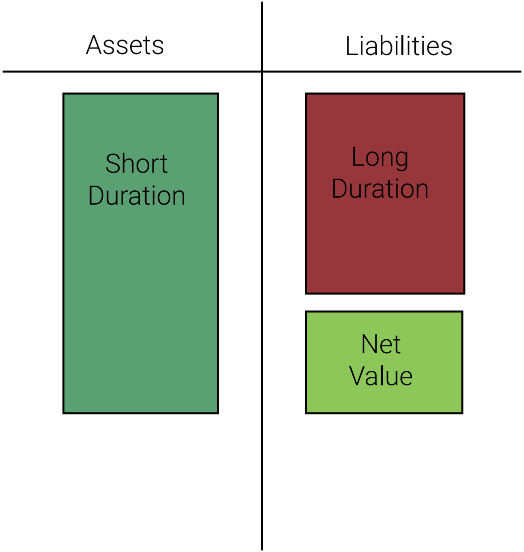
This paper: *Liquidity After Solvency Hedging risk* ("LASH risk")

Example: LASH Risk from Interest Rates



Fund with long-term liabilities vs assets:

- Rate rises improve solvency
- Rate falls worsen solvency

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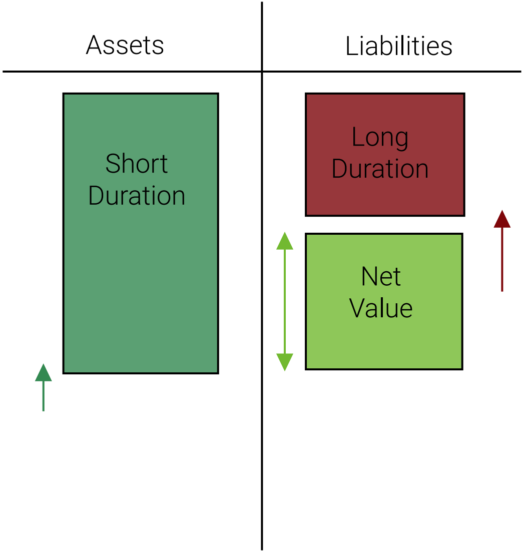

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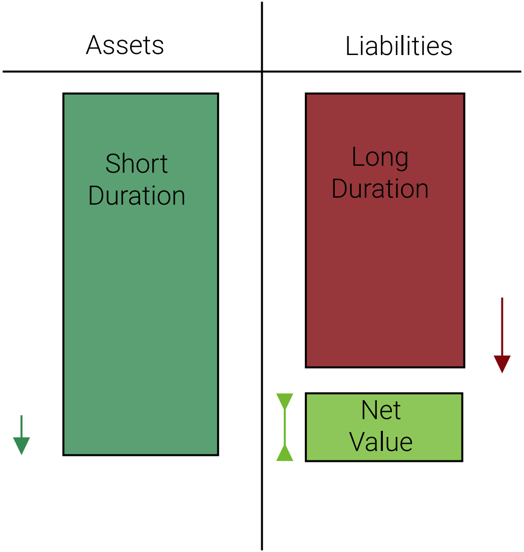

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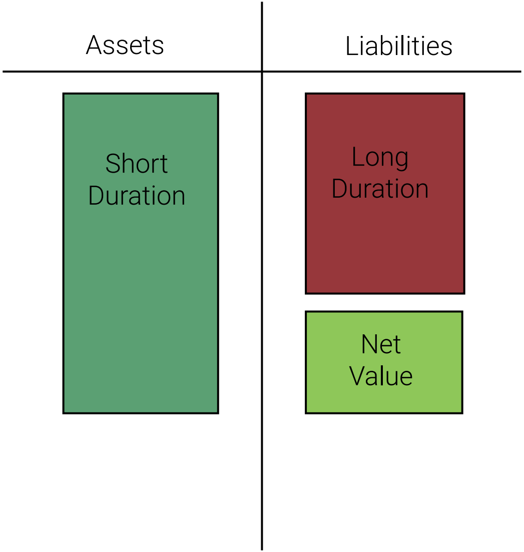

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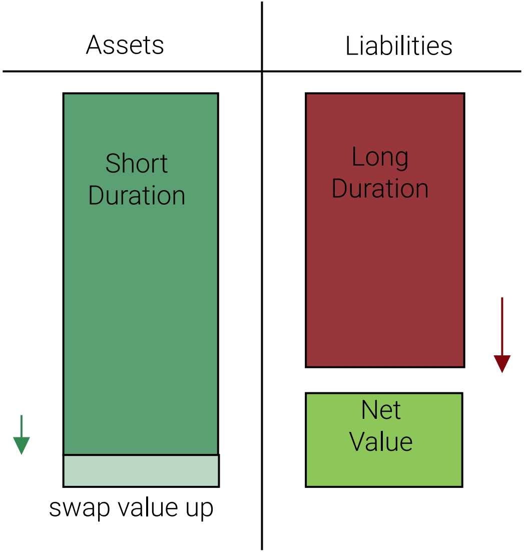

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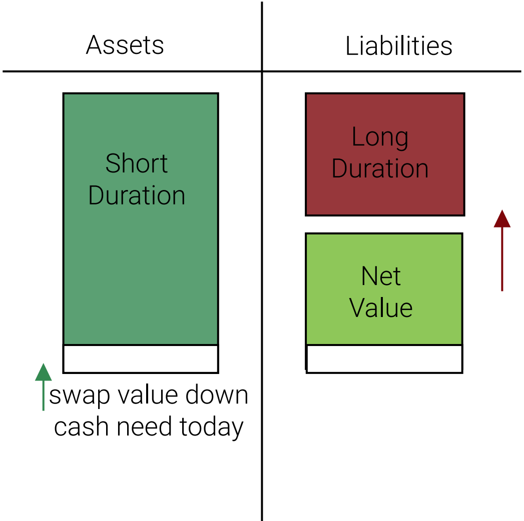

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  - Pays out when rates fall + eliminates solvency risk
  - But generates liquidity needs when rates rise (i.e. variation margin)

LASH risk: liquidity needs if solvency improves—value of hedge falls

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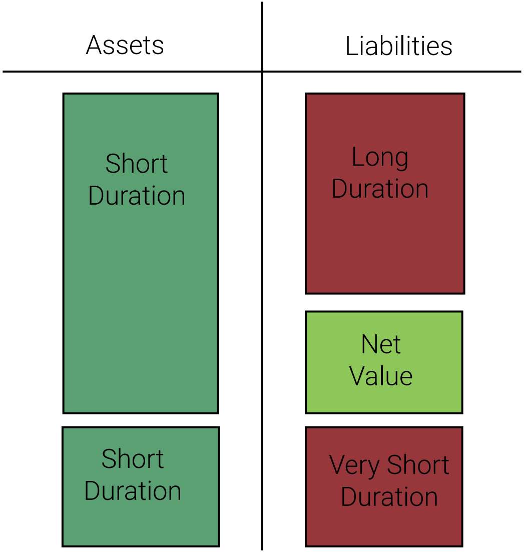

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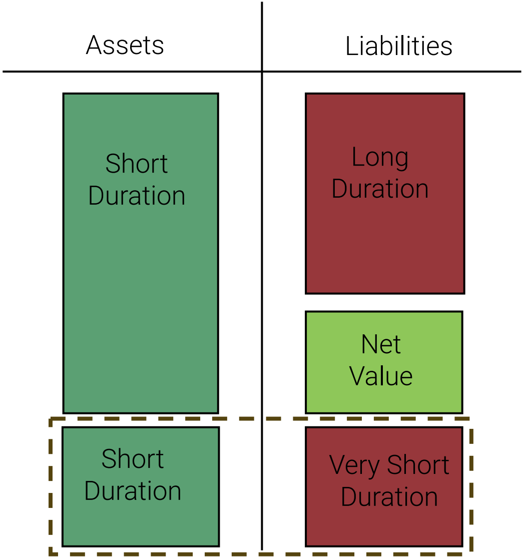

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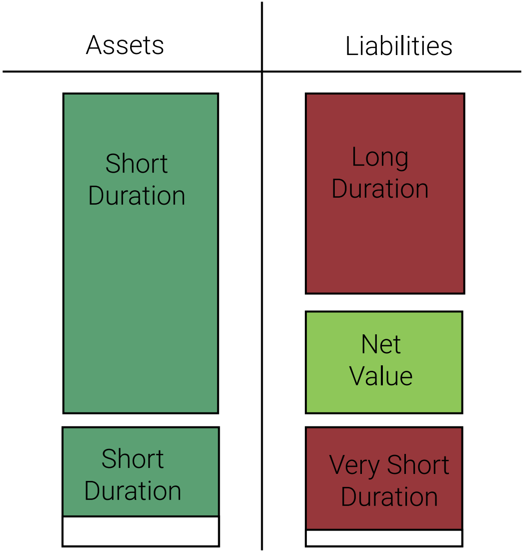

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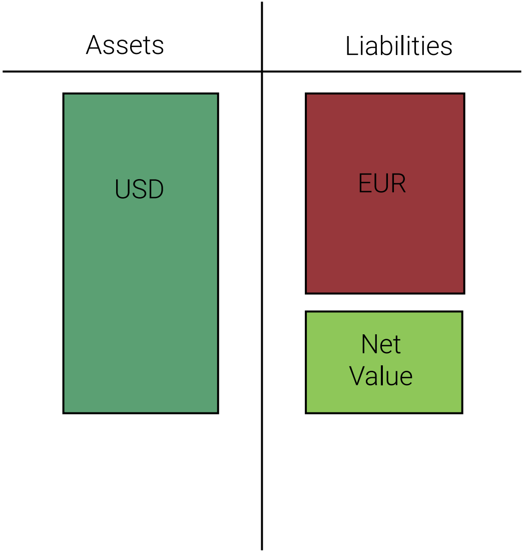
Again: LASH risk

- Reduces solvency risk if rates fall
- But increases liquidity needs if rates rise (i.e. variation margin)

Interest rates are just one case...



