Demanding Collateral

Sergio Florez-Orrego

October 2025

Abstract

This paper studies how the demand for collateral in derivatives markets influences the pricing of U.S. Treasuries. I exploit the mechanical rules set by the Chicago Mercantile Exchange (CME) governing collateral requirements for interest rate futures to study how changes in margining practices affect the aggregate need for eligible collateral—predominantly short-term Treasury securities. Combining contract-level margin data with Treasury and derivatives yields, I show that increases in required collateral lead to a significant rise in short-term Treasury convenience yields (CY). A one-billion-dollar increase in collateral demand raises the 30-day OIS–T-bill spread by about 1.4 to 1.5 basis points, implying that the 2021–2024 rise in aggregate collateral use (roughly $20 billion) accounts for 28–30 basis points of additional CY. These effects represent nearly half of the historical short-term convenience yield documented in prior work. The results highlight how margining rules and clearinghouse activity propagate into Treasury pricing, underscoring the growing link between derivatives market infrastructure and the convenience value of government debt.

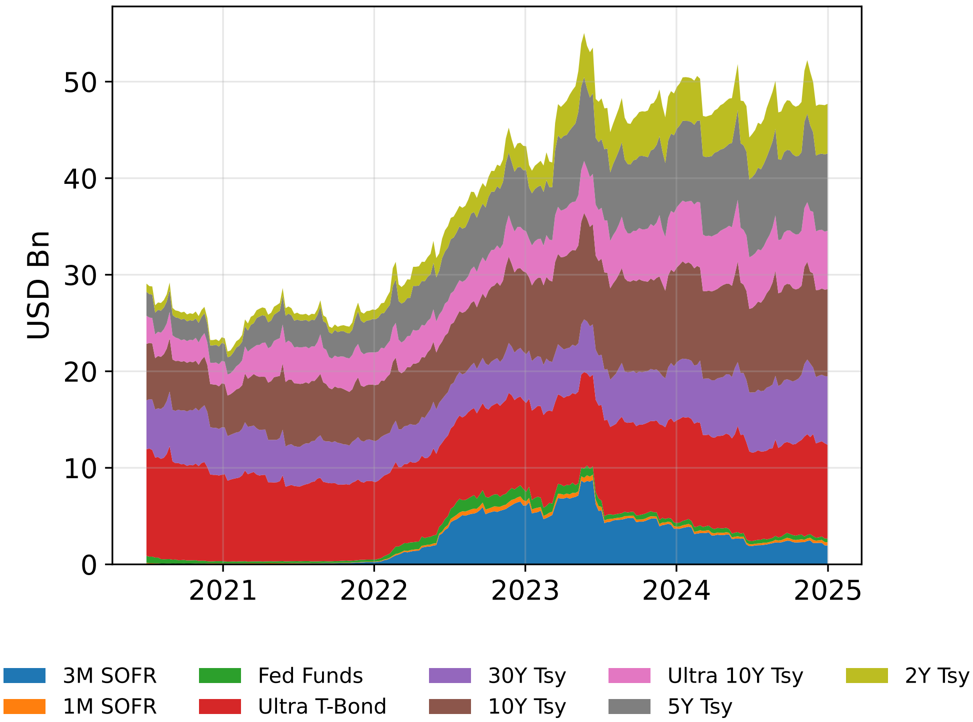
1 Introduction

U.S. Treasuries occupy a unique position in global financial markets. Beyond their role as default-free benchmark securities, they provide investors with valuable non-pecuniary benefits associated with liquidity, safety, and collateral eligibility. These benefits manifest empirically as a negative yield differential—often termed the *convenience yield* (CY)—relative to comparable non-Treasury instruments such as repos, swaps, or synthetic Treasury positions. The existence of convenience yields has been widely documented across time and maturities, and their magnitude tends to vary with the state of financial intermediation and the supply of safe assets (Krishnamurthy and Vissing-Jorgensen, 2012; Nagel, 2016; Greenwood et al., 2015; He et al., 2022).

A central insight of recent literature is that part of the convenience yield stems from the *collateral value* of Treasuries. Treasuries can be pledged to obtain funding, to meet regulatory requirements, and to open positions in centrally cleared derivatives. Their privileged eligibility within these infrastructures enhances their demand even when equivalent synthetic exposures could, in principle, be created through other instruments. For example, pure interest rate derivatives such as SOFR or Fed Funds futures can replicate the cash flows of a short-term Treasury bill, but these derivatives cannot themselves be rehypothecated as collateral to support additional trading activity. The wedge between the Treasury and its synthetic counterpart thus reflects the shadow price of collateral usefulness.

This paper studies empirically how shocks to the demand for collateral in interest rate futures markets affect short-term Treasury convenience yields. The core idea is that changes in the amount of collateral required to open or maintain positions in futures markets—largely determined by the CME's margining rules—alter the aggregate demand for eligible collateral assets, primarily short-term Treasuries. These shifts propagate to Treasury prices and, consequently, to convenience yields.

Figure 1: Rise in Collateral Demand 2021-2025

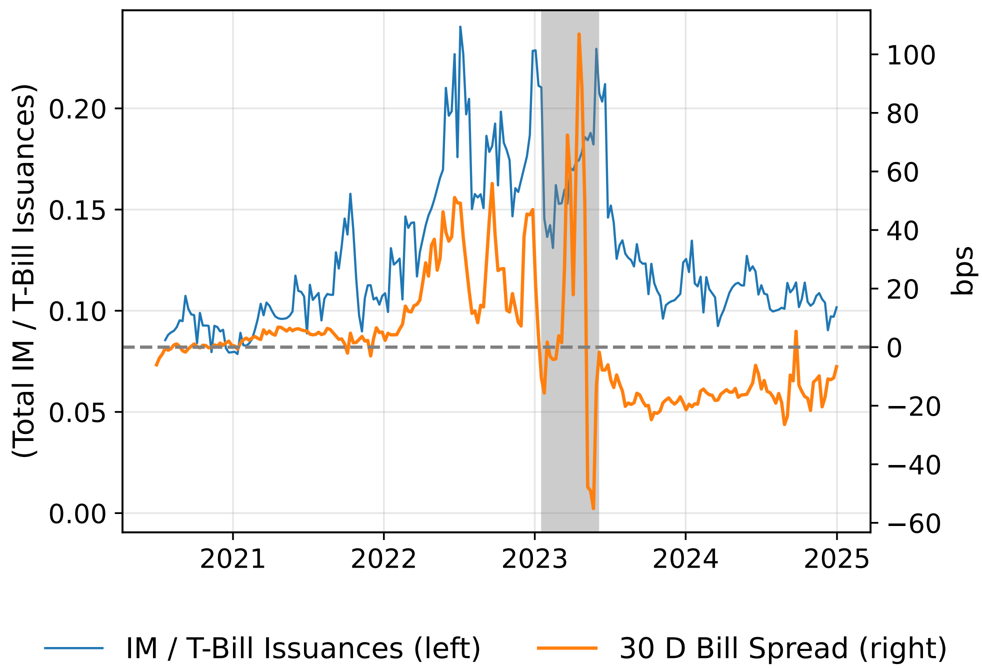


The figure reports the estimated total initial margin (IM) posted as collateral in CME interest rate futures. Total IM for each contract is calculated as the product of open interest and the corresponding per-contract initial margin requirement. Open interest data are obtained from the CFTC Commitments of Traders reports, while contract-level IM requirements come from CME's Historical Margins (Minimum Performance Bond Requirements). Aggregate IM is constructed by summing across SOFR, Fed Funds, and Treasury futures, providing an estimate of the total collateral pledged in these markets at each point in time.

