Brookings Papers
ON ECONOMIC ACTIVITY

BPEA Conference Draft, March 27-28, 2025

Treasury Market Dysfunction and the Role of the Central Bank

Anil K Kashyap (University of Chicago)

Jeremy C. Stein (Harvard University)

Jonathan L. Wallen (Harvard Business School)

Joshua Younger (Columbia University)

Conflict of Interest Disclosure: Anil K Kashyap receives compensation for occasional speaking engagements with financial services firms. Joshua Younger contributed to this paper while he was a senior policy advisor at the Federal Reserve Bank of New York and a lecturer in law at Columbia University. As of February 3, 2025, he is employed at Tudor Investment Corporation, a Brookings donor (Tudor's longstanding financial support to Brookings is not in any way related to this article or Younger's authorship). The authors did not receive financial support from any firm or person for this paper. The views expressed in the paper are authors' own and do not necessarily represent the views of the Tudor Investment Corporation, the Federal Reserve Bank of New York, or the Federal Reserve System. Brookings is committed to quality, independence, and impact in all of its work. Activities supported by its donors reflect this commitment and the analysis and recommendations are solely determined by the scholars.

ANIL K KASHYAP
University of Chicago, CEPR and NBER

JEREMY C. STEIN
Harvard University and NBER

JONATHAN L. WALLEN
Harvard Business School

JOSHUA YOUNGER
Columbia University

Treasury Market Dysfunction and the Role of the Central Bank[*]

First draft: January 2025
This draft: March 2025

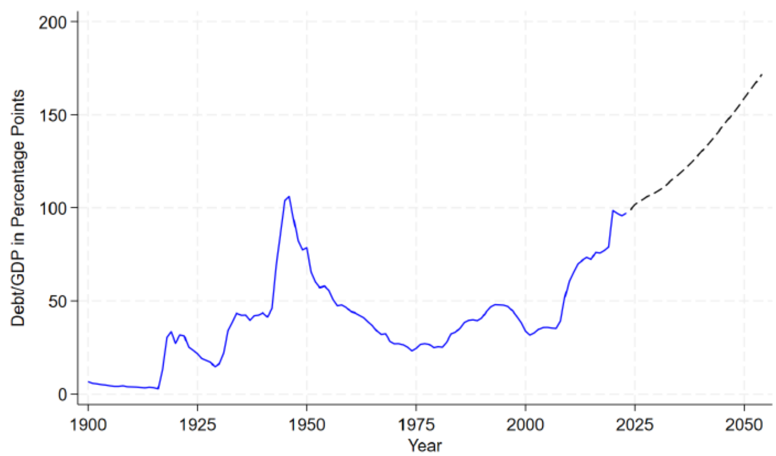
ABSTRACT: We build a simple model that shows how the incentives and constraints facing three key types of market players—broker-dealers, hedge funds, and asset managers—interact to create a heightened level of fragility in the Treasury market, and how this fragility can become more pronounced as the supply of Treasury securities increases. After validating a number of the model's empirical premises and implications, we ask what it can tell us about how the Federal Reserve might best address future episodes of market dysfunction. In so doing, we take as given that an important priority for any Fed response to Treasury-market dysfunction is that it be clearly separated from anything having to do with monetary policy.

[*] Draft prepared for *Brookings Papers on Economic Activity*, March 2025 meeting. We thank Citadel Securities for graciously sharing their data on the Treasury-futures basis, and Wenxin Du, Janice Eberly, Jon Hall, Sam Hanson, Andrew Hauser, Vicky Saporta, Hyun Song Shin, Dan Tarullo, Mark Van Der Weide, and Annette Vissing-Jorgensen for helpful comments.

I. Introduction

The market for U.S. Treasury securities is enormous: as of Q3 2024, federal debt held by the public of $28.3 trillion represented 96% of GDP, close to an all-time high. And Congressional Budget Office projections show the debt-to-GDP ratio continuing to climb rapidly in the coming years, as shown in Figure 1. These facts raise two principal concerns. First, there are questions regarding debt dynamics and fiscal sustainability. As the debt burden grows and interest costs become a larger share of GDP, will the U.S. at some point be forced by the bond market to make an undesirably sharp adjustment in fiscal policy?

Figure 1: Federal Debt Held by the Public



This figure shows the federal debt held by the public as a percentage of GDP from 1900 to 2023 (the solid blue) and Congressional Budget Office projections of this ratio from 2024 to 2054 (black dashes).