Other examples:

- Similar in FX, same liquidity risk from FX swaps, “Dash for Cash” (Czech et al., 2023)

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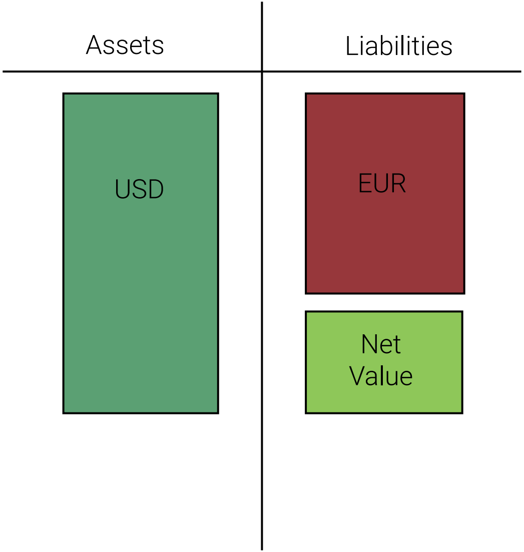

Other examples:

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- Or energy firms hedging commodity prices...
- Or infrastructure funds with real assets and nominal liabilities...

Broad concept

- Main idea: hedging can reduce solvency risk but then increases liquidity risk
- Interest risk as an application - but a sizeable one

What We Do

1. **Definition:** *Liquidity After Solvency Hedging risk* ("LASH risk")

2. **Measurement:** LASH risk for universe of non-banks and sterling interest rates (repos + swaps)

   - Amongst non-banks: LASH risk concentrated in pension fund and insurance sector
   - LASH risk is large: liquidity needs after 100 bps point rate increase ≈ cash of pension fund sector
   - Negatively correlated with interest rates

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3. **Causes:** Low interest rates and high LASH risk
   - Document causal link between LASH risk and low rates

Proposed mechanism: funds choose hedging to balance liquidity vs. solvency risk
- Rates $\downarrow \Rightarrow$ solvency $\downarrow \Rightarrow$ demand for hedging $\uparrow$

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4. **Consequences:** Backlash during crises
   - LASH predicts institution-level sales and yield spikes during mini-budget crisis

Measurement: LASH Risk from Interest Rates

- **liquidity needs** / **variation margin** from Δ in NPV of hedging contract (e.g. swap or repo)

For contract i at time t (from interest rates, R_t):

$$LASH_{i,t} \approx \Lambda_i \times \frac{\partial NPV_{i,t}}{\partial R_t}$$

- For simplicity: response of NPV to level shift of yield curve (cash duration, PV01)
- Λ_i captures liquidity needs per unit of NPV change
- For rates turns out $\Lambda_i \approx 1$ and we abstract from changes in Λ_i

▸ Measurement across different instruments

Main Data Sources

- Universe of gilt transactions (MiFID II Database)
- Universe of gilt repo transactions (Sterling Money Market Database)
- Universe of pound sterling interest rate swap positions (EMIR Trade Repositories)
- Hand collected data on UK pension funds

- Aggregation: merge repo and IRS LASH risk at individual (non-bank) institution level
- Sample period: Jan 2019 to April 2023

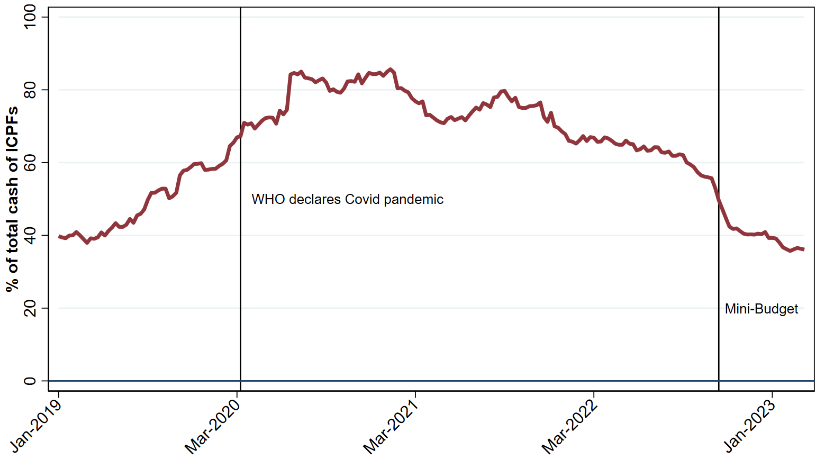
Pension Funds: Solvency Improves with High Rates

- Left Panel: Aggregate funding ratio (total assets/total liabilities) of UK pension funds
- Right Panel: Yields of UK government bonds (gilts) at different maturities

Pension Fund Balance Sheets

LASH Risk: Size and Interest Rates

Repo vs. Swaps | Sectoral



Units: liquidity need after 100bps rise in interest rates relative to cash of insurers + pension funds (%)

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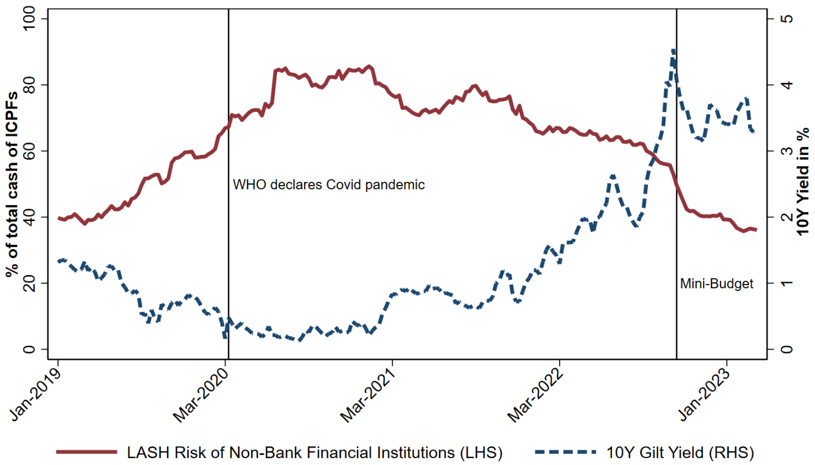

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Model Sketch: LASH Risk and Rates

Perpetual liability, portfolio of assets. Fixed horizon portfolio management problem. **4 ingredients:**

1. **Duration mismatch:** No perpetual bond. Derivatives can be used to hedge.
2. **Solvency deficits costly:** e.g. regulatory penalty, → kink in the objective, effective risk aversion
3. **Illiquidity of longer duration assets:** Selling (or repo'ing) the long duration asset has liquidation cost.
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Optimal hedging strategy reveals liquidity solvency trade-off:

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$$\kappa \times Pr\,(\text{Solv. Deficit}) \times \mathbb{E}\,(\Delta R|\text{Solv. Deficit}) = c \times Pr\,(\text{Liq. Deficit}) \times \mathbb{E}\,(\Delta R|\text{Liq. Deficit})$$

LHS: Benefit of hedging in insuring solvency; RHS: Cost in terms of liquidity risk.

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Key: $Pr\,(\text{Solv. Deficit})$ depends on the underlying level of solvency. The marginal benefit of hedging, is increasing as rates fall. The same does not apply to $Pr\,(\text{Liq. Deficit})$.

Do Low Interest Rates Cause High LASH Risk?

