Reaching for Yield and Leverage in the Treasury Market

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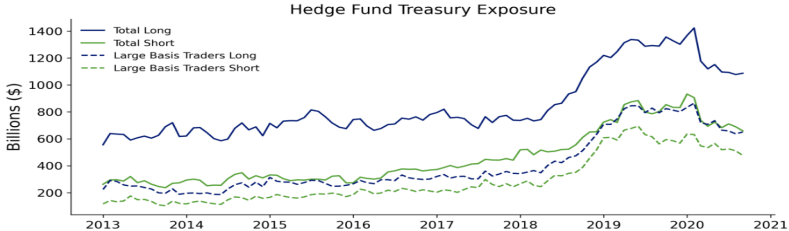
Fixed Income Research and Implications for Monetary Policy

Disclaimer: The views expressed in this presentation are those of the speaker and do not necessarily represent the views of the Board of Governors of the Federal Reserve System.

Starting point: Hedge funds and the cash-futures basis trade (Barth and Kahn, 2021)



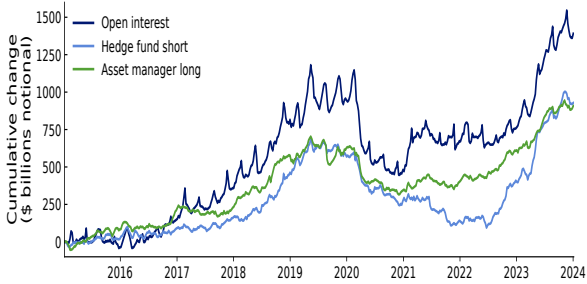
At the peak of Treasury stress in March 2020, hedge funds sold >$200B

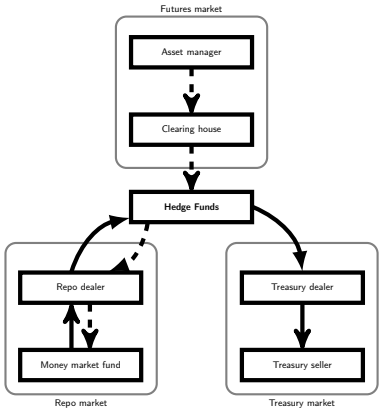
- Preceeded by a buildup in hedge fund Treasury exposure of $960B between 2017 and 2019.
- 80% of this buildup, and 50% of sales COVID attributable to **cash-futures basis trade.**

Basis trade: near-arbitrage that profits from disconnect between cash and futures prices of Treasuries.

- When futures overvalued, trader short futures and buy cash funded in repo.
- Highly levered, exposed to rollover and margin risk that can lead to large sales of cash Treasuries.

The puzzle: Who holds the other side of the trade? (Barth and Kahn, 2021)





Our model showed basis trade results from:

- MMFs incentives to provide cheap funding in repo.
- Dealer balance sheet costs for cash Treasuries.
- **Demand for long Treasury futures.**

But who holds long Treasury futures and what drives variation in demand?

This paper: Mutual funds held nearly $600B in long Treasury futures in 2023.

>50% of AM positions and >60% of change in total positions since 2021.

Employ regulatory filings covering details on fund positions including detailed data on derivatives.

Show substantial time-series and cross-sectional variation in Treasury futures holdings.

Understanding why mutual funds hold this synthetic Treasury leverage is important because:

1. ***Helps to explain variation in cash-futures basis trade volumes.***
   - The cash-futures basis trade is a highly levered arbitrage trade funded in the repo market.
   - Important impact on aggregate dealer repo lending, hedge fund leverage, and Treasury market stress.
     - See Schrimpf et al. (2020), Barth and Kahn (2021), Kruttli et al. (2023), d'Avernas et al. (2024)

2. ***Provides unique window into incentives to take on non-bank leverage in the Treasury market.***
   - Risks of this leverage has been illustrated by March 2020 dash-for-cash, September 2022 gilt crisis.
   - Data on other non-banks in the Treasury market (hedge funds, LDI funds, sovereign funds) is scarce.
     - Duffie (2020), He et al. (2020), Vissing-Jorgensen (2021), Pinter (2023), Alfaro et al. (2024)

3. ***Helps to understand mutual funds' use of derivatives:*** Kaniel and Wang (2022), Choi et al. (2023)

This paper:

Mutual funds use Treasury futures to "reach for duration."

a. Match duration of benchmark weighted towards Treasuries, while...

b. Tilting portfolio towards higher yielding assets.