Figure 1 motivates this analysis by showing the substantial increase in estimated collateral requirements—measured as aggregate initial margin (IM)—across major interest rate futures contracts since 2021. Aggregate IM is constructed as the product of contract-level margin requirements and open interest, summed across SOFR, Fed Funds, and Treasury futures. The figure illustrates a pronounced rise in total collateral posted to CME clearinghouses, from roughly $25 billion in mid-2021 to peaks above $45 billion by end-2022. The purpose of this work is to examine whether this sharp rise in collateral demand has had measurable repercussions on Treasury convenience yields.

Figure 2 provides a first look at how the evolution of collateral demand relates to short-

Figure 2: Collateral Pressure and the Pricing of Short-Term Treasuries



Notes: The figure plots the relationship between aggregate collateral demand and short-term Treasury convenience yields. The blue line shows the ratio of aggregate initial margin (IM) in CME interest rate futures to total T-bill issuance, capturing the intensity of collateral demand relative to available bill supply. The orange line (right axis) reports the 30 day (OIS − T-bill yield) spread, a standard measure of short-term Treasury convenience yields. Aggregate IM is computed using open interest from the CFTC Commitments of Traders reports and contract-level IM requirements from CME's Historical Margins (Minimum Performance Bond Requirements). T-bill issuance data are obtained from the U.S. Treasury's FiscalData.

term Treasury convenience yields. The blue line plots the ratio of aggregate initial margin (IM) to total T-bill issuance, capturing the relative scarcity pressure that futures-related collateral demand may impose on the stock of bills available in the market. The orange line (right axis) shows the spread between the 30-day OIS and the 30-day T-bill.[1] Both refer to very short-term, safe assets that normally trade at almost zero spread. When the spread rises above zero, it indicates that Treasury bills are trading at a premium. Figure 2 shows the two series move closely over the sample, with peaks in the IM-to-issuance ratio coinciding with

[1]The 30-day OIS rate refers to the fixed rate in an overnight index swap whose floating leg compounds the realized daily overnight rate (SOFR) over a 30-day period. It represents the market's expectation of the average risk-free overnight rate over the next month and serves as a close proxy for a risk-free benchmark yield of equivalent maturity.

widening OIS-bill spreads. This descriptive evidence suggests that fluctuations in collateral demand may have a direct bearing on the pricing of short-term Treasuries.

To empirically estimate the role of collateral demand in shaping Treasury convenience yields, I relate weekly changes in the aggregate initial margin (IM) measure previously introduced to changes in short-term Treasury convenience yields, measured by the spread between the 30-day OIS rate and the 30-day T-bill yield. To address potential endogeneity of collateral demand to market conditions, I implement an instrumental variables (IV) strategy that exploits variation in contract-level IM requirements set by the CME. These requirements are determined by a fixed rule specifying the dollar amount of margin that must be posted ex-ante to the clearinghouse to open each new futures position. Periodic revisions to these rules, published as discrete updates in CME's Minimum Performance Bond Requirements, induce variation in total collateral needs that is plausibly unrelated to contemporaneous Treasury pricing. This variation serves as the instrument for changes in aggregate collateral demand used to estimate their effect on convenience yields.

Estimation results indicate that a positive one-billion-dollar shock to collateral demand raises the short-term convenience yield by roughly 1.4 - 1.5 basis points. Given the observed increase of approximately twenty billion dollars in total collateral use during the sample period, this implies an overall effect of about 28 - 30 basis points on the level of convenience yields–corresponding to roughly one-half of the average short-term CY estimates reported in Greenwood et al. (2015).

I then present a second set of results that examine the sensitivity of short-term Treasury convenience yields to the level of interest rates. Following Nagel (2016), convenience yields should be positively correlated with interest rates. This occurs due to the fact that higher rates increase the opportunity cost of money, embedding interest-rate earning money-like assets with an additional monetary premium. I find that, around IM shock events, the positive slope of the convenience yield with respect to the level of interest rates is increased by roughly 0.2 basis points per percentage point increase in the Federal Funds rate. This effect, however, seems negligibe as the original estimates provided by Nagel (2016) are around 6 basis points per percentage point increase in the Federal Funds rate. All previous findings highlight the growing importance of derivatives market structure and collateral constraints in shaping Treasury pricing dynamics.

Literature

This paper relates, in first level, to a broad strand of literature on the sources of asset "specialness," which attributes interest rate differentials between comparable, collateralizable securities and the cash market to institutional requirements and frictions in the supply of collateral (Duffie, 1996; Jordan and Jordan, 1997; Krishnamurthy, 2002).[2] Episodes of margin tightening can be interpreted as exogenous increases in these underlying frictions, providing a novel way to understand why these arise.

On a second level, this work relates to the more recent work that has extended the notion of Treasury specialness beyond repo markets. Krishnamurthy and Vissing-Jorgensen (2012) provide a microfoundation for the existence of short-term and long-term convenience yields on Treasuries. Their model builds on the liquidity and safety attributes of these securities, arguing that investors derive direct utility from holding Treasuries. Empirically, they document the presence of priced liquidity and safety components consistent with the model's predictions.[3] However, their analysis relies on low-frequency data and does not address the causal identification of Treasury demand shocks, which is the focus of this paper.

Nagel (2016) likewise extends the analysis of convenience yields beyond repo markets,

[2] Here, *comparable assets* refers to securities with similar maturity and credit risk, while *collateralizable assets* are those eligible for use as collateral in repo markets.

