

Hedge Fund Treasury Trading and Funding Fragility: Evidence from the COVID-19 Crisis

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Views expressed in this presentation are those of the speaker and not necessarily of the Federal Reserve Board of Governors.

Outline

Overview

Data and summary statistics

Hedge fund Treasury trading and the COVID-19 shock

Creditor regulatory constraints

Redemption risk

Margin pressure

Conclusion

Background

- ▶ Hedge funds have increasing presence in US Treasury (UST) markets
 - Treasury market arbitrage and other relative-value trading
- ▶ Questions about hedge funds' impact on UST market functioning
 - **Less regulated** than broker-dealers, **few disclosures**
 - Use substantial **leverage**, investments that are **illiquid, especially during crises**
 - Potentially **fragile funding structures** on both equity and debt side
- ▶ The March 2020 UST sell-off was unprecedented in scale
 - Rocked assumptions about the safe haven status of UST
 - Short-lived: yields and volatility spiked March 10, fell on March 23
 - Raised **questions about the activities and funding of hedge funds (HFs)**, e.g., *Bloomberg: How a Little Known Trade Upended the U.S. Treasury Market*
- ▶ **Big picture:** During March 2020 turmoil, **did HFs provide liquidity** in UST markets? If not, why not?

Questions

1. What was the impact of external financing constraints?
 - Debt: Did **creditor regulatory constraints** matter?
 - Conjecture that post-GFC regulations hindered G-SIB dealers' ability to intermediate in UST markets and fund arbitrageur activity
E.g., Boyarchenko et al. (2020); He, Nagel, and Song (2020)
 - Equity: Did share restrictions dampen investor runs and fire sale pressure?
 - Debate on **whether share restrictions stabilize HF capital base** during a crisis:
 - Allow HFs to avoid value-destroying liquidations (Hombert and Thesmar, 2014)
 - Induce more intense investor redemptions (Ben-David, Franzoni, Moussawi, 2012)
 2. How did HFs **manage cash and portfolio liquidity** during the crisis?
 - LTCM sold more liquid positions first to meet margin calls, reduce risk (Jorion, 2000)
 - Contrasting findings on the “pecking order” of liquidity for asset managers:
 - Mutual funds (MFs) sell most liquid assets first (Ma, Xiao, and Zeng, 2020)
 - MFs preserve portfolio liquidity to meet future needs (Jiang, Li, Wang, 2020)
- ▶ Our analysis helps to understand the **impact of the Fed intervention**.
- “The Fed did unbelievable things this time.” —Janet Yellen, July 2020
NYT: A Hedge Fund Bailout Highlights How Regulators Ignored Big Risks

Our paper

- ▶ First to give **granular view of how hedge funds face systematic crisis**
 - Novel comprehensive regulatory data (SEC Form PF) and empirical approach
- ▶ Examine **role of hedge funds during the UST sell-off** in March 2020
 - UST exposures
 - Financing (bilateral repo) of UST positions and leverage
 - Fund flows, returns, cash holdings, and portfolio liquidity
- ▶ Analyze factors that may have affected hedge fund trading and funding
 - Liquidity and leverage management
 - Creditor regulatory constraints
 - Redemption risk
 - Margin pressure

Findings

- ▶ Hedge fund UST exposures **doubled from 2018 to February 2020** to \$2.4 trillion gross notional exposure, driven by relative value arbitrage funds
- ▶ In March 2020, average UST fund **reduced UST exposure by 20%**, had **-7% return**
- ▶ **No evidence of credit supply constraints** driving the sell-off
 - Unchanged repo borrowing levels, repo haircuts, and leverage
 - Large, more regulated dealers provided disproportionately higher funding
- ▶ Findings consistent with **precautionary flight to cash**
 - **Increased cash holdings by over 20%**, reduced portfolio illiquidity and size
- ▶ Funds with **longer share restrictions sold off less** and held less liquidity
- ▶ Speed of Fed **intervention likely prevented destabilizing, disorderly fire sales**
 - Intervention reversed substantial HF losses and prevented further capital drain

Related literature

- ▶ **(Equity) hedge fund sector** during other periods of significant market stress
 - Dot-com boom/crash: Brunnermeier and Nagel (2004)
 - GFC: Aragon and Strahan (2012); Ben-David, Franzoni, and Moussawi (2012)
- ▶ **Fixed income arbitrage strategies**
 - Case studies on LTCM: Edwards (1999); Jorion (2000)
 - Risk-return simulation of FI arbitrage strategies: Duarte, Longstaff, Yu (2007)
 - Economics of the cash-futures basis trade: Barth and Kahn (2020)
- ▶ **Asset management** during March 2020 crisis
 - Mutual fund fire sales: Falato, Goldstein, Hortacsu (2020); Ma, Xiao, Zeng (2020)
 - MMF liquidity restrictions: Li, Li, Macchiavelli, and Zhou (2020)
- ▶ **Fixed income markets** during March 2020 crisis
 - UST: Duffie (2020); He, Nagel, and Song (2020); Schrimpf, Shin, and Sushko (2020)
 - Corporate bonds: Haddad, Moreira, Muir (2020); OHara and Zhou (2020); others