- Holding shorter duration assets implies higher capital losses, and hence greater solvency risk, when interest rates fall
- Low asset duration institutions should disproportionately increase LASH risk when R decreases
- **Identification** — cross-sectional variation:
  - Investor level *j*: quarterly portfolio rebalancing.
  - shift share design the initial duration *j*'s gilt repo portfolio at the start of sample ($\omega_{j,i,t=0} \times AD_{i,t}$)

$$\Delta LASH_{j,t}^{Discretionary} = \alpha + \alpha_j + \beta_1 \Delta Yield_t^{10Y} + \beta_2 (\Delta Yield_t^{10Y} (\sum_i^I \omega_{j,i,t=0} \times AD_{i,t})) + \epsilon_{j,t}$$

  - $LASH_{j,t}^{Discretionary}$ adjusts for mechanical movements due to convexity.

net duration versus asset duration

Causality: Interest Rates and LASH

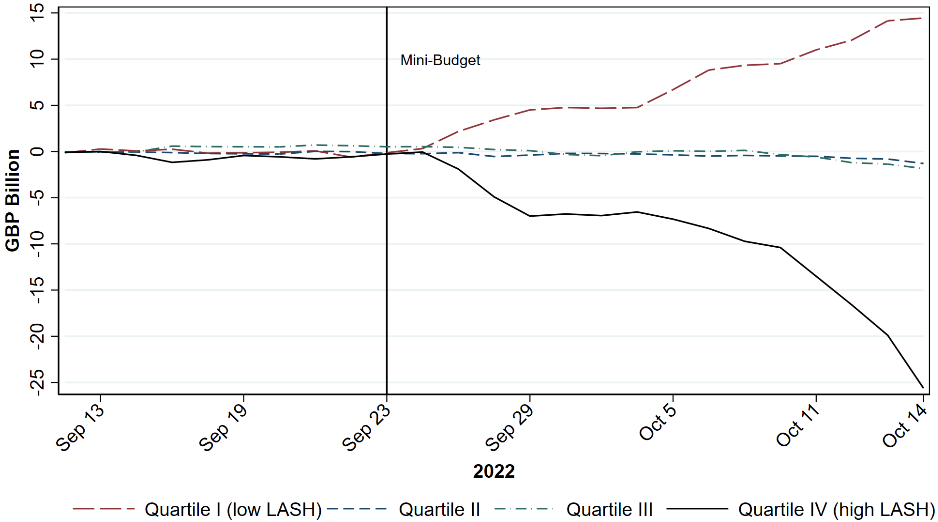
	(1)	(2)	(3)	(4)
		$\Delta LASH^{Discretionary}$		
$\Delta Yield^{10Y}$	-1.33***			
	(0.37)			
$\Delta Yield^{10Y}$ × Duration	0.89**	0.95**	1.08***	0.87**
	(0.37)	(0.35)	(0.35)	(0.37)
Observations	4657	4657	4657	4657
R squared	0.016	0.024	0.040	0.063
Time FE	no	yes	yes	yes
Institution FE	yes	yes	yes	yes
Institution-Yield Level FE	no	no	yes	no
Institution-Yield Slope FE	no	no	no	yes

- 100bps quarterly decrease in the gilt yield index: 133% increase in discretionary LASH Risk
- Interaction: Effect reduced to a 44% increase if initial asset duration increases by one SD

Did LASH Risk Contribute to the 2022 Gilt Market Crisis?

- Mini budget announcement: 23 September 2022
- Period of market turbulence: 16 trading days (September 23 - October 14)
  - 30-year gilt yield jumped by 140bps in the first three days
- Hypothesis: LASH risk materialized when yields jumped
- *Can pre-crisis LASH exposures predict gilt selling?*

Pre-crisis LASH Exposure Predicts Gilt Sales



▸ Regression

Sources of Illiquidity

1. Capacity constraints on dealers. ▸ Repo Spreads
2. Lack of cash management practice on the part of funds (50% don't use repo). ▸ Repo Use
3. LASH more problematic for assets that were falling in value. ▸ Bond Liqudation Choices
4. Coordination issues with pooled LDI funds. ▸ Excess sensitivity of pooled funds

Discussion: Implications of LASH Risk

Periods of low rates followed by a sharp increase can lead to liquidity crises...

- ... more broadly, so to can swings in exchange rates or commodity prices...

Is this a problem?

- LASH risk materializes precisely when solvency improves
- "Responsible" institutions exposed to LASH risk due to hedging solvency risk

→ LASH risk not associated with moral hazard from risky investments

Policy: implications for liquidity support after crises ("Bagehot's Dictum")

- Different from standard liquidity crises with deteriorating solvency (e.g. Farhi & Tirole 2012)
- Alternative is to loosen margin rules but these are the solution to a contracting problem.

Appendix

More Literature

1. Non-bank intermediaries (Campbell & Sigalov 2022, Khetan et al. 2023, Becker & Ivashina 2015, Aramonte et al. 2022, Pinter & Walker 2023, Jansen et al. 2022)
2. Monetary policy, interest rates & financial stability (Stein 2012, Adrian & Shin 2020, Jiménez et al. 2014, Ioannidouet al. 2015, Adrian et al. 2019, Greenwood et al. 2022, Acharya et al. 2023, Grimm et al. 2023, Farhi & Tirole 2012)
3. Financial stability & pension funds (Lucas & Zeldes 2009, Jansen et al. 2023, Koijen & Yogo 2022, Czech et al. 2023)
4. Crises (Kindleberger 1978, Froot et al. 1993, Brimm et al. 2023, Ma et al. 2022, Pinter 2023, Cesa-Bianchi et al. 2023)

back

Measurement Across Markets

- **Repo**
  - LASH risk: via change in bond prices and hence need to provide additional collateral

$$LASH_{i,t}^{Repo} = \frac{Q_{i,t}}{100} \times \underbrace{\frac{\sum_{k=1}^{K}(1+r_t)^{-k_b} \cdot CF_{b,k} \cdot k_b}{P_{b,t}} \times \left(1 + \frac{YTM_{b,t}}{c_b}\right)^{-1}}_{\text{Modified duration of bond } b}$$

  - Contract i, $Q_{i,t}$ borrowing amount, $P_{b,t}$ market price of bond b, k_b time to each cash flow $CF_{b,k}$' from time t (in years), $YTM_{b,t}$ bond's yield to maturity
- **Interest rate swaps**
  - LASH risk: via cash flow sensitivity to changes in interest rates

$$LASH_{i,t}^{IRS} = \frac{Q_i}{100c} \sum_{k=1}^{cT} \left[d_k + \frac{k}{c} d_k (\bar{r}_i - r_{k,k-1}) \right]$$

  - Contract i, net notional Q (receiving fixed rate), with maturity T, coupon frequency c, discount rate for cash flow k is $d_k = e^{-R_{k,t} \cdot (T_k - t)}$, fixed rate $\bar{r}$, forward rates $r_{k,k-1}$

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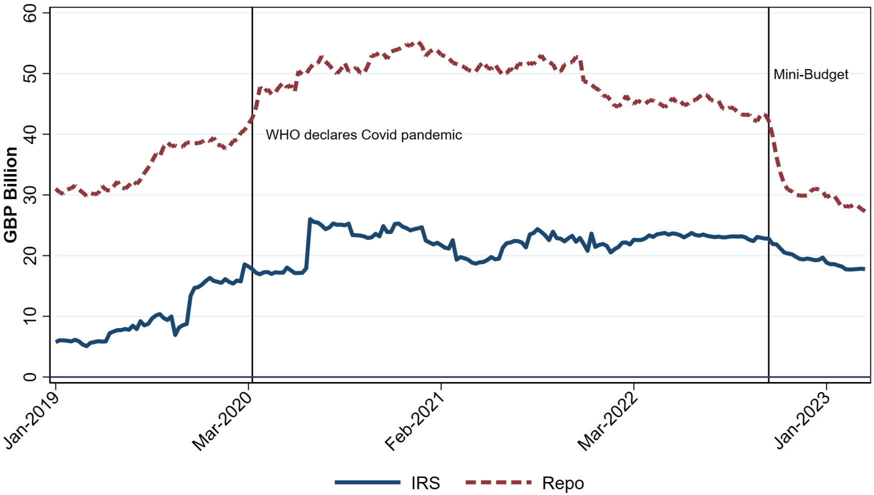
LASH Risk: Concentrated in Repo back