[3] Specifically, their framework implies a negative relation between convenience yields and the supply of Treasuries, as the representative investor's marginal utility from convenience assets decreases with the level of such assets held.

studying the relation between short-term convenience yields and the level of interest rates. As previously discussed, this work finds that higher rates are associated with higher convenience yields, and attributes this fact to the increased opportunity cost of holding money when rates rise. While insightful, this interpretation remains agnostic about the underlying drivers of the opportunity cost of money. By linking margining activity to Treasury demand and short-term spreads, the present paper provides a more complete account of the market-microstructure determinants of this opportunity cost. [4]

On a third level, this paper relates to the literature that departs from the traditional Capital Asset Pricing Model (CAPM) by emphasizing the role of liquidity and institutional frictions in asset pricing. Early work such as Holmström and Tirole (2001) examines how firms' demand for liquidity affects asset prices. More recent studies highlight the role of financial intermediaries as marginal investors, showing that intermediary leverage and capital constraints generate priced risk factors (He and Krishnamurthy, 2013; Adrian et al., 2014; He et al., 2017; Hu et al., 2013; Du et al., 2023) that account for the cross-section of returns more effectively than traditional factors originally studied in the classic work of Fama and French (1992) and Fama and French (1993). This paper contributes to this line of research by showing how specific market segments—particularly those involved in futures trading—can influence the pricing of assets as fundamental as Treasury bills.[5]

Finally, this work relates to the now-standard strand of literature that studies how finan-

[4] A somewhat different approach is taken by Drechsler, Savov and Schnabl (2017), who argue that the opportunity cost of money is explained by market power in bank deposits that allow banks to increse the spreads they charge on deposits as interest rates rise. It remains to be seen whether the interpretations provided in the present paper is consistent with their findings. A more recent strand of this literature suggests, however, that Treasuries have been charaterized by inconvenience–rather than convenience yields in recent years. (He, Nagel and Song, 2022)

[5] Some additional work that studies the role of segmented arbitrage in intermediation include Siriwardane, Sunderam and Wallen (2022), d'Avernas and Vandeweyer (2024) as well as Stein and Wallen (2024). As a matter of a fact, the latter work studies the same 2022 market dislocation episode that I study in this paper, arguing that segmented arbitrage, together with inelastic money market investors, prevented the market from closing the short-term spread shown in Figure 2. I interpret rising margin requirements in interest rate futures as one of the factors that contributed to the initial widening of these spreads during this period—an issue on which Stein and Wallen (2024) remain agnostic.

cial frictions can affect macroeconomic outcomes. The classic work of Kiyotaki and Moore (1997) shows how collateral requirements can generate negative feedback loops, where falling asset prices tighten credit limits and amplify shocks. Brunnermeier and Pedersen (2009) discuss how margin requirements may trigger fire sales during episodes of market dislocation, while Gorton and Metrick (2012) show how repo markets can become sources of systemic risk. This paper contributes to this literature by showing how derivatives trading can generate financial vulnerabilities through margining practices. On a more general level, the relation between market dislocations and margining practices could be a provocative source of future research addressing whether Treasury issuance provides a public good by supplying high-quality collateral (Gorton and Laarits, 2018; Holmström and Tirole, 1998), as well as optimal debt issuance in this setting (Greenwood, Hanson and Stein, 2015).

The remainder of the paper is organized as follows. Section 2 provides institutional background on margining practices in interest rate futures and describes how CME margin rules translate into aggregate collateral demand. Section 3 details the data sources used to construct measures of collateral requirements and Treasury pricing variables. Section 4 presents the empirical framework and main results, including an instrumental-variables estimation and an event–study analysis of margining shocks. Finally, Section 5 concludes.

2 Institutional Background

2.1 Margining in Interest Rate Futures

In order to open a position in futures, traders must post collateral to the clearinghouse. This process, known as margining, ensures that all participants can meet their obligations as prices fluctuate. In the case of interest rate futures, margining is administered by the Chicago Mercantile Exchange (CME), which acts as the central counterparty for all major contracts, including SOFR, Fed Funds, and Treasury futures.

CME distinguishes between two main types of margin: initial margin (IM) and variation margin (VM). Variation margin covers mark-to-market losses and is settled daily in cash as prices move. By contrast, initial margin is posted *ex ante* as a performance bond to open new positions and is held to cover potential future exposure until the position is closed. This paper focuses on IM, as it represents the portion of margin requirements typically satisfied with securities and therefore the channel through which U.S. Treasuries enter the collateral framework.

To meet these IM obligations, the CME permits a range of assets as eligible collateral, including cash, U.S. government securities, exchange-traded funds (ETFs), and certain equities. Accepted assets are subject to haircuts that reduce their recognized collateral value based on asset type and maturity. Because U.S. Treasury bills receive the smallest haircuts among eligible instruments, they are particularly attractive for satisfying margin requirements and play a central role in meeting the collateral needs of futures markets.[6]

2.2 CME Margin Rules

The CME sets IM requirements through a mechanical rule that specifies the post-haircut dollar amount of collateral that must be posted to the clearinghouse for each contract type. In what follows, I will refer to this requirements as *IM per contract requirements*. These requirements are published as part of the exchange's 'Minimum Performance Bond Requirements' and are applied uniformly across all clearing members. The CME updates its IM require-

[6] Table A.1 summarizes CME's indicative collateral haircuts by asset class and maturity (Apr 2025). Figure A.1 illustrates the composition of collateral posted across all derivatives cleared by CME. The prominent role of U.S. Treasuries during the analyzed period is evident: their share increased from less than 20 percent of reported collateral in January 2022 to more than 55 percent by early 2024. Although CME's public disclosures do not distinguish between Treasury bills and notes, the available data—aggregated at the Treasury level—together with the haircut schedule suggest that short-term Treasury bills likely represent the most desirable form of collateral.

ments at discrete intervals, altering the total amount of collateral that must be posted for outstanding and new positions. Because these adjustments are set by rule and applied mechanically, they introduce discrete variation in aggregate collateral needs that can be used for empirical identification.

2.3 Implications for Aggregate Collateral Demand

For each futures contract c, denote by $\text{IM}_{c,t}$ the margin requirement per contract at time t and by $\text{OI}_{c,t}$ its open interest. The total initial margin posted in CME interest rate futures at time t can be expressed as:

$$\text{Total IM}_t = \sum_c \text{IM}_{c,t} \times \text{OI}_{c,t}. \tag{1}$$

This aggregate measure represents the estimated notional amount of collateral tied up in interest rate futures at any point in time. Increases in either per-contract IM or open interest both raise total collateral demand. If one treats the variation in contract-level IM requirements—set mechanically by the CME's margining rule—as plausibly exogenous to contemporaneous Treasury pricing, then this component of the aggregate measure can be used to identify the causal effect of collateral demand on convenience yields.

By combining weekly open interest data from the CFTC Commitments of Traders (COT) reports with contract-level initial margin requirements from CME's Historical Minimum Performance Bond Requirements, one can use equation 1 to construct a high-frequency proxy for the aggregate demand for eligible collateral assets. While CME's public quantitative disclosures (QD) report the composition of posted collateral, those data are available only at a quarterly frequency and are aggregated across all derivatives cleared by CME. In contrast, the IM-based measure provides a weekly series, at the level of individual contracts, that captures fluctuations in collateral demand over time with much finer temporal resolution.

3 Data

Data on open interest for interest rate futures are obtained from the CFTC Commitments of Traders (COT) reports, which provide weekly observations by contract group. The analysis focuses on SOFR, Fed Funds, and Treasury futures, all of which are cleared by the Chicago Mercantile Exchange (CME). Contract-level initial margin requirements are taken from the CME Historical Minimum Performance Bond Requirements, which specify the dollar amount of collateral that must be posted to the clearinghouse to open a new position for each contract and date. These reports record discrete updates to the margining rule that governs the level of required collateral and are available for all major interest rate futures.