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Data

- ▶ **Comprehensive fund-level data** from SEC Form PF
- ▶ Sample of qualifying hedge funds (**NAV \geq \$500 million**)
- ▶ Data on Treasury exposures, bilateral repo borrowing and lending, leverage, cash, portfolio liquidity, and share restrictions
- ▶ **Creditor-hedge fund level borrowing data** from SEC Form PF Q47
- ▶ UST fund sample: Gross UST exposure of at least \$1 million in Q4 2019

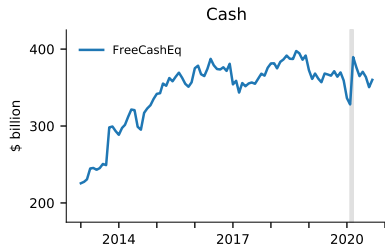
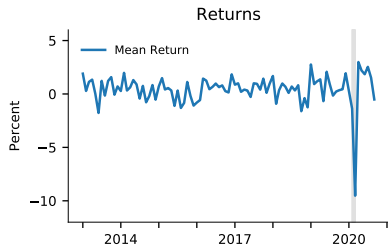
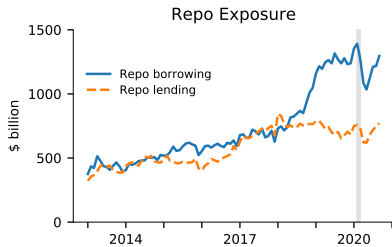
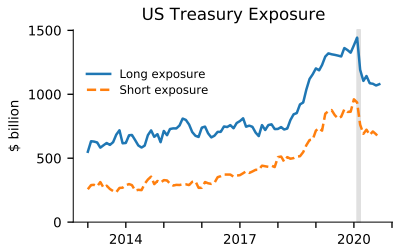
Treasury exposures

- ▶ Long and short UST exposures reported in SEC Form PF Q30
 - $UST_GNE_{h,t} = UST_LNE_{h,t} + UST_SNE_{h,t}$
- ▶ Both notional value and duration as of the end of each month
- ▶ Gross (long+short) UST exposures can be **arbitrage** or **directional**
 - $UST_GNE_{h,t} = 2 \times \min(UST_LNE_{h,t}, UST_SNE_{h,t}) + \text{abs}(UST_NNE_{h,t})$
 - Arbitrage exposure: $\min(UST_LNE_{h,t}, UST_SNE_{h,t})$
 - Directional exposure: $\text{abs}(UST_NNE_{h,t})$

Summary statistics: US Treasury exposures

	N	Mean	Median	Stdev	25th	75th	10th	90th
$UST_GNE_{h,t}$ (m US\$)	33,027	2,790.343	348.228	8,451.260	76.688	1,553.683	18.180	5,736.337
$UST_LNE_{h,t}$ (m US\$)	33,027	1,858.255	240.291	5,192.603	34.999	1,131.989	0.484	4,337.850
$UST_SNE_{h,t}$ (m US\$)	33,027	896.717	17.140	3,351.960	0.000	214.722	0.000	1,554.543
$UST_NNE_{h,t}$ (m US\$)	33,027	846.016	124.704	2,262.571	-2.692	737.179	-134.569	2,616.289
$abs(UST_NNE)$ (m US\$)	33,027	1,096.909	220.822	2,386.734	48.658	906.084	12.505	2,939.572
$min(LNE_{h,t}, SNE_{h,t})$ (m US\$)	33,027	779.867	1.983	3,165.206	0.000	126.536	0.000	1,100.635
$\frac{UST_GNE_{h,t}}{NAV_{h,t}}$	32,612	99.720	26.663	248.848	7.294	78.759	1.802	189.425
$\frac{abs(UST_NNE)}{UST_GNE_{h,t}}$	33,027	75.219	97.864	32.881	50.827	100.000	17.330	100.000
$\frac{UST_NNE_{h,t}}{UST_GNE_{h,t}}$	33,027	40.873	77.628	71.193	-3.902	100.000	-96.158	100.000
$\frac{min(LNE_{h,t}, SNE_{h,t})}{UST_GNE_{h,t}}$	33,027	24.781	2.136	32.881	0.000	49.173	0.000	82.670
$UST_LNE_Drtn_{h,t}$ (years)	29,259	4.578	3.515	4.818	0.288	7.331	0.120	10.720
$UST_SNE_Drtn_{h,t}$ (years)	20,221	6.810	6.210	4.745	3.523	9.100	0.920	13.122
$UST_NNE_Drtn_{h,t}$ (years)	32,025	0.834	0.299	10.365	-1.616	5.436	-8.530	10.039

Aggregates



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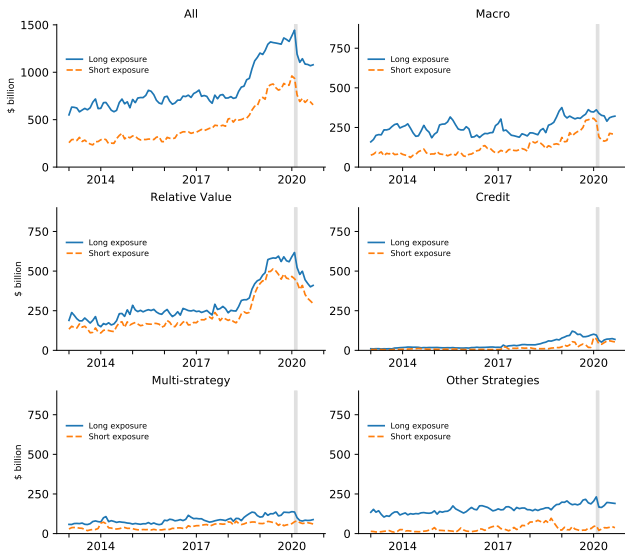
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Hedge fund US Treasury exposures