1. Higher futures for core bond funds associated with switch from Treasuries to MBS/ABS.
   - Little evidence of taking on credit risk, but see a shift from fixed to floating rate.
   - For funds with broader focus, also see a shift to equities.
2. As futures holdings rise, the duration of the cash portfolio falls relative to benchmark.
   - Driven by the difference in allocation to MBS/ABS and Treasuries.
   - While cash duration falls, duration of total portfolio rises, tracking the index closer.
3. Increase in futures use coincides with higher yields on MBS relative to Treasuries.

Futures use is concentrated in funds benchmarked to high Treasury exposure.

Discuss alternative means of leverage and implications for Treasury issuance.

Outline

1. Data
2. Summary statistics on mutual fund Treasury futures positions
3. Treasury futures and cash holdings
   - Association with cash Treasury and MBS holdings
   - Duration tracking of mutual funds
   - Yields on MBS and Treasury futures
4. Cross-sectional variation in Treasury futures positions
5. Discussion

Data on mutual fund holdings is from SEC Form N-PORT

Quarterly filing for registered investment companies, required for funds with assets $\geq$$1B.

- Reporting for all funds began in June 2019, but coverage is poor before Q4 2019.
- **We scrape 208,569 filings for over 14,600 funds from the SEC's EDGAR database.**

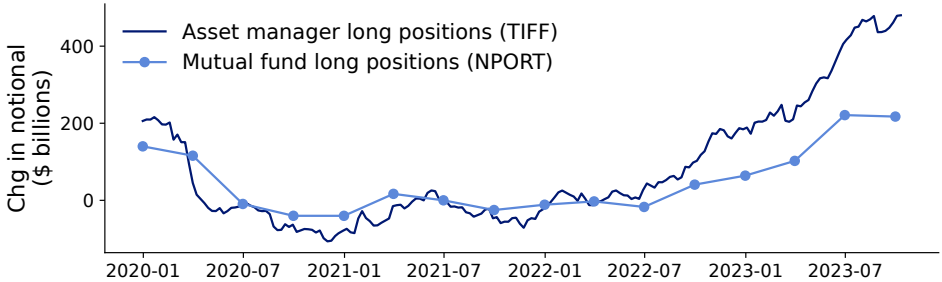
Includes notional value of derivatives contracts, direction of trade, and underlying security.

- Identify 96,227 Treasury futures positions from 396,991 total futures positions.

Merge in additional data from other sources:

- CRSP data for mutual fund attributes, returns and flows.
- Data from mutual fund prospectuses to identify benchmark indices.
- Data from ICE and JP Morgan for durations and ratings of cash securities.

Mutual funds' aggregate Treasury futures positions

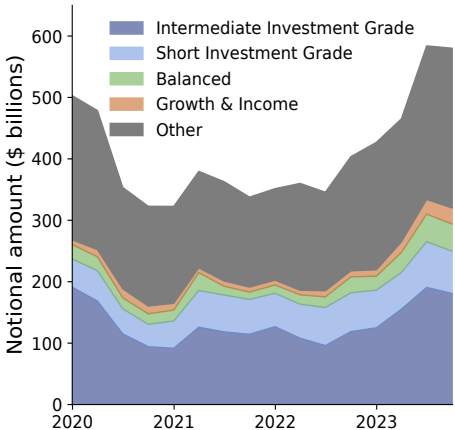


Notional $B	Q4 2019	Q2 2021	Q2 2023
Asset manager	888	682	1,087
Mutual fund	503	362	583
2-year only			
Asset manager	347	166	346
Mutual fund	190	122	259

- **Mutual funds roughly 52% of AM futures**
  - Recently, larger share of 2-year and 5-year.
  - (Contracts where basis trade is popular)
- **Dynamics match overall change in AM Treasury futures.**
  - High in 2019, low in 2021, high again in 2023.