Information on Treasury securities is drawn from the U.S. Treasury's FiscalData portal, which provides daily issuance data for Treasury bills by maturity. Data on amounts outstanding for Treasury securities are taken from the CRSP Daily Treasuries dataset, which reports end-of-day quantities and yields across all bill and note maturities. Yields on Treasury bills are obtained from the Federal Reserve Economic Data (FRED) database, while overnight index swap (OIS) rates—both 1-month and 1-year maturities—are taken from Bloomberg. The 30-day Treasury bill yield is used together with the 1-month OIS rate to measure short-term Treasury pricing relative to risk-free overnight rates. Additional macro-financial variables used for control purposes include the effective federal funds rate from FRED and the BoA MOVE index of Treasury market volatility from public market data.

All series are aligned at a weekly frequency, consistent with the CFTC reporting schedule and the update timing of CME margin requirements. The sample period spans June 2020 to December 2024. Observations corresponding to the 2023 debt-ceiling episode—when Treasury bill yields temporarily reflected default-risk premia rather than collateral scarcity—are excluded from all analysis.

Treasury security-level data, including yields, amount outstanding and maturity, obtained from CRSP Daily Treasuries database.

4 Empirical Analysis

This section presents the empirical framework used to estimate the effect of collateral demand in interest rate futures markets on short-term Treasury convenience yields and discusses the main results.

4.1 Empirical Strategy

The objective is to quantify how fluctuations in the amount of collateral pledged to the CME affect short-term Treasury pricing. The empirical analysis focuses on the 30-day OIS–T-bill spread, a standard measure of short-term Treasury convenience yields (CY). The key explanatory variable is the change in total collateral required to support open futures positions, measured by the weekly variation in aggregate initial margins (IM) across major CME interest rate futures.

The baseline specification relates changes in the convenience yield to changes in collateral demand and a set of control variables:

$$\Delta s_t^{30D} = \alpha + \beta \, \Delta \mathrm{IM}_t + \gamma_1 \, \Delta \mathrm{Issuance}_t + \gamma_2 \, \Delta r_t^{FF} + \gamma_3 \, \Delta \mathrm{MOVE}_{t-1} + \varepsilon_t, \tag{2}$$

where Δs_t^{30D} denotes the weekly change in the 30-day OIS–T-bill spread, $\Delta \ \mathrm{IM}_t$ the change in total required collateral across CME-cleared interest rate futures, $\Delta\mathrm{Issuance}_t$ the change in Treasury bill issuance, Δr_t^{FF} the change in the effective federal funds rate, and $\Delta\mathrm{MOVE}_{t-1}$ the lagged change in Treasury market volatility. The coefficient β captures the sensitivity of short-term convenience yields to changes in collateral demand. Panel B of Table 1 presents summary statistics for the time series used in the estimation of equation 2.

In practice, changes in total IM reflect both adjustments in CME margin requirements and fluctuations in open interest. To isolate the variation in collateral demand that affects convenience yields only through its impact on required margins, I instrument the dollar value of aggregate IM with the per-contract IM requirements set by the CME. The idea is that rule-based changes in the margin required per contract mechanically alter the total amount of collateral that must be posted for a given level of open interest, generating variation in aggregate IM that is plausibly orthogonal to shifts in traders' portfolio choices or market sentiment. In practice, CME determines per-contract IM using its SPAN (Standard Portfolio Analysis of Risk) methodology, which sets margin levels based on the simulated distribution of potential losses under different market scenarios. Market volatility enters this framework as one of the key inputs used to calibrate risk exposures. As a result, the instrument is not fully exogenous to market conditions, since increases in volatility can mechanically lead to higher margin requirements even without discretionary intervention. However, to the extent that these margin requirements are adjusted discretionally by the CME—rather than being continuously optimized by market participants—the instrument can still be viewed as a useful second-best source of variation.[7]

Given the above, the instrument is defined as a market-weighted averate of IM requirements per contract, normalized by risk, and aggregated across all CME interest rate futures. Specifically, for each contract c, the per-contract margin requirement $\mathrm{IM}_{ct}^{\mathrm{pc}}$ is normalized by its DV01, capturing the dollar value of a one-basis point change in the underlying yield. This adjustment accounts for differences in interest rate sensitivity across contracts of varying maturities and durations. Let $\mathrm{IM}_{ct}^{\mathrm{tot}}$ be the total dollar IM posted in period t for contract c. The normalized margins are then aggregated using lagged weights defined as each contract's

[7]The fact that market participants cannot perfectly anticipate or replicate CME's internal process for setting margin levels seems consistent with policy discussions, such as Abruzzo and Park (2014).

Table 1: Summary Statistics

Panel (A): Full Sample

	N. Obs	Mean	Std. Dev	Min.	Max.
30D T-Bill Spread (bps.)	205	2.62	23.02	-55.13	106.95
Issuance	205	3.98	0.85	2.23	5.79
Fed Funds (pp.)	205	2.95	2.30	0.06	5.33
IM (Bn USD)	205	38.89	9.92	22.04	55.04
MOVE Index	205	103.49	29.09	43.14	169.65

Panel (B): Excluding Debt Ceiling (Jan 2023–June 2023)

	N. Obs	Mean	Std. Dev	Min.	Max.
30D T-Bill Spread (bps.)	186	1.29	18.84	-26.44	55.90
Issuance	186	4.01	0.89	2.23	5.79
Fed Funds (pp.)	186	2.77	2.34	0.06	5.33
IM (Bn USD)	186	38.08	9.97	22.04	53.52
MOVE Index	186	100.55	28.38	43.14	158.12

Panel (C): Security-Level Summary Statistics

	N. Obs	Mean	Std. Dev	Min.	Max.
Months to maturity	1566	3.41	2.79	0.03	12.00
OIS - Yield Spread (bps.)	1566	3.15	6.97	-39.89	32.78
Amount Outstanding (Bn USD)	1566	76.00	39.52	35.00	174.99

Notes: The table presents summary statistics for the main variables used in the analysis. All summary statistics correspond to the variables in levels. Panel (A) and (B) correspond to weekly summary statistics for the series used in the baseline analysis. The 30 D-TBill Spread is reported in basis points. The Federal Funds rate is reported in percentage points. Issuance corresponds to weekly dollar issuance of T-Bills, as percentage of total T-Bill issuance in the previous 4 weeks. Panel (C) corresponds to summary statistics for the Treasury securities used in the event study, which includes observations between the weeks of January 25, 2022, and March 8, 2022. OIS - Yield spread reported in basis points. Amount outstanding reported in billion USD.

share of total dollar IM posted in the previous week:

$$w_{ct} = \frac{\mathrm{IM}^{\mathrm{tot}}_{ct-1}}{\sum_c \mathrm{IM}^{\mathrm{tot}}_{ct-1}},$$

so that

$$\mathcal{M}_t = \sum_c \left(w_{ct} \times \frac{\mathrm{IM}^{\mathrm{pc}}_{ct}}{\mathrm{DV01}_{ct}} \right) \tag{3}$$

is the instrument of interest. Intuitively, this measure isolates the variation in total required collateral driven by CME's margining rule rather than by traders' adjustments in open interest or positions. The instrument therefore captures the mechanical effect of CME's periodic revisions to margin requirements, which are published in the exchange's 'Minimum Performance Bond Requirements'. Figure A.2 in the Appendix shows the decomposition of $\mathcal{M}_t$ into its contract-level components, illustrating the discrete adjustments in per-contract margin requirements that underlie the definition of the instrument.