Second, there are risks of market dysfunction and financial instability. The Covid-triggered turmoil in the Treasury market in March of 2020 highlighted the nature of these risks. Dealers were overwhelmed with selling pressure, measures of trading costs spiked, and dealer-provided intermediation contracted. These problems threatened to spill over into other markets as well, potentially interrupting the smooth flow of credit and impairing the implementation of monetary policy. It is natural to wonder whether such episodes of fragility will become more frequent and/or more severe as the Treasury market continues to grow.

This paper focuses on these market-functioning issues and seeks to make three contributions. We begin by developing a simple model that highlights the incentives and constraints facing three types of market players: broker-dealers, hedge funds, and asset managers.

These incentives and constraints can interact to create fragility in the Treasury market, fragility which can become more pronounced as the stock of Treasury securities increases. The model's mechanism is not the only potential driver of dysfunction, but changes in market structure and regulation in recent years have arguably increased its importance and impact.

Next, we explore a number of the model's premises and implications, including several which can help us understand the events of March 2020 (Duffie, 2020; Liang and Parkinson, 2020; Schrimpf, Shin and Sushko 2020; Vissing-Jorgensen 2021; Barone et al. 2022; Menand and Younger, 2023). And finally, we ask how the Federal Reserve might best address future episodes of Treasury market dysfunction. Crucially, we take as given that an important priority for any Fed response is that it clearly separate monetary policy from financial stability operations. That was arguably not the case with the Fed's massive bond-purchase response to the market turmoil of March 2020 (Fleming et al., 2021; Duffie and Keane, 2023), which over the following months morphed into a longer period of more traditional monetary-policy-motivated quantitative easing (Kashyap, 2024; Menand and Younger, 2025).

The basic logic behind our model can be described as follows. Asset managers—who we think of as an aggregate of institutions such as bond mutual funds, pension funds, and insurance companies—are the only agents in the model who take on unhedged interest-rate (or "duration") risk. Their preferences therefore determine the term premium on long-term Treasury bonds. Importantly, consistent with the empirical work of Barth et al. (2024), asset managers choose to take this duration risk both by investing in cash Treasury bonds and by taking long positions in Treasury derivatives such as futures and swaps. This allows them to meet their benchmark duration targets while conserving some balance-sheet space to invest in higher-yielding corporate bonds.[1]

Hedge funds and dealers cater to the asset managers by taking short positions in Treasury derivatives. They then hedge these short positions with offsetting purchases of cash Treasury securities. Thus, these two agents are essentially providing inventorying services to asset managers, taking on to their balance sheets some of the Treasury securities that the asset managers prefer to hold synthetically, i.e., off of their own balance sheets. In equilibrium, hedge funds and dealers are compensated for these services via a positive spread between the return on cash Treasuries and the implied return on Treasury derivatives. In this regard, it should be emphasized

[1] For example, an insurance company or pension fund will typically want to have a long-duration asset portfolio to match the interest-rate exposure of its liabilities.

that the presence of hedge funds in the Treasury market is not an exogenous cause of fragility. If they were somehow prevented from participating in the market, the demand for long derivatives positions on the part of asset managers would inevitably draw forth another type of counterparty, which would potentially introduce a different set of vulnerabilities.

A crucial feature of both our model, and of reality, is that when hedge funds engage in the basis trade, their long positions in cash Treasuries are financed almost entirely by borrowing using them as collateral in the market for repurchase agreements, or repos—they are, in other words, highly levered.[2] This arrangement is inherently fragile. Any exogenous shock that reduces the wealth of the hedge funds or impairs their access to funding can lead to sharp unwinds. That is, hedge funds can be forced to simultaneously sell cash Treasuries and reduce their short positions in Treasury derivatives, leading to a spike in the price differential between these two markets.