(anecdotal: remainder likely sep. accounts)

Mutual fund styles and Treasury futures positions

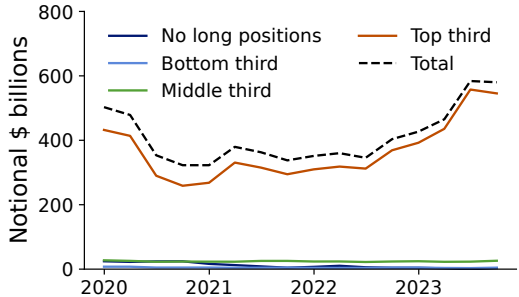


- **Intermediate investment grade (IID) funds:**
  - 32% of total.
  - Primarily investment grade debt, WAM of 5-10 years.
  - Usually benchmarked to Bloomberg Aggregate Index.
  - Mix of government, corporate, MBS and ABS.

  Also called core / core plus bond funds.
- **Short-intermediate/short investment grade funds:**
  - 12% of total
  - Similar to IID, but shorter maturities.
- **Balanced / Growth and Income funds:**
  - 11% of total
  - Invest in a mix of equities and fixed income.
  - Fixed income often benchmarked to Aggregate Index.

Heterogeneity in Treasury futures positions

	Share	Percentiles			
	> 0	50%	75%	90%	99%
Total	**10**	**0**	**0**	**0.002**	**0.81**
IID	53	0.003	0.14	0.59	15.09
SID	50	0.002	0.14	0.50	3.13
B	24	0	0	0.06	1.98
SII	39	0	0.07	0.36	7.28
GI	6	0	0	0	0.14



There is a great deal of heterogeneity in Treasury futures positions, even within styles.

There is a persistent set of funds that hold large Treasury futures positions.

- Right figure groups funds in 2023 that don't hold futures, low, middle and high futures holders.
  - *High futures holders in 2023 account for 83% of futures in 2019.*
- 97% of funds that did not have long futures in 2023 did not in 2019.
- 77% of funds that did have long futures in 2023 did in 2019.

Makes the cross-sectional choice of funds to hold futures meaningful.

Mutual funds Treasury futures positions have varied substantially over time.

Many potential reasons for this variation:

- Hedging, speculation on interest rates, preserving cash for redemptions, yield-curve bets

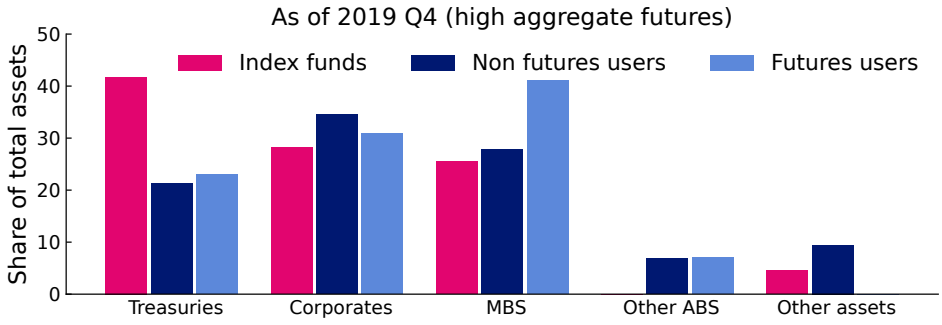
Variation both over time and across funds allows us to exploit panel structure of data.

- Compare futures holders to both index funds and non-futures holders in same quarter.
- *Not* causal, but associations helps to understand why funds hold futures.
  - Reject many of the above hypotheses, provide evidence for reaching for duration as an important driver.
- *Additional restrictions to present the best possible comparison:*
  - Restrict to funds with the Bloomberg Aggregate Index as benchmark.
  - Exclude feeder funds (identified as funds with $> 90\%$ allocations to equities or investment companies).

Start by looking at how futures fit into the overall asset allocation of funds.

Cash holdings of investment-grade debt funds

Sort funds into index funds, futures users, and non-futures users as of June 2023.



- **Holdings of cash Treasuries differ substantially from index funds.**
  - Index funds have $\approx 40\%$ in cash Treasuries, whereas futures users and non-users $\approx 20\%$.
- **Futures funds tilt towards MBS and ABS, non-futures users towards corporate debt.**
  - Size of tilt varies with aggregate level of futures use.