Specification for fund-level analysis

- ▶ Fund-level analysis of changes in Treasury exposures, financing, liquidity and leverage (D_t is an indicator variable for March 2020):

$$\Delta y_{h,t} = \beta_1 D_t + \gamma Z_{h,t-1} + \mu_h + \epsilon_{h,t}$$

Treasury notional exposures

	$\Delta \text{LogUST_GNE}$	$\Delta \text{LogUST_LNE}$	$\Delta \text{LogUST_SNE}$	$\Delta \frac{\text{UST_GNE}}{\text{NAV}}$	$\Delta \frac{\text{UST_LNE}}{\text{NAV}}$	$\Delta \frac{\text{UST_SNE}}{\text{NAV}}$
	(1)	(2)	(3)	(4)	(5)	(6)
<i>March2020_t</i>	-19.530*** -15.378	-19.010*** -11.342	-23.882*** -7.773	-15.270*** -11.585	-8.481*** -8.843	-7.689*** -10.579
<i>LogNAV_{h,t-1}</i>	-1.922* -1.828	-0.329 -0.261	-2.404 -1.142	0.899 0.534	0.652 0.540	0.158 0.203
<i>NetRet_{h,t-1}</i>	0.871 1.124	1.847** 2.410	-0.232 -0.118	-0.445 -0.831	0.059 0.167	-0.506 -1.285
<i>NetFlows_{h,t-1}</i>	0.983*** 2.773	0.875** 2.458	1.860** 2.164	0.181 0.537	-0.206 -0.876	0.333* 1.975
<i>PortIlliq_{h,t-1}</i>	1.425 0.950	-0.707 -0.337	1.930 0.799	0.526 0.383	0.233 0.316	0.398 0.487
<i>ShareRes_{h,t-1}</i>	3.035* 1.747	3.648* 1.960	-1.884 -0.527	1.796 1.306	1.237* 1.852	0.562 0.774
<i>FinDur_{h,t-1}</i>	-0.542 -0.806	-0.667 -0.785	0.742 0.366	-0.356 -0.987	-0.128 -0.432	-0.173 -0.585
<i>MgrStake_{h,t-1}</i>	0.398 0.777	0.196 0.179	0.197 0.248	1.197 0.875	0.392 0.376	0.913 1.641
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18,849	16,874	12,978	18,801	18,801	18,801
R ²	0.015	0.015	0.017	0.016	0.016	0.012

- ▶ Long and short Treasury exposures both fell by around 20% in March
- ▶ As a fraction of NAV, long and short exposures decreased by around 8%

Treasury arbitrage and directional exposures

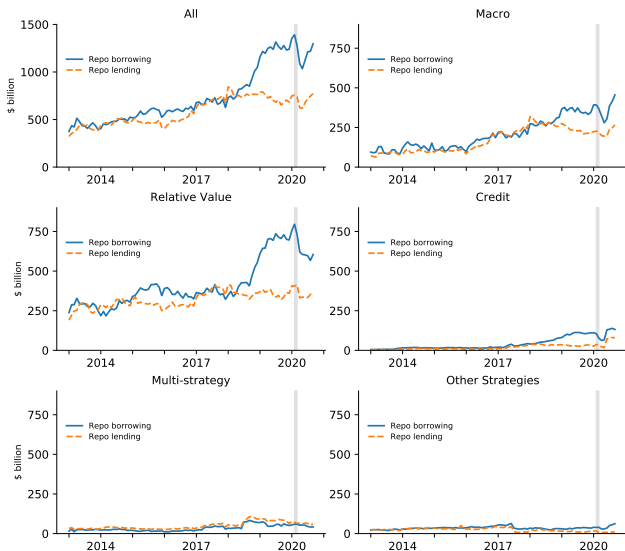
	$\Delta \log(\min(LNE, SNE))$	$\Delta \log(\text{abs}(NNE))$	$\Delta \frac{2 \times \min(LNE, SNE)}{GNE}$	$\Delta \frac{\text{abs}(NNE)}{GNE}$
	(1)	(2)	(3)	(4)
<i>March2020_t</i>	-25.331*** -8.462	-15.533*** -8.230	-2.093*** -6.160	2.093*** 6.160
Other Controls	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes
Observations	11,053	18,834	18,849	18,849
R ²	0.013	0.007	0.005	0.005

- ▶ UST arbitrage exposures decreased more than directional exposures

Hedge fund repo activity

- ▶ Hedge fund positions in Treasury securities are primarily financed in repo markets [▶ Trade overview](#)
- ▶ Form PF data provide a unique view into hedge funds' repo activities
 - Largely bilateral and uncleared
 - Magnitudes increasingly significant
- ▶ Like UST exposures, repo borrowing also **doubled since early 2018**
 - Until then, repo borrowing and lending were **roughly matched**
 - Divergence likely driven by **basis trades** (long bond, short futures)