4.2 Empirical Results

Table 2 shows the results of estimating equation 2 under different specifications. Columns (1)-(4) present OLS specifications while columns (5)-(6) instrument total dollar IM with the aggregate measure of IM per contract as discussed previosuly.

Column (1) shows a baseline regression that only includes the controls for Issuance and the level of the Fed Funds rate, being these variables important determinants of convenience yields as highlighted by Nagel (2016). Column (2) and (3) show that the baseline effect of dollar IM on the 30D convenience yield is not statistically different from zero, both before and after controlling for market volatility captured by the MOVE Index. All regressions exclude observations between January-June 2023 as these coincide with the debt ceiling standoff. Over that period, short-dated Treasury bills briefly traded at sizable discounts to comparable safe rates, reflecting investors' reluctance to hold securities maturing near the

Table 2: Collateral Demand and Short-Term Convenience Yields

	(1)	(2)	(3)	(4)	(5)
Issuance (Std.)	-0.016	-0.016	-0.016	-0.015	-0.015
	(0.012)	(0.012)	(0.012)	(0.013)	(0.013)
Fed Funds	-0.007	-0.008	-0.012	-0.011	-0.015
	(0.062)	(0.062)	(0.064)	(0.072)	(0.073)
IM (Bn. USD)		0.382	0.378	1.496*	1.421*
		(0.408)	(0.398)	(0.881)	(0.824)
MOVE Index (Lagged)			0.049		0.047
			(0.047)		(0.053)
N. Observations	185	185	185	185	185
R-Squared (IV: F-stat 1-Stage)	0.007	0.011	0.017	107.4	120.8
Sample	2021-2024	2021-2024	2021-2024	2021-2024	2021-2024
Model	OLS	OLS	OLS	IV	IV

Notes: The table shows the result of estimating equation (2). The dependent variable is the 30D OIS - 30D TBill spread, measured in basis points. The Fed Funds rate is also expressed in basis points. Issuance is standardized across the full sample. IM is the total IM posted as collateral in interest rate futures. All regressions exclude observations between Jan-Jun 2023. NW SEs with 4-week lag reported.

projected default date.[8] In this episode, short-term Treasuries temporarily behaved less like risk-free collateral and more like risky paper, complicating the interpretation of convenience-yield movements around that period.

The IV estimates shown in columns (5)-(6) show a different story, and indicate a positive statistically significant relationship between collateral demand and short-term convenience yields. A one-billion-dollar increase in required collateral raises the 30-day OIS-T-bill spread by approximately 1.4 to 1.5 basis points. Given the observed increase of roughly twenty billion dollars in aggregate collateral use between 2021 and 2024–shown in figure 1– this implies an overall effect of about 28-30 basis points on the level of short-term convenience yields. These magnitudes correspond to roughly one-half of the average short-term convenience yield reported in Greenwood et al. (2015).

Table A.2 in the appendix reports the results of estimating equation 2 in levels. For the OLS specifications, the coefficient on IM is positive and significant, and quantitatively similar to the baseline results presented in Table 2. For the IV specifications, the coefficient on IM roughly halves when excluding market volatility and becomes statistically insignificant after controlling for it. This attenuation likely reflects the high correlation between CME margin requirements per contract and market volatility—highlighting the previously discussed challenge of finding a fully exogenous instrument for IM requirements. In this specification, the MOVE Index appears to absorb much of the variation in IM per contract that was exploited for identification in the baseline regression.

Table A.3 in the appendix reports the results of estimating equation 2 under the difference specification, but using the VIX on Treasuries to control for Treasury market volatility (columns (1)-(2)), and the VIX on the S&P 500 (columns (3)-(4)) as a control for flight to safety. Though the point estimates as of similar magnitude as those in table 2, the effect is

[8] This is also evidenced by the spike in the 30-day (OIS–T-bill yield) spread above 100 basis points, as shown in Figure 2.

non statistically different from zero.

4.3 Event–Study Evidence

To complement the baseline regression results, I conduct an event–study analysis that examines how the sensitivity of short-term Treasury convenience yields (CY) to the level of short-term interest rates changes following discrete shocks to CME initial margin (IM) requirements. This exercise builds on the intuition in Nagel (2016), who shows that higher policy rates are typically associated with increases in short-term convenience yields, and tests whether such sensitivity itself varies with collateral demand pressures in derivatives markets.

The idea is that a positive shock to CME margin requirements raises the amount of Treasuries pledged as collateral. If Treasuries become more "in demand" for collateral use, their convenience value should increase—and so should their responsiveness to changes in the Fed Funds rate. In other words, the slope of the CY–Fed Funds relation is expected to steepen following an IM shock.

I define IM shocks as the largest discrete increases in CME margin requirements, measured by the IM instrument $\mathcal{M}_t$ defined in equation 3. Specifically, I compute the week-on-week percentage change in $\mathcal{M}_t$ and identify IM shock weeks as those in the 99th percentile of positive changes. Two episodes stand out under this criterion: (i) the second week of February 2022 and (ii) the second week of March 2023. Because the latter coincides with the 2023 debt-ceiling episode, the analysis focuses primarily on the February 2022 event.

In order to obtain cross-sectional variation in short-term convenience yields, I construct a CUSIP-level measure of CY using all Treasury bills in the CRSP Daily Treasuries database with remaining maturities below one year. For each security i on day t, I compute the spread between the matched-maturity overnight index swap (OIS) yield and the observed Treasury yield, $s_{it}^{\text{bps}} = r_t^{\text{OIS}} - y_{it}^{\text{Tbill}}$, expressed in basis points. The OIS rate is linearly interpolated to match each bill's residual maturity, ensuring that the spread captures the pricing wedge between a synthetic and an actual Treasury position of comparable duration. As in the baseline specification, higher s_{it}^{bps} indicates a stronger convenience yield—that is, a larger premium investors are willing to pay to hold that specific bill as collateral. This CUSIP-level construction allows the event-study specification to exploit within-week variation in convenience yields across individual Treasury securities.