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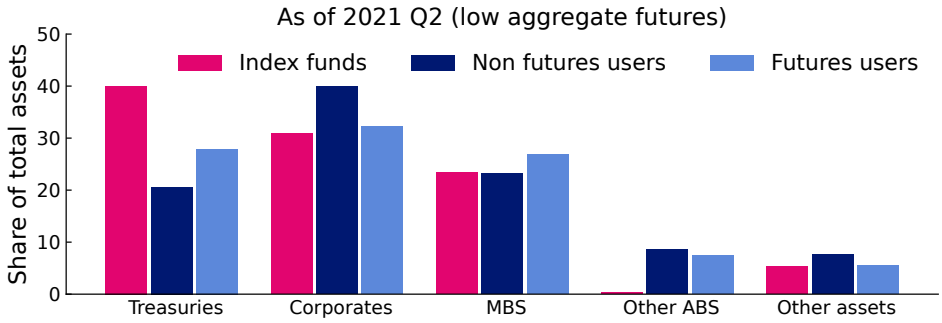

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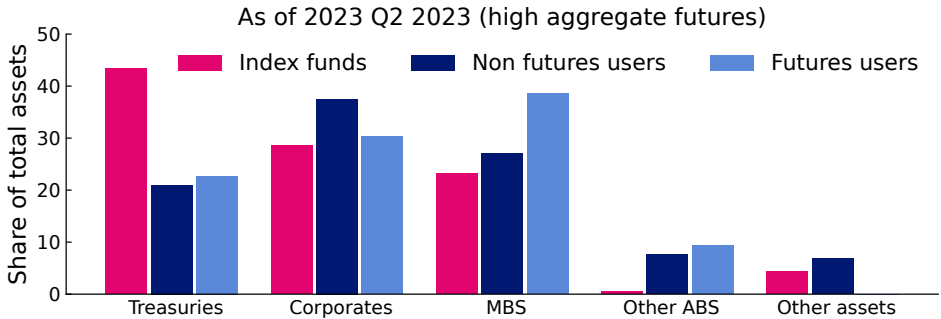

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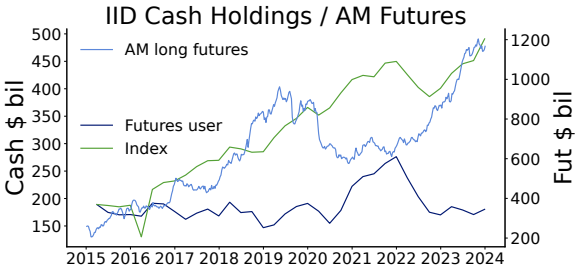
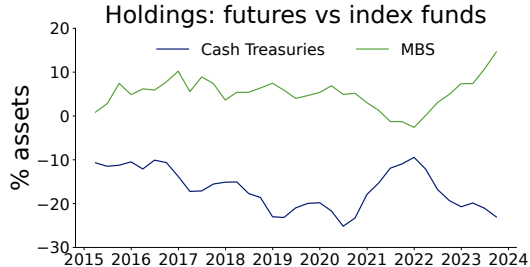
Further evidence of association with MBS investments





- **Pattern still holds in longer time series available through CRSP.**
  - As AM futures holdings rise, index fund holdings of cash Treasuries rise, futures holders do not.
  - Decreases in futures holding fund Treasuries relative to index coincide with increases in MBS.

However, these results don't consider the effect of futures directly

Regression evidence on asset allocation

For broader set of funds, we include a flexible style $\times$ time fixed effect:

$$\text{Asset allocation (\%)}_{it} = \alpha_i + \gamma_t + \beta \times \text{Futures to assets}_{it} + \epsilon_{it}$$

	Treasuries	MBS	Corporate Debt	Other ABS	Equity
			IID Funds		
Treasury futures to assets	-0.125^{***}	0.047^{***}	0.008	0.040^{***}	
	(0.015)	(0.013)	(0.009)	(0.008)	
Observations	4,931	4,931	4,931	4,931	
			All Funds		
Treasury futures to assets	-0.053^{***}	0.004^{***}	-0.005^{***}	0.004^{***}	0.028^{***}
	(0.007)	(0.003)	(0.002)	(0.002)	(0.008)
Observations	183,594	183,594	183,594	183,594	183,594

- Effects on equity concentrated in balanced funds, suggest broader asset reallocation.

Why should Treasury futures holdings be complements to MBS holdings?

Fixed rate MBS and ABS are generally within investment scope.

- However, we will show they have very different duration.
  - **This matters because IID funds tend to target duration.**
  - About 35% of IID funds have an explicit duration target in their prospectus.