Hedge fund repo exposures



Repo exposures and maturity

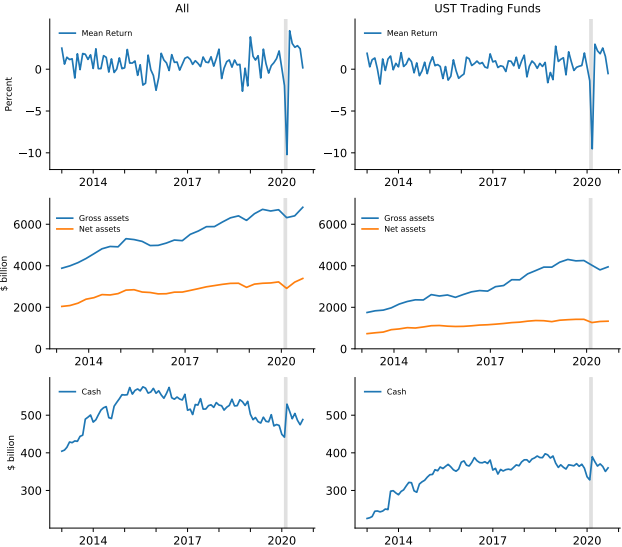
	$\Delta \text{LogRepoBorrowing}$	$\Delta \text{LogRepoLending}$	$\Delta \text{RepoBrrwTerm}$	$\Delta \text{RepoLendTerm}$
	(1)	(2)	(3)	(4)
<i>March2020_t</i>	-1.767 -0.864	-25.015*** -9.544	2.997*** 6.190	-0.993** -2.293
Fund FE	Yes	Yes	Yes	Yes
Observations	9,387	9,083	9,387	9,083
R ²	0.014	0.014	0.022	0.021

- ▶ Repo *borrowing* by hedge funds did not change significantly
 - Suggests much of the decrease in Treasury exposures either positions held outright without financing (e.g., for liquidity management) or derivatives exposures
- ▶ Repo *lending* by hedge funds declined by 25%

Returns, assets, and cash

- ▶ In March, the average hedge fund with UST holdings **lost 7%**
 - Notably, limited effects on outflows (unlike mutual funds) [▶ Returns/flows](#)
- ▶ Total gross and net asset values decreased; leverage ratios unchanged
- ▶ Cash holdings increased sharply

Returns, assets, and cash



Cash and portfolio size

	$\Delta \text{LogFreeCashEq}$	$\Delta \frac{\text{FreeCashEq}}{\text{NAV}}$	$\Delta \text{LogCash}$	$\Delta \frac{\text{Cash}}{\text{NAV}}$	$\Delta \text{LogPortfolioGNE}$	$\Delta \text{LogOpenPositions}$
	(1)	(2)	(3)	(4)	(5)	(6)
<i>March2020_t</i>	25.723*** 18.937	6.289*** 37.199	23.003*** 20.388	8.824*** 28.202	-21.769*** -43.878	-4.643*** -8.428
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,236	21,377	18,765	18,973	21,694	21,676
R ²	0.012	0.025	0.015	0.021	0.070	0.026

- ▶ Unencumbered cash and total cash each increased by over 20% in March
- ▶ Portfolio size and the number of open positions decreased
- ▶ Portfolio liquidity also increased ▶ Portfolio liquidity
- ▶ Balance sheet leverage was unchanged ▶ Leverage

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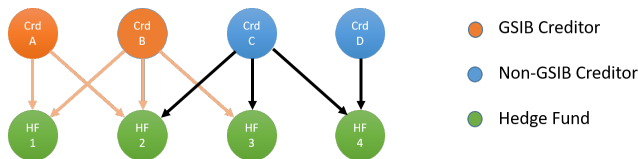
Redemption risk

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Role of creditor constraints

- ▶ Some have argued that regulatory constraints of dealers may have affected UST intermediation during the March 2020 shock
 - E.g., He, Nagel, and Song (2020).
- ▶ Within hedge fund-time analysis to test for differences in funding provision between regulatory constrained (G-SIB) and unconstrained creditors
- ▶ G-SIB dealers are subject to enhanced regulations (including eSLR)



$$\Delta \log HF_PB_Credit_{h,p,t} = \gamma_1 DlrCnstr_{p,t} + \gamma_2 DlrCnstr_{p,t} \times D_t + \phi Z_{h,p,t-1} + \mu_{h,t} + \psi_p + \epsilon_{h,p,t}$$

Role of creditor constraints: G-SIB status

	(1)	(2)	(3)	(4)	(5)	(6)
$March2020_t \times IsGSIB_{p,t}$	12.032*** 9.589	11.285*** 4.141	13.374*** 3.701	12.637** 2.496	13.335*** 3.318	13.375*** 3.316
$IsGSIB_{p,t}$	-0.602 -0.464	-5.143*** -2.972	-6.230** -2.315	-2.516 -0.840	14.215*** 4.630	13.540*** 4.742
$LogHF_PB_Credit_{h,p,t-1}$					-80.762*** -27.208	-74.351*** -16.801
$CrdtrRankInHF_{h,p,t-1}$						-0.325 -0.222
$HFRankInCrdtr_{h,p,t-1}$						-6.428** -2.451
Other Controls	No	No	No	No	No	Yes
Fund FE	Yes	Yes	No	No	No	No
Time FE	Yes	Yes	No	No	No	No
Creditor FE	No	Yes	Yes	No	No	No
Fund \times Time FE	No	No	Yes	Yes	Yes	Yes
Fund \times Creditor FE	No	No	No	Yes	Yes	Yes
Observations	9,816	9,816	9,816	9,816	9,816	9,816
R ²	0.031	0.038	0.236	0.318	0.516	0.517