4.3.1 Specification

The daily event-study regression is defined as:

$$s_{it}^{\text{bps}} = \alpha + \gamma_r \, r_t^{\text{pp}} + \sum_{w=-3}^{3} \gamma_w^l \, \mathbb{1}(t \in w) + \sum_{w=-3}^{3} \gamma_w \left(\mathbb{1}(t \in w) \, \times \, r_t^{\text{pp}} \right) + X_t + \varepsilon_{it}, \tag{4}$$

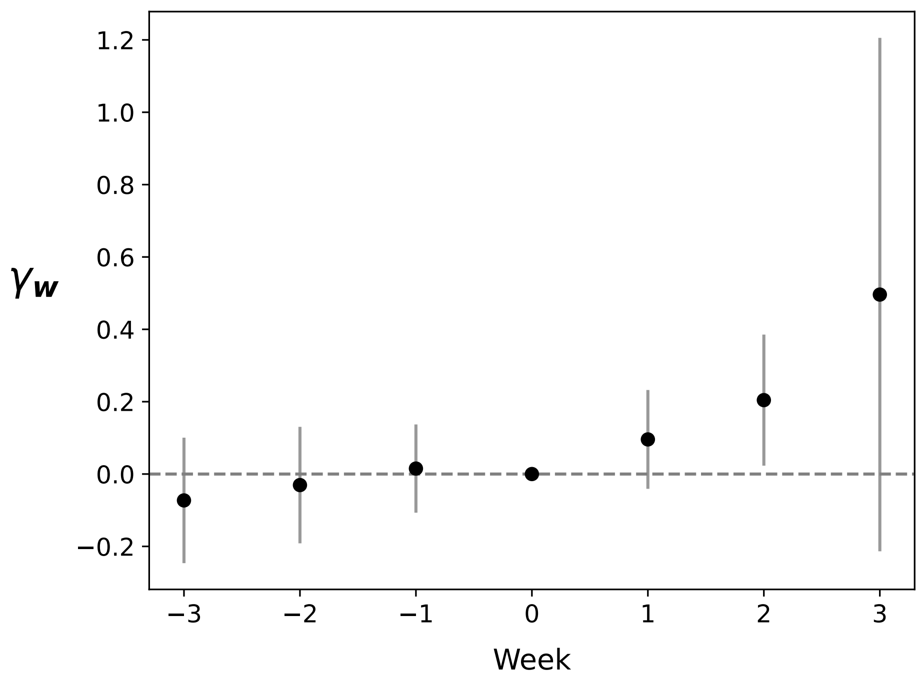
where s_{it}^{bps} denotes the maturity-interpolated OIS–yield spread for Treasury CUSIP i at day t, expressed in basis points, r_t^{PP} is the effective Federal Funds rate, expressed in percentage points,[9] and $\mathbb{1}(t \in w)$ is a lead/lag indicator that equals one for days falling within event window w relative to the IM shock week. The vector X_t includes as daily-varying controls (i) Treasury bill issuance within the week in USD, (ii) the Bank of America MOVE index of Treasury volatility, and (iii) expected short-term rates as implied by 1M and 3M SOFR futures. The main coefficients of interest $\{\gamma_w\}_{w=-3}^{3}$ are the ones corresponding to the interaction terms of the Fed Funds rate and the lead/lag indicators. Panel (C) of table 1 presents summary statistics for the Treasury securities used in the event study analysis.

[9] The selection of units is done in order to report estimates that are consistent in scale with Nagel (2016), who reports estimates of CY in basis points per percentage point of Federal Funds rate.

4.3.2 Results

Figure 3 plots the estimated coefficients γ_w from Equation (4). The results indicate that the responsiveness of convenience yields to the federal funds rate increases by roughly 0.2 basis points per percentage point change in the policy rate, about two weeks after the IM shock. This finding is consistent with the notion that higher collateral requirements amplify the convenience value of Treasuries. However, the effect is estimated with considerable noise and ceases to be statistically distinguishable from zero three weeks after the shock.

Figure 3: Event Study Results



Notes: Event–study estimates of the response of Short Term Treasury convenience yields to the federal funds rate around a discrete increase in CME margin requirements (February 2022). The figure reports coefficients γ_w from Equation (4). The specification controls for market volatility using the MOVE index. Standard errors are robust.

Figure A.3 in the appendix replicates the analysis controlling instead for the CBOE Volatility Index (VIX) on Treasury securities. The results are quantitatively unchanged: the slope of the CY–Fed Funds relation rises after the IM shock in 0.2 bps per percentage point Federal Funds increase, implying that Treasury convenience yields become more sensitive to monetary policy when collateral demand is high.

Overall, this evidence reinforces the baseline finding: margining shocks not only elevate the level of short-term convenience yields, but also intensify their sensitivity to monetary policy, highlighting the transmission channel from derivatives market infrastructure to Treasury pricing dynamics.

5 Conclusion

This paper quantifies how collateral demand in derivatives markets affects the pricing of U.S. Treasuries. Using variation in CME margin requirements as an exogenous source of collateral shocks, I show that a one-billion-dollar increase in required collateral raises short-term Treasury convenience yields by about 1.4–1.5 basis points. Given the roughly twenty-billion-dollar increase in collateral use between 2021 and 2024, these estimates imply a 28–30 basis-point rise in convenience yields—nearly half the historical short-term premium documented in prior studies.

Extensions reveal that the sensitivity of convenience yields to monetary policy also strengthens following margining shocks, suggesting that collateral constraints amplify the transmission of policy through the Treasury market. Taken together, the results highlight that clearinghouse margining practices and derivatives activity are increasingly central to the pricing dynamics of U.S. government debt.

References

Abruzzo, Nicole and Yang-Ho Park, "An Empirical Analysis of Futures Margin Changes: Determinants and Policy Implications," Finance and Economics Discussion Series 2014-86, Board of Governors of the Federal Reserve System 2014.

Adrian, Tobias, Erkko Etula, and Tyler Muir, "Financial Intermediaries and the Cross-Section of Asset Returns," *Journal of Finance*, December 2014, *69* (6), 2557–2596. Federal Reserve Bank of New York Staff Report No. 464 (July 2010; rev. 2013).

Brunnermeier, Markus K. and Lasse Heje Pedersen, "Market Liquidity and Funding Liquidity," *Review of Financial Studies*, 2009, *22* (6), 2201–2238.

d'Avernas, Adrien and Quentin Vandeweyer, "Treasury Bill Shortages and the Pricing of Short Term Assets," *The Journal of Finance*, December 2024, *79* (6), 4083–4141.

Drechsler, Itamar, Alexi Savov, and Philipp Schnabl, "The Deposits Channel of Monetary Policy," *Quarterly Journal of Economics*, 2017, *132* (4), 1819–1876.

Du, Wenxin, Benjamin M. Hébert, and Amy Wang Huber, "Are Intermediary Constraints Priced?," *The Review of Financial Studies*, 2023, *36* (4), 1464–1507.

Duffie, Darrell, "Special repo rates," *The Journal of Finance*, 1996, *51* (2), 493–526.

Fama, Eugene F. and Kenneth R. French, "The Cross-Section of Expected Stock Returns," *The Journal of Finance*, 1992, *47* (2), 427–465.

Fama, Eugene F. and Kenneth R. French, "Common risk factors in the returns on stocks and bonds," *Journal of Financial Economics*, 1993, *33* (1), 3–56.

Gorton, Gary and Andrew Metrick, "Securitized banking and the run on repo," *Journal of Financial Economics*, 2012, *104* (3), 425–451.

Gorton, Gary B and Toomas Laarits, "Collateral Damage," Working Paper 24298, National Bureau of Economic Research February 2018.

Greenwood, Robin, Samuel G Hanson, and Jeremy C Stein, "A comparative-advantage approach to government debt maturity," *Journal of Finance*, 2015, *70* (4), 1683–1722.