PACE Intermediate Fixed Income	*"...within +/- 50% of the duration of the Bloomberg US Aggregate Bond Index..."*
Invesco Core Plus Bond Fund	*"...within +/- 2 years of the benchmark index."*

  - Other funds will state ranges on duration:

Janus Henderson Flexible Bond	*...average portfolio duration typically ranges between 3 and 7 years*

- **In this section we show that futures holders tend to track their portfolio index closer overall...**

  ... but their cash duration falls relative to the benchmark.

  - Driven by differences in MBS/ABS and Treasury holdings.
  - Suggests that IID funds are using futures to manage duration.

Futures users track duration better

Measure empirical duration via a regression:

$$\text{Fund return}_{it} = \alpha_i + \delta_i \times \Delta\text{10-year yield}_t + \epsilon_{it}$$

where δ_i is fund i's empirical duration.

Compute for all IID funds and the Aggregate Index, then bin based on futures holdings.

- *Average absolute tracking error:* Average percent deviation from index across funds.
- *Share within 1-year:* Percent of funds with empirical duration within 1 year of index.

	Average duration	Difference from index	Standard error	Average absolute tracking error	Share within 1-year of index
No futures	4.51	−0.64	0.009	13.06	87.27
Low futures	4.72	−0.43	0.014	8.48	95.24
Medium futures	4.77	−0.38	0.013	10.80	90.91
High futures	4.86	−0.29	0.010	7.18	95.65
High minus no	0.35***	0.35***			8.38

Futures user duration tracking improves when futures use is higher

Repeat exercise on a yearly basis, using only returns within the year.

- Difference from index falls and share within 1-year rises during periods of high futures use.
- Similar results for average tracking error.

Note that generally funds have ***too little duration*** relative to the index.

- Therefore not surprising that long futures positions, which increase duration, improve tracking.

	2019 (high)		2021 (low)		2023 (high)	
	Diff index	Share 1-year	Diff index	Share 1-year	Diff index	Share 1-year
No futures	−0.56	81.82	−0.78	74.55	−0.59	83.64
Low futures	−0.40	85.71	−0.38	80.95	−0.32	90.48
Medium futures	−0.27	87.88	−0.48	87.88	−0.24	100.00
High futures	−0.18	93.48	−0.45	80.43	−0.04	97.83
High minus no	0.37***	11.66*	0.34***	5.89	0.56***	14.19**

Gap between cash portfolio duration and index duration grows when futures popular.

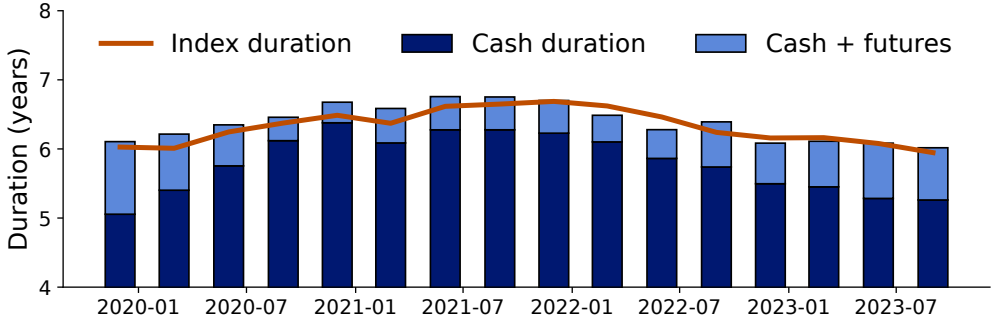
Inclusive of derivatives use, futures holders track the index better when futures are popular.

- If futures are for duration matching, expect *cash* portfolio duration to *fall* relative to benchmark.
  $\Longrightarrow$ **Futures help to fill the gap.** Detail
- Using ICE data, calculate weighted average cash duration for portfolio, asset categories.