- ▶ G-SIB dealers provided disproportionately higher funding to connected funds in March
- ▶ Inconsistent with regulatory balance sheet constraints limiting hedge fund activities

▶ post-January 2018

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Role of share restrictions

- ▶ Hedge funds use share restrictions to manage redemption risk, e.g., lockups, redemption notice periods, redemption frequency limits
- ▶ Unclear whether share restrictions help during a crisis:
 - Reduce pressure to engage in fire sales (Hombert and Thesmar, 2014)
 - Strategic complementarities can induce greater redemptions (Ben-David, Franzoni, Moussawi, 2012; Agarwal, Aragon, Shi, 2019; Li, Li, Macchiavelli, Zhou, 2020)
- ▶ We construct $ShareRes_{h,t}$, the weighted average time it would take for investors to redeem the fund's equity
- ▶ We analyze the impact of redemption risk:

$$\Delta y_{h,t} = \beta_0 + \beta_1 D_t + \beta_2 ShareRes_{h,t-1} + \beta_3 D_t \times ShareRes_{h,t-1} + \gamma Z_{h,t-1} + \mu_h + \epsilon_{h,t}$$

Role of share restrictions: Cash and liquidity position

	$\Delta \text{LogFreeCashEq}$	$\Delta \frac{\text{FreeCashEq}}{\text{NAV}}$	$\Delta \text{LogPortfolioGNE}$	$\Delta \text{LogOpenPositions}$	$\Delta \text{LogPortIlliq}$
	(1)	(2)	(3)	(4)	(5)
March2020_t	27.019*** 20.211	7.069*** 40.083	-23.098*** -43.441	-5.166*** -8.539	-12.907*** -10.008
$\text{ShareRes}_{h,t-1}$	1.500 0.767	0.248 1.200	0.520 1.278	0.239 0.996	1.285 0.531
$\text{March2020}_t \times \text{ShareRes}_{h,t-1}$	-6.571*** -5.875	-3.728*** -23.922	6.197*** 16.183	2.416*** 6.612	8.830*** 7.711
Other Controls	Yes	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes
Observations	20,236	21,377	21,694	21,676	7,625
R ²	0.012	0.030	0.073	0.027	0.087

- ▶ Funds with *longer* share restrictions boosted their cash holdings and portfolio liquidity by *less*

Role of share restrictions: Treasury exposure

	$\Delta \text{LogUST_GNE}$	$\Delta \log(\min(LNE, SNE))$	$\Delta \frac{\min(LNE, SNE)}{GNE}$
	(1)	(4)	(5)
<i>March2020_t</i>	-20.977*** -15.687	-27.312*** -8.757	-2.331*** -6.682
<i>ShareRes_{h,t-1}</i>	2.907* 1.672	-2.402 -0.614	-0.274 -0.586
<i>March2020_t × ShareRes_{h,t-1}</i>	8.140*** 6.655	15.624*** 4.915	1.340*** 3.224
Other Controls	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes
Observations	18,849	11,053	18,849
R ²	0.016	0.014	0.005

- ▶ Funds with longer share restrictions reduced their Treasury exposures by much less
- ▶ Share restrictions likely prevented more significant Treasury fire sales by HFs in March
- ▶ Unlike MFs and MMFs, hedge funds faced significant outflows *after* the initial shock period

Investor outflows in the post-crisis period

	<i>NetRetQ</i> (1)	<i>NetFlows</i> (2)	ΔLogNAV (3)	ΔLogGAV (4)	$\Delta \text{LeverageRatio}$ (5)
<i>March2020_t</i>	-9.625*** -22.092	-1.933*** -5.921	-14.064*** -24.445	-13.291*** -18.541	-0.028 -1.162
<i>June2020_t</i>	6.617*** 5.931	-3.347*** -5.040	2.797*** 3.193	-1.137 -1.225	-0.210*** -7.559
<i>Sept2020_t</i>	1.254** 2.159	-3.330*** -6.565	-2.244*** -3.462	-1.764** -2.474	0.080*** 3.353
Other Controls	Yes	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes
Observations	8,361	8,349	8,356	8,356	8,356
R ²	0.556	0.335	0.231	0.133	0.036

- ▶ Quarterly regression extending sample to end of 2020Q3
- ▶ While market turmoil subsided immediately following Fed intervention, hedge funds continued to face large outflows
- ▶ UST hedge funds delevered portfolios and did not ramp back up their UST exposures