LASH Risk: Concentrated in Wider Pension Fund Sector

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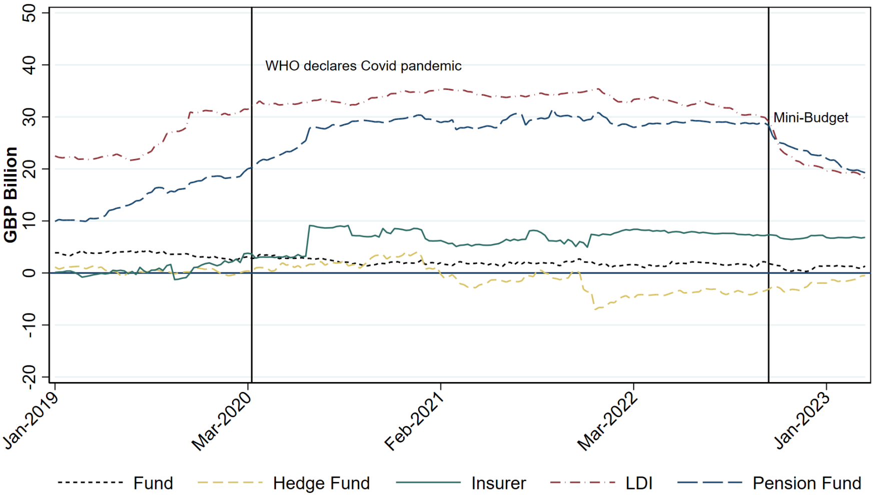
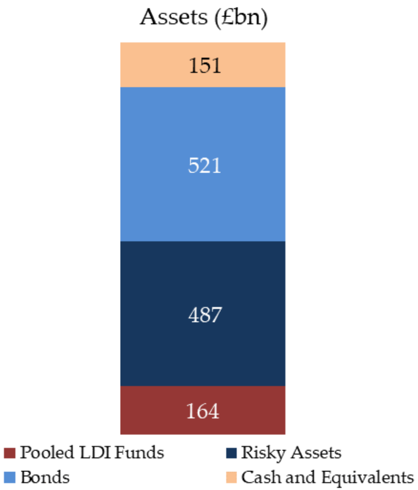
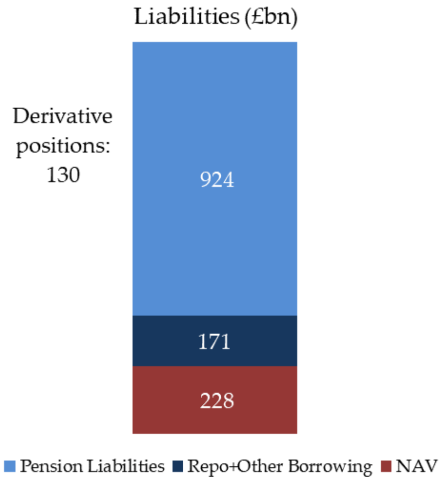


Aggregate Balance Sheet of Private UK Defined Benefit Funds





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- Liquidity-solvency trade-off: fund is imperfectly hedged + lower rates worsen the funds financial position
- Lower rates worsen solvency, tilt balance towards more hedging.

Environment

- Investment problem of a non-bank financial institution (“the fund”); $t = 0, 1, \dots, T, \dots \infty$.
- Fund’s liabilities: perpetuity that require paying a fixed l in every period. Invest in:
  1. one period bond, a_t
  2. a geometrically decaying bond, b_t, with decay rate δ
  3. interest rate swap s_t
- Can’t short bonds: $a_t \geq 0$ and $b_t \geq 0$, but the swap position, s_t, can be positive or negative
- All assets are priced by a deep pocketed, competitive, risk-neutral marginal investor active in the bond and swap markets that discounts the future at rate R_t^{-1}.
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  * $q_t^b = \mathbb{E}_t\left[\sum_{j=0} \delta^j \prod_{s=0}^j R_{t+s}^{-1}\right]$: price of the geometric bond.
  * $q_t^l = \sum_{j=0}^{\infty} \prod_{s=0}^j \mathbb{E}_t\left[R_{t+s}^{-1}\right]$: price of a perpetuity paying one every period:
  * $q_t^a = R_t^{-1}(1+\eta)$, price of the short term bond

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- Interest rate swaps are priced fairly and have a fixed leg $\mathbb{E}_t\left[R_{t+1}^{-1}\right]$ and floating leg R_{t+1}^{-1}: buying the swap means paying fixed and receiving floating
- Cashflows from the realised swap position are given by $s_t\left(R_{t+1}^{-1} - \mathbb{E}_t\left[R_{t+1}^{-1}\right]\right)$

Fund Value

- Net asset value of the fund: $w_t = q_t^a a_t + q_t^b b_t - q_t^l l$
- Accounting for liquidity costs, w_t:

$$w_t = a_{t-1} + b_{t-1} - l + q_t^b \delta b_{t-1} + s_{t-1}\left(R_t^{-1} - \mathbb{E}_{t-1}\left[R_t^{-1}\right]\right) - c q_t^b \underbrace{\max\left\{0, \delta b_{t-1} - b_t\right\}}_{\text{sales of geometric bond}} - q_t^l l$$

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- RHS: loss on the swap contract net of the liquidity available to the fund → when positive: the fund needs to liquidate long term assets
- LHS: proceeds from liquidations → when positive (LASH risk materialises) the fund is forced to sell assets at a cost to cover losses on its hedges

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- Net asset value of the fund: $w_t = q_t^a a_t + q_t^b b_t - q_t^l l$
- Accounting for liquidity costs, w_t:

$$w_t = a_{t-1} + b_{t-1} - l + q_t^b \delta b_{t-1} + s_{t-1}\left(R_t^{-1} - \mathbb{E}_{t-1}\left[R_t^{-1}\right]\right) - c q_t^b \underbrace{\max\left\{0, \delta b_{t-1} - b_t\right\}}_{\text{sales of geometric bond}} - q_t^l l$$

- No shorting condition on a_t implies cash flow constraint:

$$(1-c) q_t^b \max\left\{0, \delta b_{t-1} - b_t\right\} \geq \max\left\{s_{t-1}\left(\mathbb{E}_{t-1}\left[R_t^{-1}\right] - R_t^{-1}\right) - a_{t-1} - b_{t-1} + l, 0\right\} \quad (1)$$

- Liquid resources: $m_t = a_{t-1} + b_{t-1} + s_{t-1}\left(R_t^{-1} - \mathbb{E}_{t-1}\left[R_t^{-1}\right]\right) - l$
- If $w_t < 0$ solvency deficit, if $m_t < 0$ liquidity deficit.

Fund Manager's Problem

Fund manager is risk neutral, does not enjoy limited liability and receives compensation (that is negligible compared to the value of the fund) proportional to:

$$\pi_T = w_T + \kappa \mathbf{1}\left(w_T < 0\right) w_T$$

$\kappa > 0$ is a penalty term that incentivizes the manager to avoid deficits. Problem can be written as

$$\max_{\{a_t\}\geq 0, \{b_t\}\geq 0, \{s_t\}} \mathbb{E}_0\left[\left(1+\kappa \mathbf{1}\left[q_T^a a_T + q_T^b b_T - q_t^l l < 0\right]\right)\left(q_T^a a_T + q_T^b b_T - q_t^l l\right)\right]$$

subject to

$$q_t^a a_t + q_t^b b_t = a_{t-1} + b_{t-1} - l + q_t^b \delta b_{t-1} + s_{t-1}\left(R_t^{-1} - \mathbb{E}_{t-1}\left[R_t^{-1}\right]\right) + \frac{c}{1-c} q_t^b \min\left\{m_t, 0\right\}.$$

Importantly, m_t and w_t are exogenous from the perspective of period t: they depends on predetermined choices and the exogenous state (R_t).

Funds' Exposure to Interest Rate Risk (Excluding Hedging)

- Fund never hedges ($s_t = 0$):

$$\frac{dw_t}{dR_t^{-1}} = b_{t-1}\frac{dq_t^b}{dR_t^{-1}} - l\frac{dq_t^l}{dR_t^{-1}}$$

- i.i.d. discount factor with unconditional mean $\bar{R}^{-1}$:

$$\frac{dq_t^b}{dR_t^{-1}} = \frac{1}{1-\delta\bar{R}^{-1}}$$

$$\frac{dq_t^l}{dR_t^{-1}} = \frac{1}{1-\bar{R}^{-1}} > \frac{dq_t^b}{dR_t^{-1}}$$

- Unless $w_t \gg 0$, $\frac{dw_t}{dR_t^{-1}} < 0$ (i.e. a fall in interest rates hurts the fund): fund tries to set $s_t > 0$

Optimal Hedging Strategy with $T = t + 1$

From the fund' first order condition with respect to s_t we obtain the following condition:

$$\kappa Pr\left\{w_{t+1} < 0\right\}\left(\mathbb{E}_t\left[R_{t+1}^{-1}|w_{t+1} < 0\right] - \mathbb{E}_t\left[R_{t+1}^{-1}\right]\right) =$$
$$\frac{c}{1-c}\mathbb{E}_t\left[q_t^b|m_{t+1} < 0\right]Pr\left\{m_{t+1} < 0\right\}\left(\mathbb{E}_t\left[R_{t+1}^{-1}\right] - \mathbb{E}_t\left[R_{t+1}^{-1}|m_{t+1} < 0\right]\right). \quad (2)$$

- LHS term is the marginal benefit of hedging: the probability of a solvency deficit times the extent that rates undershoot expectations in solvency deficit states multiplied by the cost of deficits.
- RHS is the marginal cost of hedging: the probability of a liquidity deficit times the extent that rates overshoot expectations in liquidity deficit states multiplied by the cost of liquidity.

Optimal Hedging Strategy with $T = t + 1$

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- RHS is the marginal cost of hedging: the probability of a liquidity deficit times the extent that rates overshoot expectations in liquidity deficit states multiplied by the cost of liquidity.

Liquidity-solvency trade-off. Interior hedging solution.

Key: $Pr\left\{w_{t+1} < 0\right\}$ depends on the underlying level of solvency. The LHS, the marginal benefit of hedging, is increasing as rates fall. The same does not apply to $Pr\left\{m_{t+1} < 0\right\}$.