	Dec 2019		Jun 2021		Jun 2023	
	Share	Duration	Share	Duration	Share	Duration
U.S. Treasuries	21.62	9.30	29.71	9.41	21.52	9.30
MBS	30.93	3.53	19.70	4.25	33.12	3.78
Corporate debt	21.76	5.56	25.24	7.38	22.81	5.95
ABS	2.28	1.70	2.83	2.04	3.24	1.86
Other	13.05	4.77	13.93	5.66	11.00	4.73
Fut holder duration		5.06		6.28		5.28
+ *futures*		*6.11*		*6.76*		*6.09*
Index fund duration		6.04		6.62		6.08

- **We do see a pattern of lower duration relative to the index when futures are popular.**
  - *Note ABS/MBS are lowest duration assets these funds hold.*

Futures fill the resulting gap, both in the aggregate and in panel regressions



	Δ Treasury futures duration		
Δ Cash duration	-0.360^{***}	-0.358^{***}	-0.417^{***}
Fund fixed effect		X	X
Time fixed effect			X
R^2	0.070	0.100	0.149

Changes in duration are driven by MBS and ABS

Can decompose changes in duration into changes in allocations and changes in security duration.

- **Nearly all of changes in index fund duration are due to allocations.**

Further explore effect of reallocation from Treasuries to MBS. $\Longrightarrow$ **Large effect from MBS.**

	2019-2021		2021-2023	
Decomposition of Δ	Index Fund	Futures Fund	Index Fund	Futures Fund
Δ **Total duration**	0.59	1.22	-0.54	-1.00
2021 allocations	0.55	0.73	-0.52	-0.47
2021 durations	0.08	0.52	-0.05	-0.30
Agency MBS only	0.06	1.03	-0.01	-0.90

- Consider each asset, reallocating from the rest of the portfolio in equal measure:

	Treasury	Agency MBS	Private-label MBS	Corporate Debt	CDO	Other ABS
Treasury futures	-0.186^{**}	-0.179^{**}	-0.112^{***}	0.059^{***}	-0.078^{***}	0.002
to assets	(0.092)	(0.072)	(0.028)	(0.021)	(0.027)	(0.037)

Treasury futures and MBS returns

Evidence to this point suggests:

1. Futures holders reallocate to MBS from UST.
2. Creates gap between duration of fund, index.
3. Futures are used to fill this gap.

Why tilt towards MBS?

- MBS spreads rise leading into futures growth.
- Spreads of MBS forecast futures growth.
  - See figure on right.

Shows funds tilting into MBS when rates are attractive, using futures to maintain duration.

Dep var: AM Longs / Total Longs	(1)	(2)
MBS returns		
TBA OAS	23.14^{***}	12.62^{**}
	(8.45)	(5.63)
Dollar Roll Spec	-61.30	-28.07
	(45.24)	(19.97)
Month FE	X	X
Duration/Convexity		X
R^2	0.33	0.79
Adj. R^2	0.31	0.78

Why do some funds hold more Treasury futures than others?

If holding futures allows funds to reach for yield, why is their use not more widespread?

Futures and derivatives use is often mentioned explicitly in prospectuses:

- *95%* of high-futures-use IID funds mention derivatives under principal risks.
  versus *66%* of IID funds that do not use futures.

Suggests futures users are differentiated from other funds.

- But doesn't explain what they provide to investors.

Assemble some key variables from the prospectus text:

- Share of Treasuries in benchmark index.
- Whether objectives mention total returns (focus on trading) vs. income (focus on holding).
  - Also include turnover ratio.
- Whether risks mention leverage.
- Whether strategies mention duration or mortgages.

Why do some fund use futures and not others?

	Has long Treas futures	
	IID funds	All funds
UST share		8.099^{***}
Turnover	0.016^{**}	0.003^{***}
Leverage	0.043	0.013^{***}
Duration	-0.058	0.016^{***}
Tot. return	-0.025	0.010^{***}
Income	-0.079^{**}	-0.007^{**}
Log assets	0.05^{***}	0.02^{***}
Mortgage	0.029^{***}	0.003^{***}
Index fund		-0.018^{***}
R-squared	0.232	0.254

No significant difference in performance for futures-users.

- Both outperform the Aggregate Index on average.
- However, some evidence that funds that use futures are less sensitive to performance.

Regress dummy for futures use in 2023 on fund characteristics.

- Funds likely to reach for duration:
  - Benchmarked to indices with higher Treasury weights.
  - Mention "duration" or "mortgage" in principal strategies.
- Funds that take advantage of temporary returns.
  - Higher turnover, total return objective instead of income.

Why not use repo for leverage?

Funds can achieve the same reach for duration using repo.