He, Zhiguo and Arvind Krishnamurthy, "Intermediary Asset Pricing," *American Economic Review*, 2013, *103* (2), 732–770.

He, Zhiguo, Bryan Kelly, and Asaf Manela, "Intermediary asset pricing: New evidence from many asset classes," *Journal of Financial Economics*, October 2017, *126* (1), 1–35.

He, Zhiguo, Stefan Nagel, and Zhaogang Song, "Treasury Inconvenience Yields during the COVID-19 Crisis," *Journal of Financial Economics*, 2022, *143* (1), 57–79.

Holmström, Bengt and Jean Tirole, "Private and Public Supply of Liquidity," *Journal of Political Economy*, 1998, *106* (1), 1–40.

Holmström, Bengt and Jean Tirole, "LAPM: A Liquidity-Based Asset Pricing Model," *Journal of Finance*, 2001, *56* (5), 1837–1867.

Hu, Grace Xing, Jun Pan, and Jiang Wang, "Noise as Information for Illiquidity," *Journal of Finance*, 2013, *68* (6), 2341–2382.

Jordan, Bradford D. and Susan D. Jordan, "Special Repo Rates: An Empirical Analysis," *Journal of Finance*, 1997, *52* (5), 2051–2072.

Kiyotaki, Nobuhiro and John Moore, "Credit Cycles," *Journal of Political Economy*, 1997, *105* (2), 211–248.

Krishnamurthy, Arvind, "The Bond/Old-Bond Spread," *Journal of Financial Economics*, 2002, *66* (2-3), 463–506.

Krishnamurthy, Arvind and Annette Vissing-Jorgensen, "The aggregate demand for Treasury debt," *Journal of Political Economy*, 2012, *120* (2), 233–267.

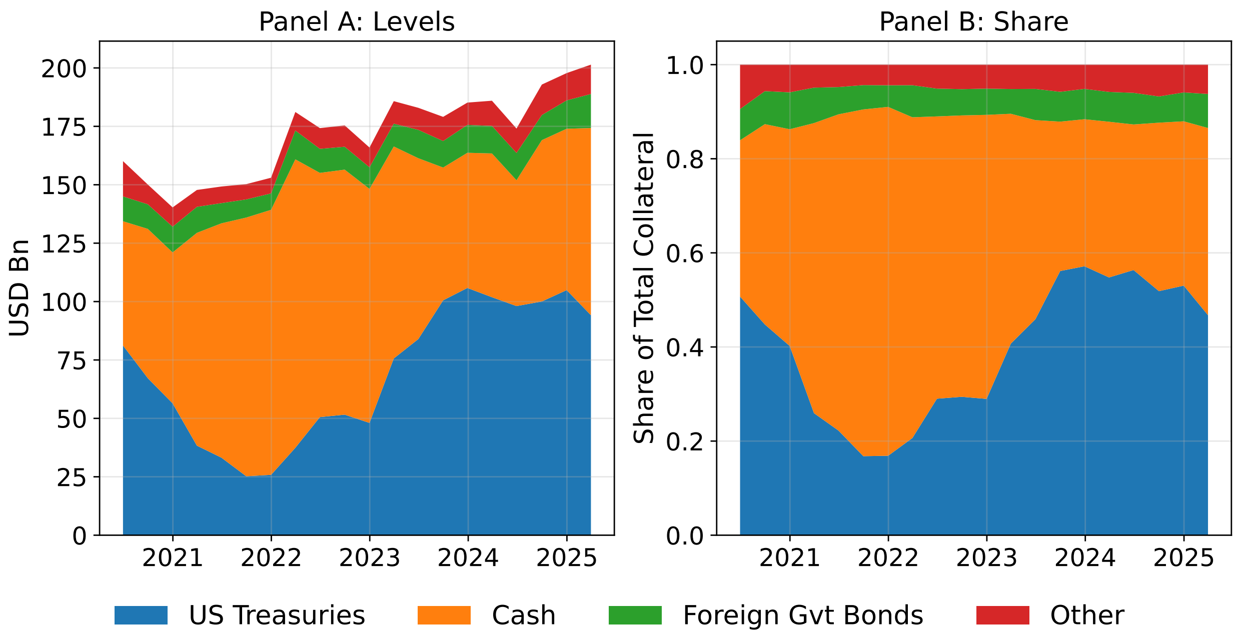
Nagel, Stefan, "The liquidity premium of near-money assets," *Quarterly Journal of Economics*, 2016, *131* (4), 1927–1971.

Siriwardane, Emil, Aditya Sunderam, and Jonathan L. Wallen, "Segmented Arbitrage," NBER Working Paper 30561, National Bureau of Economic Research, Cambridge, MA October 2022.

Stein, Jeremy C. and Jonathan Wallen, "The Imperfect Intermediation of Money-Like Assets," *Journal of Finance*, 2024. Forthcoming.

Appendix

Figure A.1: CME Reported Collateral



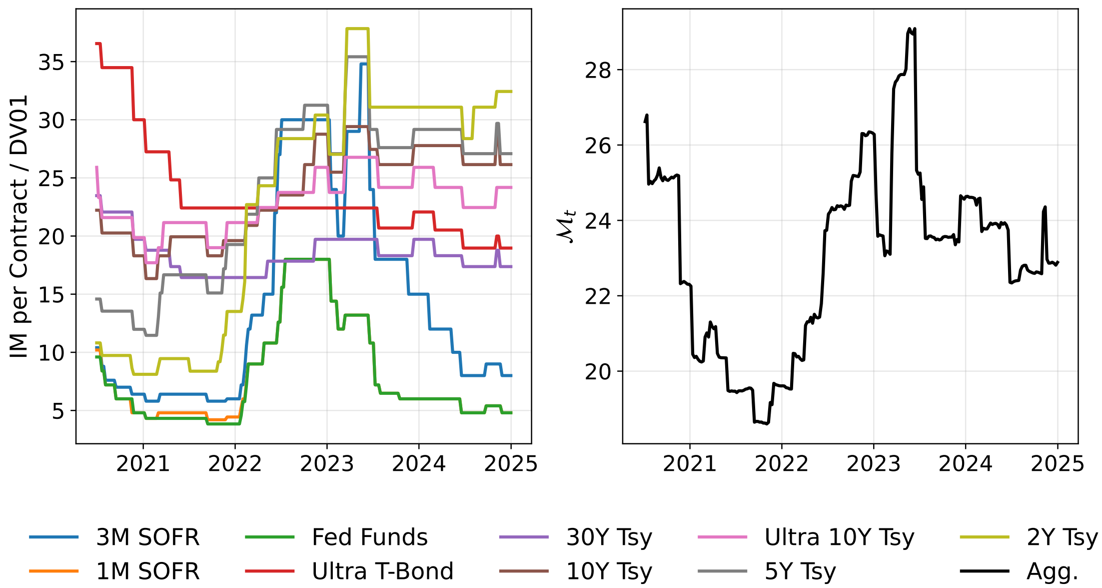
Notes: Figure shows initial margin posted by clearing members at CME, by asset class, as reported in CME Quantitative Disclosures (QD). Panel A shows the total initial margin posted, while Panel B shows the shares posted by asset class as a proportion of total initial margin. QD data are reported at a quarterly frequency.