Parameterization

Parameter	Description	Value
c	Cost of liquidation	0.015
δ	Decay rate of long term bond	0.91
l	Fund payment to its members at each period	0.04
η	Short term bond premium	0.014
κ	Penalty for fund's deficit	0.3

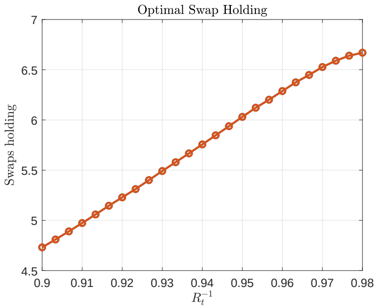
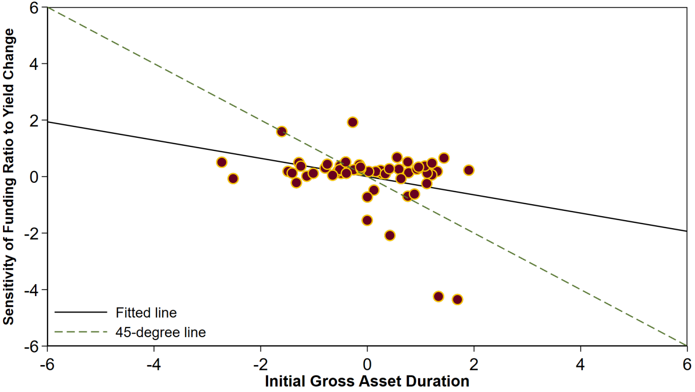


Figure Swap holdings response to a fall in interest rate across different average values for r

Pension Funds' Funding Ratios and Gross Asset Duration

- Is gross asset duration a valid proxy for net duration, i.e. the duration gap?
- We regress pension funds' funding ratios on changes in the 10Y gilt yield, and plot the fund-specific coefficients against their gross asset duration (both standardized)



▸ back

Price Impact of LASH Selling Pressure

- Endogeneity problem: price impact $\longleftrightarrow$ asset sales?
- We follow Czech et al. (2023) and construct LASH-Induced-Trading (LASH-IT) variable to mitigate these concerns:
  - Bond-level exposure to LASH risk
  - Definition: $LASH\text{-}IT_b = \frac{\Sigma_j LASH_{j,t=0} \times w_{j,b,t=0}}{Amount\ Outstanding_{b,t=0}}$
  - where $LASH_{j,t=0}$ is the estimated pre-crisis LASH exposure of investor j, and $w_{j,b}$ is the weight of bond b in investor's j pre-crisis repo collateral portfolio
  - $\Rightarrow$ Exogenous variation in LASH-induced selling pressure
- We then examine extent to which LASH-IT affects gilt yields:
  - Specification: $\Delta Yield_{b,t} = \alpha + \alpha_{m,t} + \alpha_{g,t} + \beta_1 \times LASH\text{-}IT_b + \varepsilon_{b,t}$
  - where $\alpha_{g,t}$ denotes day-bond type FE (nominal or index-linked gilt) and $\alpha_{m,t}$ denotes day-maturity bucket FE

Pre-crisis LASH Exposure Predicts Gilt Sales

- Specification at time t for institution j in sector s: $Vol_{j,t} = \alpha + \alpha_{s,t} + \beta_1 LASH_{j,t=0} + \varepsilon_{j,t}$

	(1)	(2)	(3)	(4)
	Net Volume		Sell Volume	
LASH combined	-0.21***		0.15***	
	(0.04)		(0.02)	
LASH Repo		-0.16***		0.12***
		(0.04)		(0.02)
LASH IRS		-0.13*		0.08***
		(0.05)		(0.02)
Observations	8875	8875	8875	8875
R squared	0.035	0.035	0.045	0.046
Sector-Day FE	yes	yes	yes	yes

- 1 SD increase in pre-crisis LASH risk associated with 15% higher daily sell volumes during crisis

Back Price Impact

Price Impact of LASH Selling Pressure

- Specification: $\Delta Yield_{b,t} = \alpha + \alpha_{m,t} + \alpha_{g,t} + \beta_1 \times LASH\text{-}IT_b + \varepsilon_{b,t}$

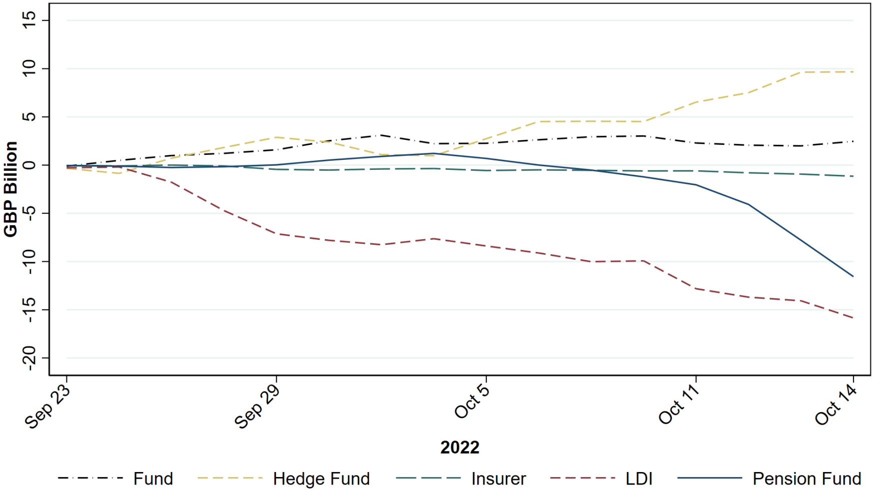
	(1)	(2)	(3)	(4)
	$\Delta Yield_{b,t}$			
LASH-IT	9.29***	9.72***	3.21**	4.13**
	(0.91)	(1.06)	(1.49)	(1.60)
Observations	1253	1253	1253	1253
R squared	0.261	0.321	0.616	0.649
Day FE	yes	-	-	-
Day × Type Gilt FE	no	no	yes	yes
Day × Maturity Bucket FE	no	yes	no	yes

- 1 SD increase in LASH-IT associated with 4.1bps daily increase in gilt yields
- Roughly 66bps over entire 16-day crisis period

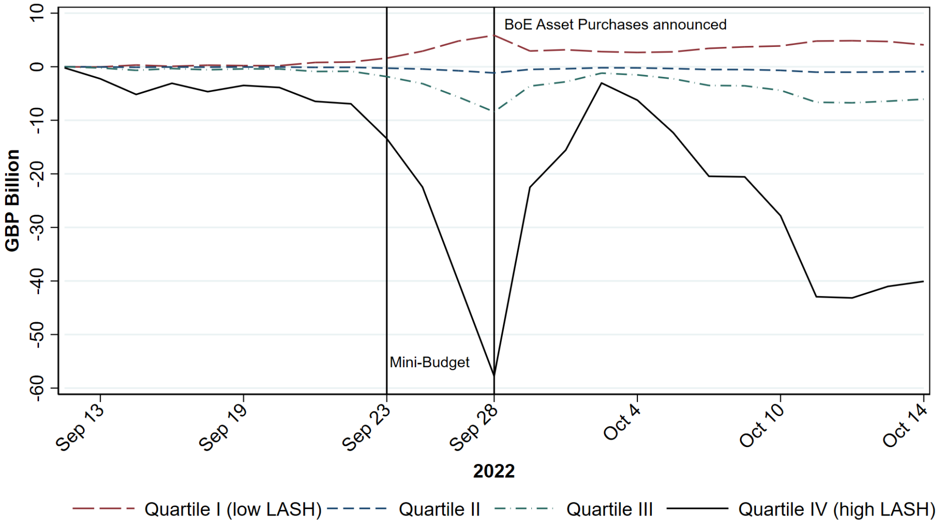
back

Cumulative Gilt Trading Volumes by Investor Type

Return



Change in the Value of Repo Collateral by Pre-crisis LASH Exposure



Sectoral

Price Impact of LASH Selling Pressure

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Price Impact of LASH Selling Pressure

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	(1)	(2)	(3)	(4)
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- Roughly 66bps over entire 16-day crisis period

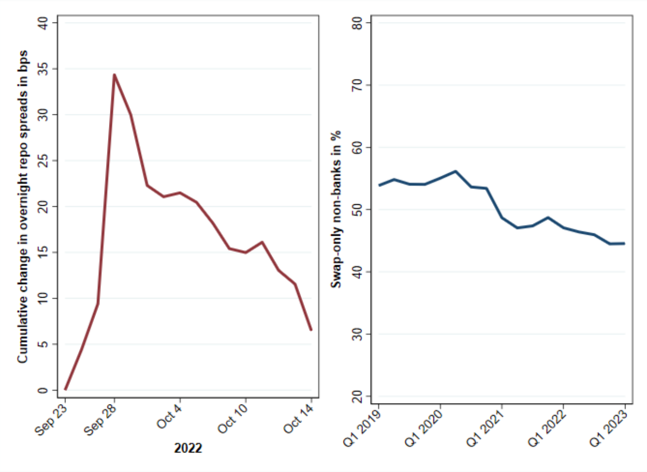
Effects Concentrate in Pooled Funds

- Specification: $Sell\ Vol_{j,t} = \alpha + \alpha_{s,t} + \beta_1 \left(LASH_{j,0} \times LDI_j \right) + \beta_2 \left(LASH_{j,0} \times Pooled\ Fund_j \right) + \varepsilon_{j,t}$

	(1)	(2)	(3)
		Sell Volume	
LASH	0.13***	0.14***	0.11***
	(0.03)	(0.02)	(0.02)
LASH × Segregated Fund	0.04		0.06*
	(0.05)		(0.03)
LASH × Pooled Fund		0.87***	0.90***
		(0.04)	(0.05)
Observations	8875	8875	8875
R squared	0.046	0.049	0.049
Sector-Day FE	yes	yes	yes

- Effect pronounced for pooled LDI funds ⇒ coordination frictions. back

Discussion: Why Not Borrow in the Repo Market?