- Buy Treasury and borrow against it in the repo market.
- Since 2021, repo and futures are subject to same portfolio-level VaR limits.

  $\Longrightarrow$ No real difference in regulatory treatment.
- Barth and Kahn (2021) show that cash-futures basis is high when Treasury futures are popular.

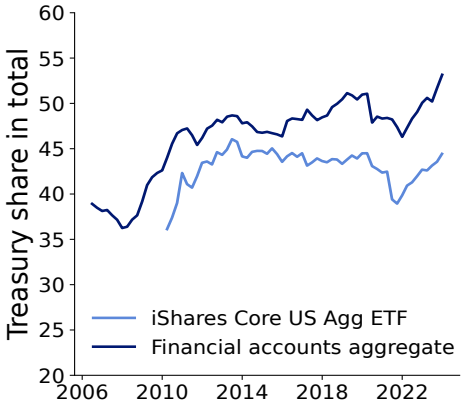
  $\Longrightarrow$ Borrowing Treasury is cheaper.

Only 1% of IID funds, 0.4% of all funds use repo. (52% of IID use futures, 9% of all funds.)

- **May be some stigma attached:**
  - 97% of funds with repo mention leverage as a risk, 80% mention repo specifically.
- **Repo is also more difficult for customers to transact in.**
  - For customer, lacks transparent pricing and electronic trading (Clark et al. (2021), Kahn et al. (2023)).
  - Pricing depends on relationships (Han et al. (2022), Huber (2023)).
  - Require trading in off-the run Treasuries.
    - Futures users hold only 54% Treasuries issued over 1-year ago, vs. 83% for index.

However, funds may use repo more as new regulations propogate through the industry.

Costs of holding Treasuries



One conclusion is that funds use Treasury futures to avoid holding cash Treasuries.

- Funds need to replicate Treasuries because they are in the benchmark index.

In turn, the Aggregate Index weight on Treasuries depends on issuance.

- Compare ETF indexed to the Aggregate and a financial accounts aggregate:

$$\frac{\text{Federal debt held by public - Fed holdings}}{\text{Estimated intermediate grade debt}}$$

As issuance increases, burden of matching Treasury share in the index will also rise.

Conclusion

We show that mutual funds are large users of Treasury futures.

- Their holdings drives a substantial share of aggregate movements in open interest.

Mutual funds use futures to reach for duration.

- Fund commonly employ futures when they move from Treasuries to MBS.
- These moves appear to be to take advantage of spreads of MBS relative to Treasuries.
- Futures offset the duration mismatch that results.

Funds that use futures appear to be differentiated.

- Likely to mention derivatives explicitly in their prospectuses and less sensitive to performance.
- Also indicate that they are more focused on duration and temporary gains from trading.

Futures and derivatives use is often mentioned explicitly in prospectus

This suggests that funds are making a longer-term strategic decision to use futures.

- More difficult to reallocate into futures for temporary gains
- Also suggests investors may be attentive to futures use.

	Mentions derivatives...			
	in Principal Strategies		in Principal Risks	
	All funds	IID funds	All funds	IID funds
No futures	27%	50%	25%	66%
Low futures	64%	82%	53%	70%
Medium futures	49%	84%	53%	86%
High futures	47%	96%	52%	95%

- About 73% of all funds that don't use Treasury futures do not use derivatives.

But, in the medium-term prospectuses can be changed.

Back

Mutual fund futures users do not appear to outperform other IID funds

	Return relative to Agg Index			Std. Dev		Flow perf coef
	Average	Beta	Alpha	Total	Duration component	
No futures	0.32	0.88	0.36	0.45	0.37	0.58
Low futures	0.34	0.93	0.38	0.45	0.39	0.51
Medium futures	0.45	0.94	0.48	0.47	0.39	0.49
High futures	0.34	0.96	0.36	0.47	0.40	0.47

No clear pattern in average returns or average alphas relative to their benchmark.

- Consistent with Koski and Pontiff (1999), Fong et al. (2005), Cae et al. (2011)
- However, beta increases and variance increases due to higher duration.

However, there do appear to be differences in how fund flows respond to performance.

- Regress monthly CRSP flows on trailing quarter performance interacted with futures use.
- **Results suggest that futures users are less sensitive to performance.**
  - Consistent with demand for these funds being segmented, investors may demand duration exposure.