Table A.1: CME Haircuts in Acceptable Collateral (Apr 2025)

Asset Class	**Typical Haircut (approx.)**	**Notes on Haircuts by Maturity**
Cash (Same Currency)	0%	
U.S. Treasury Bills	0.5%	
U.S. Treasury Notes/Bonds	1–8%	1% ($\leq$ 1 yr), 2% (1-3 yr), 3%-4.5% (3-10 yr), 8% ($>$10 yr)
U.S. TIPS	1–8%	Same schedule as Notes/Bonds
TSTRIPS	11%	
U.S. Agencies	3.5–9%	3.5–4% ($\leq$ 5 yr), 5.5% (5-10 yr), 9% ($>$10 yr)
Agency MBS	11%	
Supranationals (IBRD)	3–5%	
Foreign Sovereign Debt	5–10.5%	
Canadian Provincials	25%	
Cash (Foreign Currency)	5–15%	
Gold / Gold Warrants	15%	
IEF2 Money Market Funds	2%	
IEF4 / Corporate Bonds	20–30%	
Stocks	30%	
ETFs	25%	
Short-Term U.S. Treasury ETFs	3%	

Notes: Haircuts represent the percentage discount applied to the market value of collateral posted to satisfy margin requirements at the Chicago Mercantile Exchange (CME). Reported values are approximate and correspond to typical ranges applied as of April 2025. Source: CME Clearing Advisory Acceptable Collateral and Haircuts (April 3, 2025).

Figure A.2: IM per contract and Aggregate IM Instrument



Notes: The left panel displays the risk-normalized margin requirement per contract ($\text{IM}^{\text{pc}}_{ct}/\text{DV01}_{ct}$) across major CME interest rate futures, computed from CME's 'Minimum Performance Bond Requirements'. The right panel shows the corresponding aggregate instrument series $\mathcal{M}_t$, obtained as the lagged-collateral-weighted average of contract-level values (equation 3). Contract weights are defined by each contract's lagged share of total collateral, measured as open interest multiplied by per-contract IM. Together, these plots illustrate how discrete updates to CME's rule-based margining framework generate high-frequency variation in required collateral that underlies the empirical instrument.

Table A.2: Collateral Demand and Short-Term Convenience Yields, Levels

	(1)	(2)	(3)	(4)	(5)
Issuance (Std.)	-0.198***	-0.186***	-0.139***	-0.195***	-0.139***
	(0.030)	(0.026)	(0.030)	(0.018)	(0.023)
Fed Funds	0.009	-0.084***	-0.069***	-0.020***	-0.021***
	(0.009)	(0.020)	(0.019)	(0.005)	(0.005)
IM (Bn. USD)		2.157***	1.104***	0.645***	-0.116
		(0.434)	(0.426)	(0.042)	(0.152)
MOVE Index (Lagged)			0.211***		0.241***
			(0.059)		(0.047)
N. Observations	186	186	186	186	186
R-Squared (IV: F-stat 1-Stage)	0.671	0.732	0.761	12025.0	778.1
Sample	2021-2024	2021-2024	2021-2024	2021-2024	2021-2024
Model	OLS	OLS	OLS	IV	IV

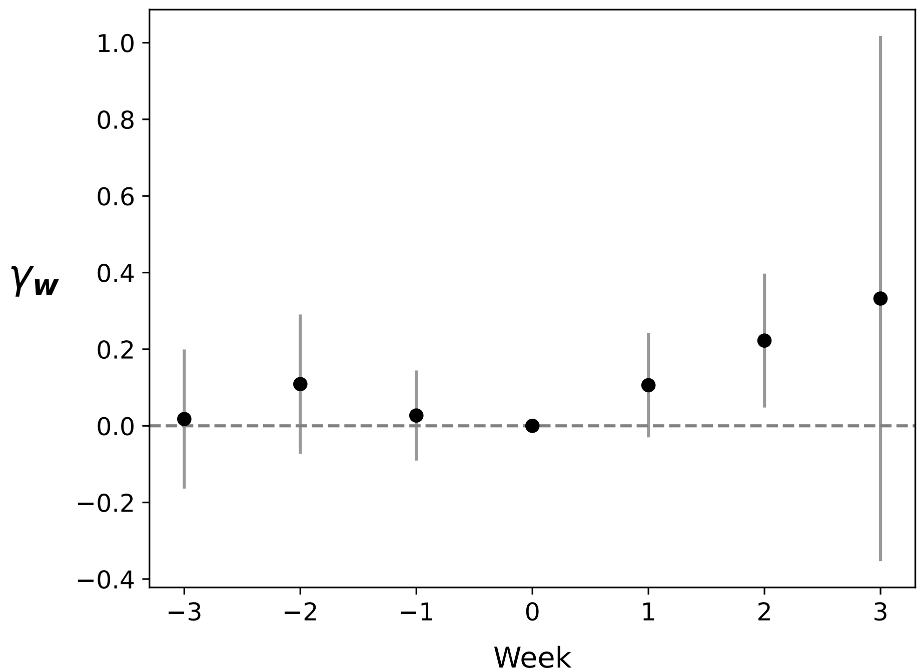
Notes: Table shows the result of estimating equation (2) in levels. The dependent variable is the 30D OIS - 30D TBill spread, measured in basis points. The Fed Funds rate is also expressed in basis points. Issuance is standardized across the full sample. IM is the total IM posted as collateral in interest rate futures. All regressions exclude observations between Jan-Jun 2023. Standard Errors are Newey-West with 4-week lag.

Table A.3: Collateral Demand and Short-Term Convenience Yields, VIX Robustness

	(1)	(2)	(3)	(4)
Issuance (Std.)	-0.016	-0.015	-0.016	-0.015
	(0.012)	(0.013)	(0.012)	(0.013)
Fed Funds	-0.008	-0.011	-0.008	-0.010
	(0.063)	(0.071)	(0.063)	(0.072)
IM (Bn. USD)	0.391	1.137	0.382	1.133
	(0.408)	(0.714)	(0.408)	(0.710)
VIX (Treas., Lagged)	0.070	0.114		
	(0.126)	(0.184)		
VIX (S&P 500, Lagged)			-0.001	-0.001
			(0.146)	(0.153)
N. Observations	185	185	185	185
R-Squared (IV: F-stat 1-Stage)	0.012	132.9	0.011	137.5
Sample	2021-2024	2021-2024	2021-2024	2021-2024
Model	OLS	IV	OLS	IV

Table shows the result of estimating equation (2) using the VIX on Treasuries (columns (1)-(2)), and the VIX on the S&P 500 (columns (3)-(4)) as a control for market volatility. The dependent variable is the 30D OIS - 30D TBill spread, measured in basis points. All regressions exclude observations between Jan-Jun 2023.

Figure A.3: Event Study Results, using VIX Treasuries



Notes: Event–study estimates controlling for market volatility using the Treasury VIX.