- Left Panel: Overnight repo rates spiked by more than 30bps during the crisis
- Right Panel: Only around 50% of non-banks routinely access repo market back

LASH and Bond-level Liquidation Choices

- Specification at bond level b : $Sell\ Vol_{j,b,t} = \alpha + \alpha_{s,t} + \alpha_{b,t} + \beta_1 \left(LASH_{j,0} \times Bond\ Char_b\right) + \varepsilon_{j,b,t}$

	(1)	(2)	(3)	(4)
	Sell Volume			
LASH	0.06***	0.05***	0.05***	0.05***
	(0.01)	(0.01)	(0.00)	(0.01)
LASH × Frequent Collateral Use		0.02*		
		(0.01)		
LASH × Low Duration			0.01	
			(0.01)	
LASH × High Duration			0.01***	
			(0.00)	
LASH × Inflation-linked				0.03**
				(0.01)
Observations	42481	42382	41667	42481
R squared	0.115	0.115	0.114	0.115
Bond-Day FE	yes	yes	yes	yes
Sector-Day FE	yes	yes	yes	yes

- Selling pressure concentrated in high-duration + index-linked gilts back

Appendix – unlinked slides

Different Liquidity Risks: Comparisons and Distinctions

"A liquid asset's salient property is that it is widely accepted as a means of payment without major capital loss, a property that Menger (1892) labeled salability" (Calvo, 2012)

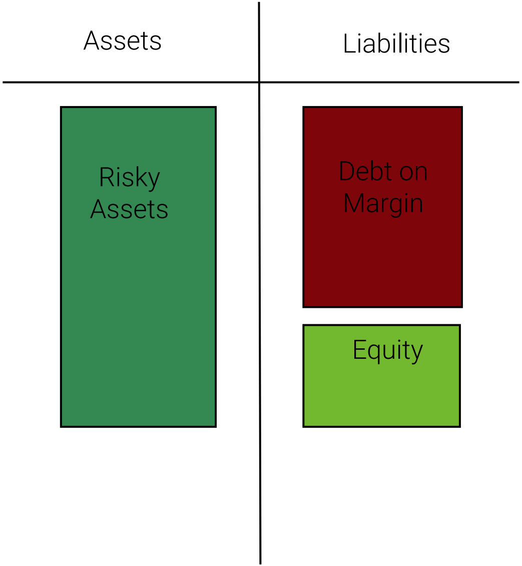
- Holmstrom and Tirole (1998): liquidity risk broadly defined shocks to cash need imperfectly correlated with solvency

Typical sources (and why LASH is different):

1. Demandability/Maturity Transformation (Poole, 1968; Kashyap et al., 2002): customer withdrawal needs generate immediate need for cash independent of asset returns
   - BUT: most NBFIs don't issue demandable claims. Open ended funds an exception
2. Run risk (Diamond and Dybvig, 1983; Rochet and Vives, 2004): creditors face coordination issues and can attempt to recall funding
   - BUT: most NBFI trading is with a small number of counterparties
3. Rollover risk (Calvo 1988, AER): short term debt can generate belief driven crises
   - BUT: liquidity risk arises from contracts at term

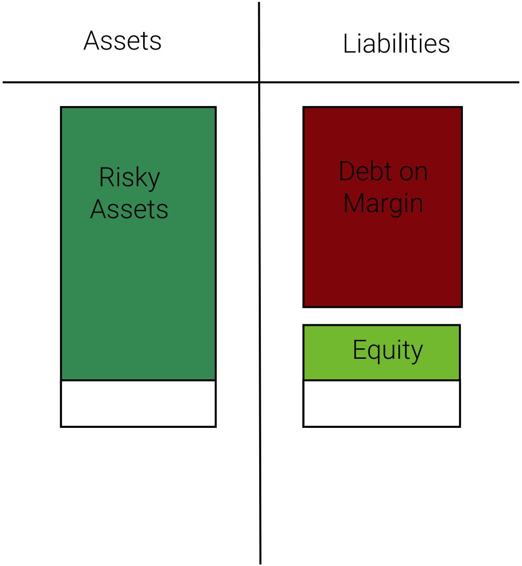
Back

Comparison with Liquidity Spiral (Brunnermeier-Pedersen, 2009)



Fund has leveraged bet on a risky asset with margin requirement

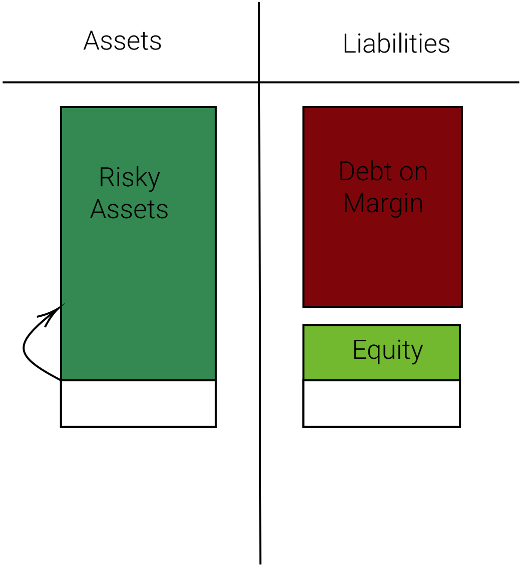
Comparison with Liquidity Spiral (Brunnermeier-Pedersen, 2009)



Fund has leveraged bet on a risky asset with margin requirement

- Initial loss wipes out some of bank assets/net worth
- Leads to margin calls...

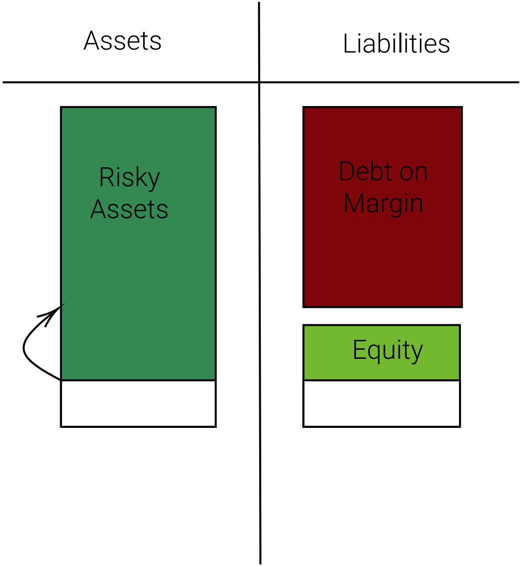
Comparison with Liquidity Spiral (Brunnermeier-Pedersen, 2009)



Fund has leveraged bet on a risky asset with margin requirement

- Initial loss wipes out some of bank assets/net worth
- Leads to margin calls...
- ...leading to asset sales...
- ...pushing down asset prices...
- ...raising margin requirements...
- ...add causing further asset sales

Comparison with Liquidity Spiral (Brunnermeier-Pedersen, 2009)



Fund has leveraged bet on a risky asset with margin requirement

- Initial loss wipes out some of bank assets/net worth
- Leads to margin calls...
- ...leading to asset sales...
- ...pushing down asset prices...
- ...raising margin requirements...
- ...add causing further asset sales

⇒ A "liquidity spiral". Fundamental difference:

- In our case, there are no losses, solvency improves

Back

Summary Statistics: Average Net Positions and LASH Risk

	Repo net borrowing (£bn)					IRS net receive fixed (£bn)				
Sector	2019	’20	’21	’22	’23	2019	’20	’21	’22	’23
Pension fund	38	64	74	69	48	65	96	101	132	112
LDI	99	121	130	113	73	17	37	40	38	23
Insurer	0	0	0	0	0	10	23	27	72	60
Hedge Fund	-7	11	-3	-34	-15	59	82	-14	-108	-81
Fund	9	7	7	4	4	23	21	11	18	15
Other financial	7	20	18	10	5	-8	-11	-3	-9	-14

	Repo behavioral LASH (£bn)					IRS behavioral LASH (£bn)				
Sector	2019	’20	’21	’22	’23	2019	’20	’21	’22	’23
Pension fund	8	15	18	16	11	5	11	12	12	10
LDI	22	28	30	26	17	2	5	5	5	3
Insurer	0	0	0	0	0	0	6	6	8	7
Hedge Fund	0	1	-1	-3	-1	1	0	-1	-1	-1
Fund	2	1	1	1	1	2	1	1	0	0
Other financial	2	4	3	2	1	-2	-2	-1	-1	-1