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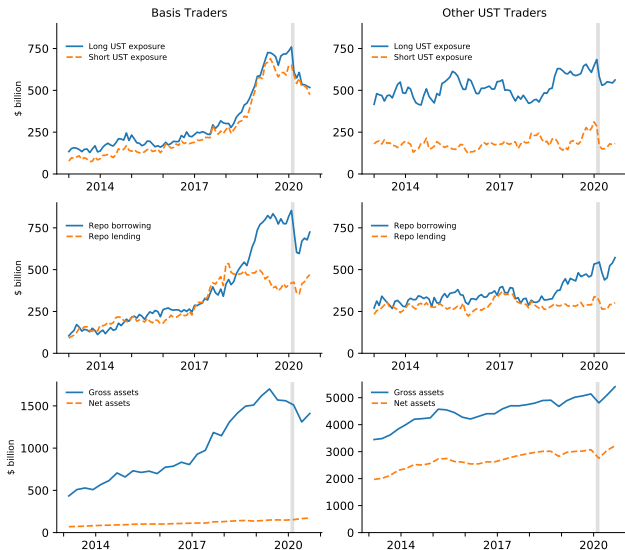
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Basis trader funds versus other UST funds



Basis trader funds versus other UST funds

- ▶ Hedge funds predominantly engaged in the long cash-futures basis trade faced **margin calls on futures leg** in March 2020 [▶ Trade overview](#)
 - short: Treasury futures
 - long: bond, deliverable into futures, financed by repo borrowing
- ▶ Basis traders likely **faced greater immediate liquidity needs**
- ▶ **Note:** Most hedge funds that trade UST are not predominantly basis traders
- ▶ In March 2020, *compared to other UST traders*, basis traders
 - Reduced UST long exposures more, but retained more arbitrage positions.
 - Repo borrowing decreased significantly; shorter maturity; higher haircuts
 - Held larger cash positions with posted margin/collateral included, but relatively less unencumbered cash (held for liquidity management)
 - Reduced leverage and number of open positions

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- ▶ In March 2020, hedge funds reduced UST exposures by around 20%, saw -7% return
- ▶ Findings consistent with liquidity preservation and stabilizing share restrictions
 - Increased precautionary cash holdings, reduced portfolio illiquidity and size
 - Sell-off larger at hedge funds with shorter share restrictions
- ▶ Findings inconsistent with massive deleveraging by HFs or regulatory constraints at broker-dealers driving the sell-off
 - Hedge fund borrowing and leverage remained largely unchanged
 - G-SIB dealers provided more stable funding in March
- ▶ Speed of Fed intervention likely prevented destabilizing, disorderly fire sales
 - Basis traders faced more immediate liquidity needs and funding pressure in March
 - HFs saw substantial investor redemptions *after* the March turmoil
 - Fed intervention reversed substantial HF losses and prevented further capital drain

Appendix

[Appendix slides]

Summary statistics: Hedge fund characteristics

	N	Mean	Median	Stdev	25th	75th	10th	90th
$NAV_{h,t}$ (m US\$)	12,503	2,828.349	1,397.077	4,127.828	714.734	3,068.911	379.007	6,894.295
$LeverageRatio_{h,t}$	12,503	2.476	1.335	3.713	1.042	2.120	1.002	3.923
$PortIlliq_{h,t}$ (days)	12,284	33.096	7.181	61.221	1.725	35.325	0.500	90.399
$ShareRes_{h,t}$ (days)	12,492	125.835	60.500	123.596	19.000	227.625	0.500	316.278
$FinDur_{h,t}$ (days)	9,836	37.107	10.710	54.451	0.500	59.256	0.500	118.853
$MgrStake_{h,t}$ (%)	11,472	13.761	3.000	25.690	0.000	13.000	0.000	44.000
$NetRetQ_{h,t}$ (%)	12,713	2.316	1.690	8.129	-0.470	4.080	-4.160	8.286
$NetRetM_{h,t}$ (%)	36,351	0.437	0.510	2.668	-0.490	1.560	-2.220	3.100
$NetFlows_{h,t}$ (%)	12,023	-0.605	-0.179	13.905	-4.462	2.770	-12.404	10.974
$FreeCashEq_{h,t}$ (m US\$)	37,133	824.945	219.609	1,650.080	39.652	784.817	0.056	2,180.929
$Cash_{h,t}$ (m US\$)	32,140	759.771	253.933	1,372.204	65.022	805.677	11.794	1,933.981
$\frac{FreeCashEq_{h,t}}{NAV_{h,t}}$ (%)	36,596	26.779	16.276	27.846	3.888	43.313	0.013	72.622
$\frac{Cash_{h,t}}{NAV_{h,t}}$ (%)	31,716	30.623	16.572	41.535	5.216	39.079	1.128	74.434
$OpenPositions_{h,t}$	37,548	2,561.640	599.000	6,366.386	219.000	1,804.000	86.000	5,768.300
$GNE_{h,t}$ (m US\$)	37,292	25,642.859	5,957.733	61,005.277	1,932.317	18,433.384	784.600	59,207.269
$PortfolioGNE_{h,t}$ (m US\$)	37,292	24,592.608	5,445.073	59,761.393	1,752.156	17,174.351	710.106	56,505.466