Summary Statistics: Cross-sectional Variation

	Repo net borrowing (£m)				Repo behavioral LASH (£m)		
Sector	N	Mean	Median	Std dev	Mean	Median	Std dev
Pension fund	273	259.3	144.3	388.3	59.4	31.5	89.3
LDI	337	360.6	113.6	1275.5	82.6	25.5	300.6
Insurer	16	45.2	36.7	205.3	6.3	3.6	43.4
Hedge Fund	284	-59.7	-0.6	561.4	-4.0	0.0	65.6
Fund	203	117.6	3.7	626.6	22.9	0.6	143.7
Other financial	13	-10.5	0.0	116.7	-1.1	0.0	21.1
	IRS net receive positions (£m)				**IRS behavioral LASH (£m)**		
Sector	N	Mean	Median	Std dev	Mean	Median	Std dev
Pension fund	450	297.9	32.0	1372.2	29.9	2.6	183.9
LDI	231	199.3	48.2	477.1	24.9	3.0	72.6
Insurer	76	971.4	17.0	4034.6	139.2	0.2	691.3
Hedge Fund	149	-231.0	10.0	19493.3	-7.4	0.0	186.4
Fund	869	54.2	0.8	565.0	2.6	0.0	29.4
Other financial	217	-148.8	-6.5	1266.4	-14.1	-0.2	107.3

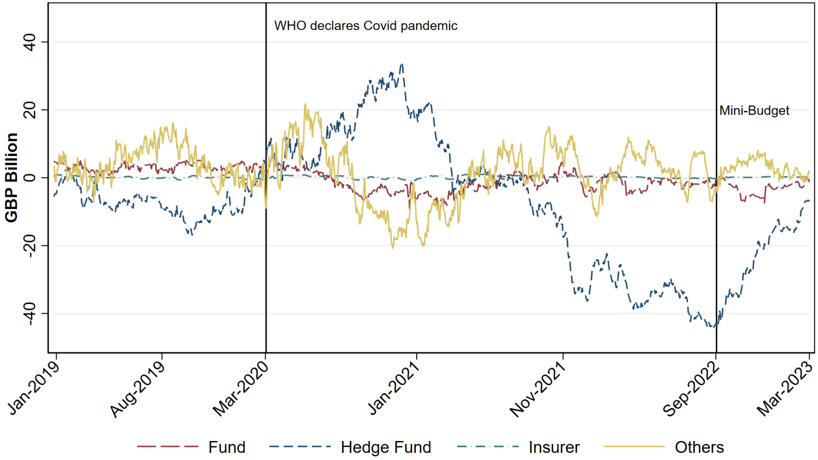
Summary Statistics: Pension Fund Balance Sheets

	2017	2018	2019	2020	2021	2022	2023
N	10	22	50	65	68	69	10
Total assets (£bn)	115.0	553.7	801.3	1046.9	956.5	876.9	55.1
Total liabilities (£bn)	117.2	560.7	815.2	1099.9	900.0	807.9	50.8
Actuarial assets (£m)							
Min	907	933	179	62	145	177	916
Mean	11501	25170	15711	15863	14066	12709	5513
Median	3600	4360	3767	3676	3611	3029	2364
Max	60000	358175	395867	444167	463022	406597	23500
Std deviation	18973	75692	55560	55490	56579	49732	7605
Actuarial liabilities (£m)							
Min	1074	1044	193	95	125	162	835
Mean	11724	25485	15985	16665	13235	11709	5078
Median	3673	4501	3499	3642	3511	2960	2195
Max	67500	368981	404974	475130	418665	366574	20300
Std deviation	20615	78046	56894	59416	51396	45031	6659

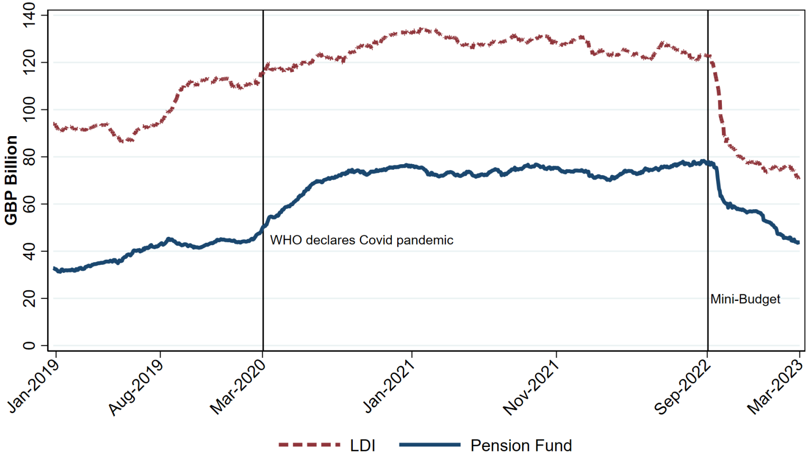
Summary Statistics: Pension Fund Funding Ratios

	2017	2018	2019	2020	2021	2022	2023
N	13	23	52	70	76	74	11
Underfunded PFs	0.62	0.52	0.56	0.60	0.33	0.27	0.27
Pension fund funding ratios							
Min	0.81	0.78	0.81	0.65	0.80	0.91	0.91
Mean	0.98	1.02	1.00	0.98	1.04	1.06	1.07
Median	0.94	1.00	0.99	0.98	1.04	1.05	1.07
Max	1.31	1.39	1.40	1.49	1.54	1.42	1.23
Std deviation	0.13	0.12	0.11	0.12	0.10	0.10	0.09