Summary statistics: Repo lending, borrowing and collateral

	N	Mean	Median	Stdev	25th	75th	10th	90th
<i>RepoBorrowing</i> _{h,t} (m US\$)	14,261	3,616.378	280.089	11,129.562	37.898	1,440.943	0.000	7,039.536
<i>RepoLending</i> _{h,t} (m US\$)	15,340	2,710.582	126.539	8,668.318	12.569	850.733	0.000	5,916.215
<i>RepoBrrwTerm</i> _{h,t} (days)	12,439	25.683	8.661	43.691	1.463	29.220	0.000	69.398
<i>RepoLendTerm</i> _{h,t} (days)	13,037	12.198	3.653	22.079	0.000	10.958	0.000	40.178
<i>RepoTotalCollateral</i> _{h,t} (%)	13,250	118.174	103.290	27.569	100.388	128.431	100.000	152.999
$\frac{\text{RepoCashCollateral}_{h,t}}{\text{RepoBorrowing}_{h,t}}$ (%)	12,910	31.619	2.428	41.006	0.039	69.532	0.000	100.146
$\frac{\text{RepoSecCollateral}_{h,t}}{\text{RepoBorrowing}_{h,t}}$ (%)	13,249	85.348	100.914	52.852	35.772	124.193	0.000	139.759
$\frac{\text{RepoCashCollateral}_{h,t}}{\text{RepoTotalCollateral}_{h,t}}$ (%)	12,910	29.758	1.863	40.311	0.034	65.271	0.000	100.000
<i>RepoClearedCCP</i> _{h,t} (%)	5,059	13.721	0.000	33.782	0.000	0.000	0.000	100.000
<i>RepoBilateral</i> _{h,t} (%)	6,172	79.484	100.000	39.031	95.000	100.000	0.000	100.000

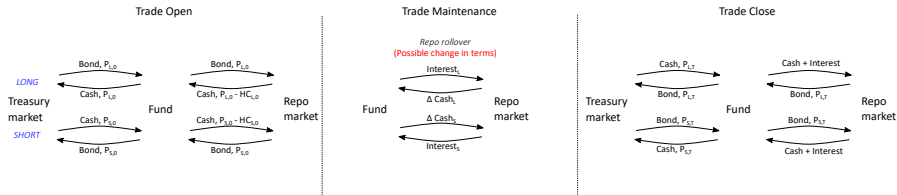
Summary statistics: Creditor exposures

	N	Mean	Median	Stdev	25th	75th	10th	90th
<i>TotalMCBorrowing_{h,t}</i> (m US\$)	6,129	6,008.282	975.979	17,719.835	329.311	3,729.416	112.594	11,833.454
<i>NumCrdtrsPerHF_{h,t}</i>	6,129	4.512	3.000	4.404	2.000	5.000	1.000	9.000
<i>HFCrdtrHHI_{h,t}</i>	6,129	49.325	39.459	30.680	25.098	67.518	16.485	100.000
<i>HF_Ctpty_Credit_{h,p,t}</i> (m US\$)	27,930	1,327.842	434.083	2,701.381	154.146	1,230.545	69.509	3,012.068
$\Delta \log HF_Ctpty_Credit_{h,p,t}$ (%)	23,294	1.304	0.798	48.744	-20.583	22.976	-54.101	56.342
<i>IsCrdtrPB_{h,p,t}</i>	27,930	0.466	0.000	0.499	0.000	1.000	0.000	1.000
<i>IsCrdtrCustodian_{h,p,t}</i>	27,930	0.504	1.000	0.500	0.000	1.000	0.000	1.000

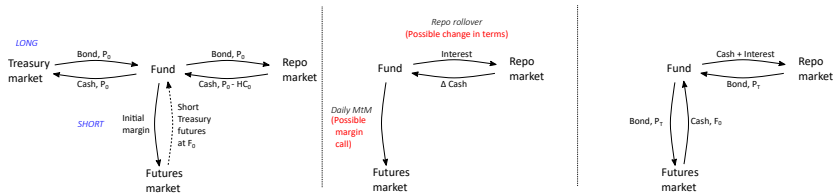
Fixed income arbitrage strategies

▶ Repo

▶ Basis traders

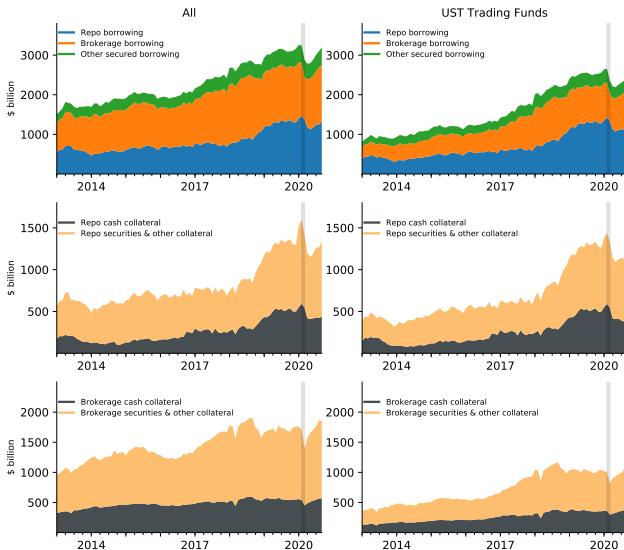


(a) Bond spread trade

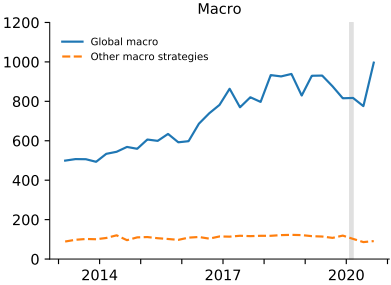
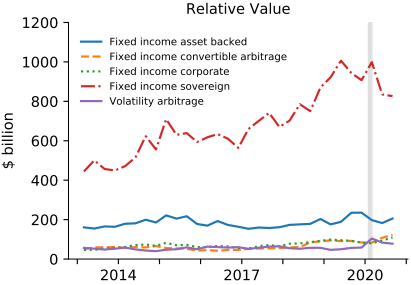


(b) Cash-futures basis trade

Hedge Fund Borrowing and Collateral



Gross Assets of RV and Macro Strategies



...

Repo collateral

	$\Delta \text{LogRepoTotalCollateral}$	$\Delta \text{LogRepoCashCollateral}$	$\Delta \frac{\text{RepoTotalCollateral}}{\text{RepoBorrowing}}$	$\Delta \frac{\text{RepoCashCollateral}}{\text{RepoBorrowing}}$	$\Delta \frac{\text{RepoCashCollateral}}{\text{RepoTotalCollateral}}$
	(1)	(2)	(3)	(4)	(5)
<i>March2020:</i>	0.565	91.952***	-0.668**	1.524***	1.326***
	0.280	19.659	-2.329	4.189	4.544
Other Controls	Yes	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes
Observations	9,810	6,954	9,810	9,478	9,478
R ²	0.014	0.037	0.012	0.019	0.020

Hedge fund returns and investor flows ▶ Back

	<i>NetRetM</i>	<i>NetRetQ</i>	<i>NetFlows</i>
	(1)	(2)	(3)
<i>March2020_t</i>	-6.624*** -37.499	-9.895*** -23.683	-1.830*** -6.040
<i>LogNAV_{h,t-1}</i>	-0.408*** -2.760	-1.172** -2.292	-7.648*** -7.232
<i>NetRet_{h,t-1}</i>	0.026 0.197	1.332* 1.792	-0.994** -2.355
<i>NetFlows_{h,t-1}</i>	-0.024 -0.650	-0.588*** -3.279	3.077*** 6.579
<i>PortIlliq_{h,t-1}</i>	-0.149 -1.377	-0.120 -0.227	-1.966*** -3.296
<i>ShareRes_{h,t-1}</i>	0.055 0.763	0.021 0.147	1.199 1.389
<i>FinDurn_{h,t-1}</i>	0.043 0.875	0.398 1.316	0.516* 1.806
<i>MgrStake_{h,t-1}</i>	-0.076* -1.714	-0.170 -1.309	0.705 1.448
Fund FE	Yes	Yes	Yes
Observations	21,659	7,630	7,618
R ²	0.193	0.549	0.344

Portfolio liquidity

	Δ share of assets that can be liquidated in:			
	$\Delta \text{LogPortLliq}$	≤ 7 days	≤ 30 days	≥ 31 days
	(1)	(2)	(3)	(4)
<i>March2020_t</i>	-10.734*** -8.741	1.005*** 5.672	0.070 0.570	-0.070 -0.570
Other Controls	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes
Observations	7,625	7,625	7,625	7,625
R ²	0.084	0.067	0.091	0.091

► Portfolio liquidity increased.

► Back

Fund equity, assets, and leverage

	ΔLogNAV	ΔLogGAV	$\Delta \text{LeverageRatio}$
	(1)	(2)	(3)
<i>March2020_t</i>	-14.139*** -24.985	-13.545*** -18.623	-0.037 -1.472
Other Controls	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes
Observations	7,625	7,625	7,625
R ²	0.246	0.149	0.038

- ▶ Balance sheet leverage was unchanged

▶ Back

Treasury duration exposure

	ΔUST_LNE_Drtn	ΔUST_SNE_Drtn	ΔUST_NNE_Drtn
	(1)	(2)	(3)
<i>March2020_t</i>	0.113*** 3.393	-0.418*** -5.482	0.435* 1.864
Other Controls	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes
Observations	16,512	12,633	18,328
R ²	0.007	0.008	0.004

- ▶ Funds increased their duration exposures

Role of dealer constraints: G-SIBs post-January 2018

	(1)	(2)	(3)	(4)	(5)	(6)
$March2020_t \times IsGSIB_{p,t}$	10.763*** 3.972	9.157*** 2.878	13.743*** 3.099	14.179** 2.614	13.134*** 3.129	13.307*** 3.126
$PostJanuary2018_t \times IsGSIB_{p,t}$	-0.423 -0.134	0.570 0.148	-0.199 -0.041	-1.426 -0.250	5.280 0.926	4.637 0.838
$IsGSIB_{p,t}$	-0.112 -0.158	-3.371 -1.610	-5.112* -1.805	-0.829 -0.249	13.302*** 3.646	12.368*** 3.512
$LogHF_PB_Credit_{h,p,t-1}$					-82.474*** -27.027	-73.967*** -17.461
$CrdtrRankInHF_{h,p,t-1}$						-0.980 -0.842
$HFRankInCrdtr_{h,p,t-1}$						-7.412** -2.530
Other Controls	No	No	No	No	No	Yes
Fund FE	Yes	Yes	No	No	No	No
Time FE	Yes	Yes	No	No	No	No
Creditor FE	No	Yes	Yes	No	No	No
Fund \times Time FE	No	No	Yes	Yes	Yes	Yes
Fund \times Creditor FE	No	No	No	Yes	Yes	Yes
Observations	13,995	13,995	13,995	13,995	13,995	13,995
R ²	0.043	0.048	0.293	0.382	0.562	0.563