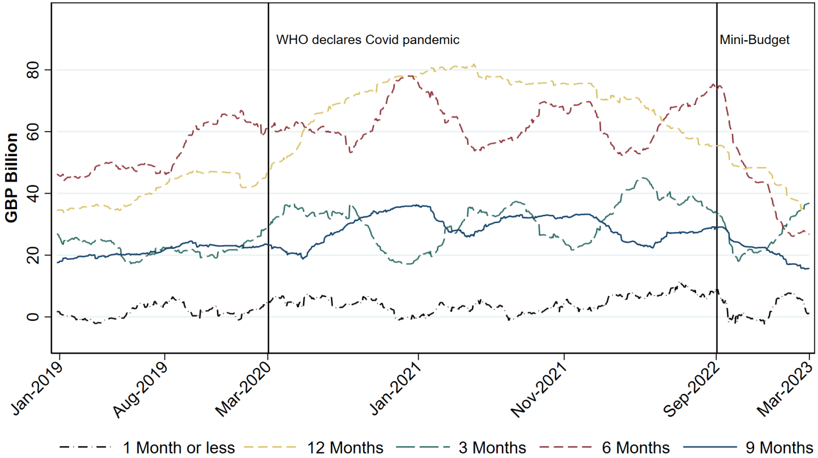
NBFI Repo Borrowing



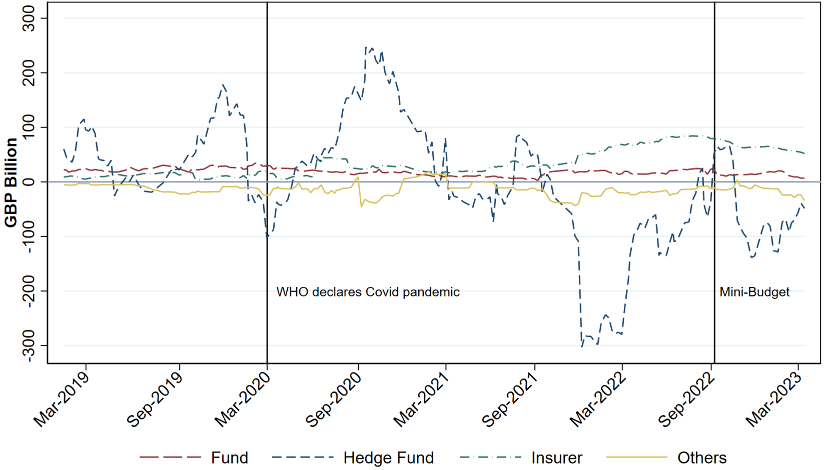
PFLDI Repo Borrowing



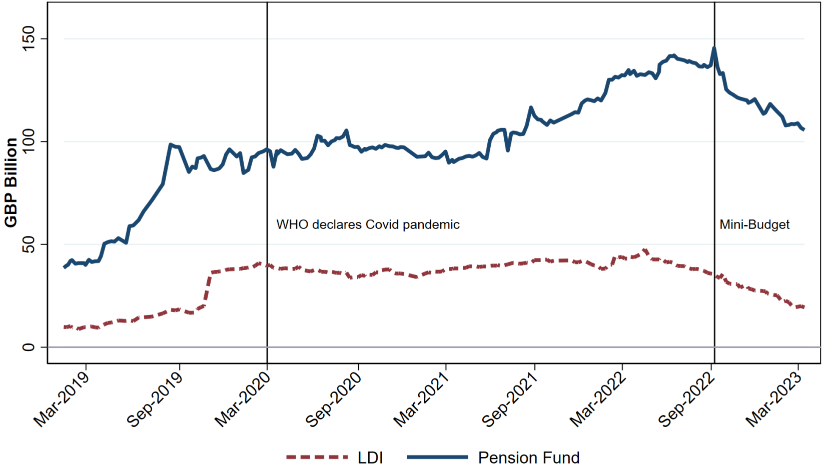
PFLDI Repo Borrowing by Maturity



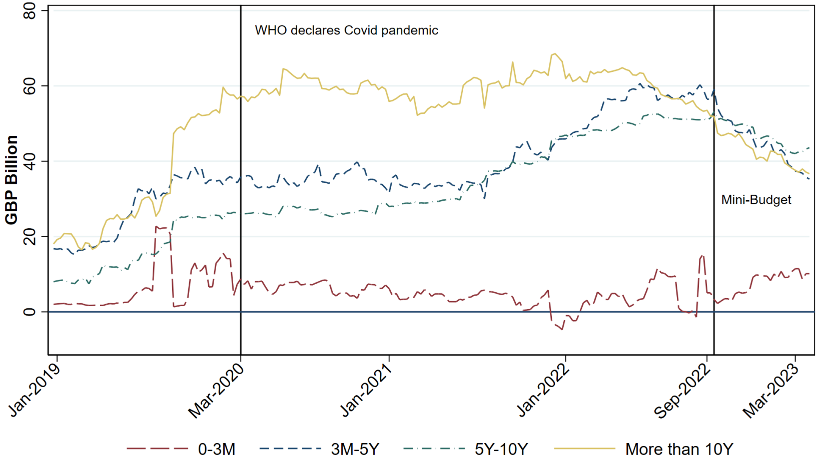
NBFI IRS Positions



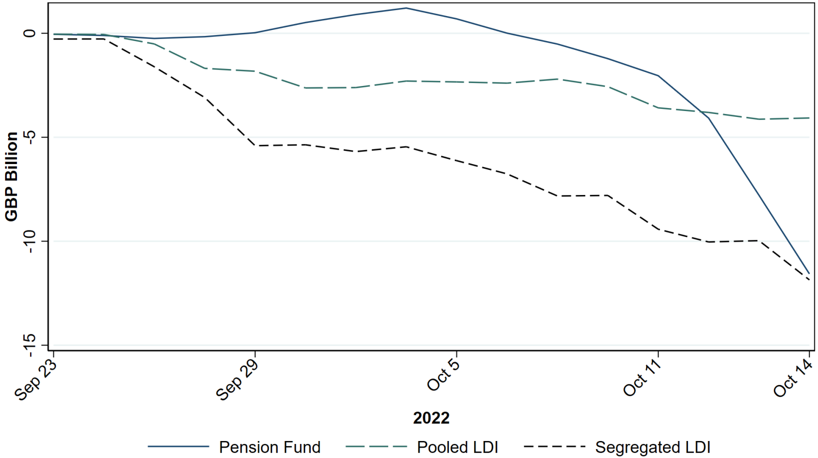
PFLDI IRS Positions



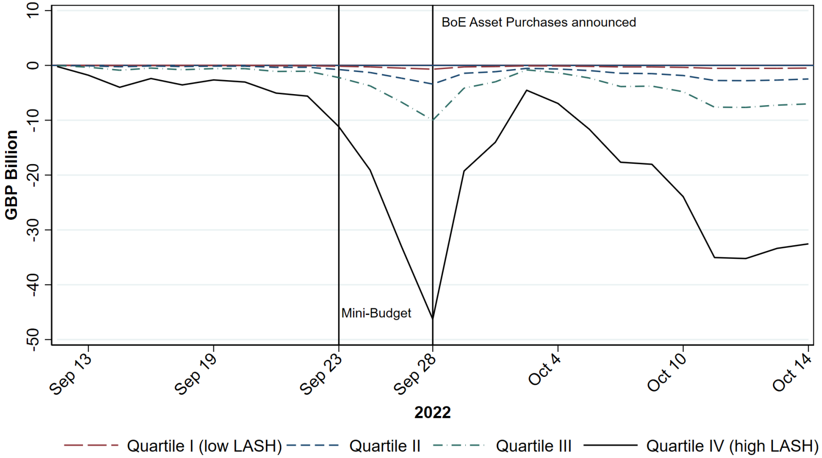
PFLDI IRS Positions by Maturity



PFLDI Cumulative Gilt Trading Volumes



PFLDI Change in Repo Collateral Value by Pre-crisis LASH Exposure



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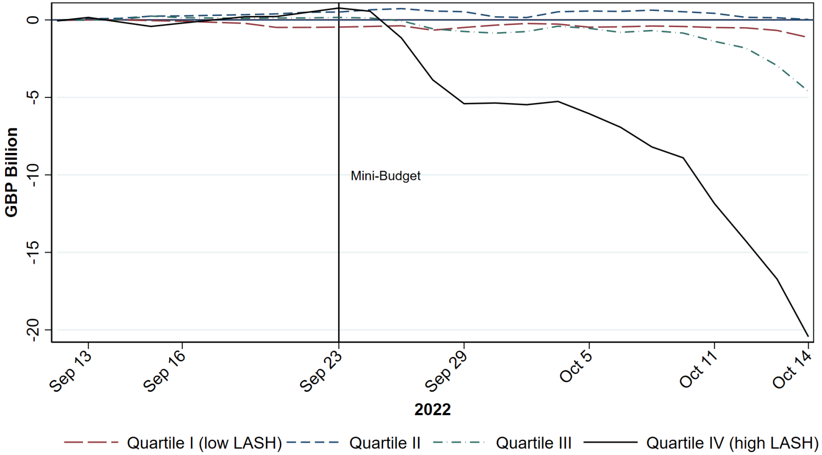
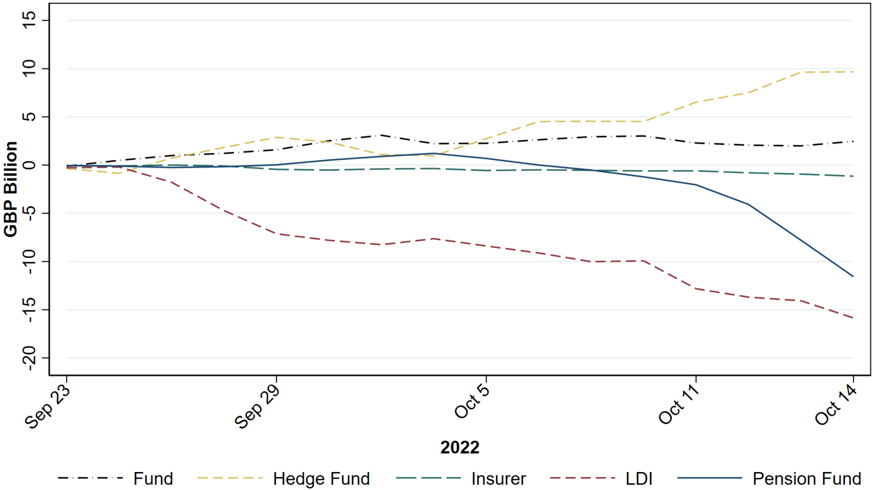
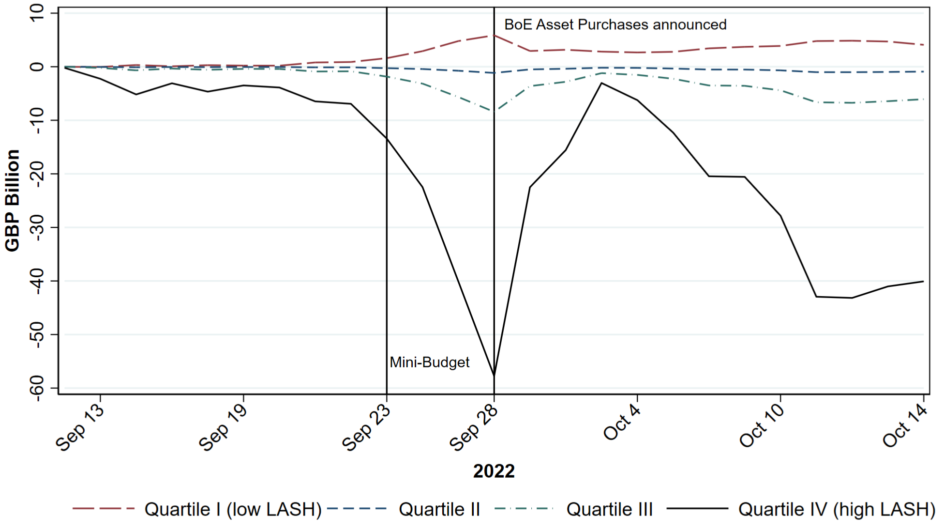


Cumulative Gilt Trading Volumes by Investor Type

Return



Change in the Value of Repo Collateral by Pre-crisis LASH Exposure



Sectoral