In the short run, unwinds by hedge funds are absorbed by the broker-dealers. However, the balance-sheet capacity of the dealers is limited by a variety of regulatory and other factors. This suggests that fire sales of basis positions not only generate a significant dislocation between cash and derivatives prices, but also cause the dealers to rearrange the rest of their balance sheets so as to pull back on their other key market functions, namely providing liquidity to traders in the Treasury market, and intermediating the repo market. Consequently, unwinds by hedge funds lead not only to a widening of the basis between cash Treasuries and derivatives, but also to increases in measures of secondary-market trading costs, as well as in repo intermediation spreads.[3]

How might the Federal Reserve best address such a market-stress scenario? In recent years, proposals have been put forward on a number of fronts, including: (i) adjusting regulations thought to restrict dealer capacity, including the supplementary leverage ratio (SLR); (ii) the creation of a broad-based standing Fed repo facility, by which the Fed could lend directly to hedge funds;[4] (iii) the imposition of minimum margin requirements on repo-financed Treasury purchases; and (iv) a mandate for clearing trades through a centralized counterparty.[5] As we discuss below, while these proposals could be helpful, they are unlikely to be a panacea in cases when the unwind is powerful

[2]Repos refer to the purchase of securities in exchange for cash (the opening leg) by a lender along with an agreement to sell those securities back to the borrower at a slightly higher price on a future date (the closing leg). Thus, repos are similar to secured loans for which the securities function as collateral to protect the lender against losses in the event of default. The difference between the price on the closing and opening leg is essentially the interest rate for that loan.
[3] Schrimpf, Shin and Sushko (2020), and Kruttli et al (2021) describe a similar hedge-fund unwind mechanism.
[4] See, e.g., G30 (2021), and Logan (2020).
[5] See, e.g., Duffie (2020); Inter-Agency Working Group (2021); Yadav and Younger (2025).

enough. Indeed, in March 2020 the Fed did temporarily exclude Treasuries and reserves from the computation of the leverage ratio, as well as lend against Treasuries in the repo market. Yet quelling the market dislocations ultimately required the Fed to buy massive quantities of cash Treasuries to ease the pressure on dealer balance sheets and restore some semblance of market function.[6]

While these purchases were ultimately successful in the goal of reducing market disorder (Logan, 2020), they arguably had a significant unintended cost. Without a clear upfront distinction between bond-buying for market-function purposes, versus for monetary-policy purposes, the initial round of Treasury purchases in the spring of 2020 morphed into a broader monetary policy effort that eventually saw the Fed add over $4 trillion to its combined holdings of Treasuries and agency mortgage-backed securities by mid-2022.[7] And, as documented by Levin, Lu, and Nelson (2022), given the subsequent surge in inflation and the accompanying series of hikes in policy rates, this volume of asset purchases ended up reducing the present value of Fed remittances to the Treasury by roughly $800 billion, potentially representing a substantial hit to taxpayers.

Our diagnosis of the root causes of Treasury-market fragility suggests a novel approach that the Fed could take if faced again with a similar situation. The key observation is that the fire sale by hedge funds, which in turn creates the severe strain on dealer balance sheets, is not just an outright liquidation of Treasury securities. Rather, it is an unwinding of a *hedged* long-cash-Treasuries/short-derivatives position. Thus, to relieve the stress on dealers, it would be sufficient for the Fed to take the other side of this unwind, purchasing Treasury securities, and fully hedging this purchase with an offsetting sale of futures; this is in effect a more surgical approach to bond-buying. The blunter policy of simply buying unhedged cash bonds from the dealers—i.e., taking

[6] In the short period between the beginning of March 2020 and the end of May, the Fed bought approximately $1.6 trillion of Treasury bonds. $362 billion of these purchases were done in a *single week*, from March 25th to April 1st. Source: https://fred.stlouisfed.org/series/TREAST.

[7] By "morphing," we mean that the stated rationale for asset purchases evolved over the course of 2020, even as the purchases themselves continued at a high level. The initial March 15 FOMC announcement stated that purchases of up to $500 billion of Treasuries and $200 billion of mortgage-backed securities were intended to "support the smooth functioning of markets…" One week later the Fed uncapped the size of the purchases saying that it would continue purchases "in the amounts needed to support smooth market functioning and *effective transmission of monetary policy to broader financial conditions*" (emphasis added). So almost from the outset market stability and monetary policy objectives were conflated. By September, Treasury-market conditions had clearly normalized, yet the intention to expand holdings at the current pace was reconfirmed. The rationale given at that time was that purchases were needed "to sustain smooth market functioning and help foster accommodative financial conditions, thereby supporting the flow of credit to households and businesses," with the latter being an overtly monetary-policy objective. And the $80 billion-dollar monthly pace of Treasury purchases remained in place for another year after that.

duration risk off their hands—does not provide them with any extra relief relative to this hedged approach, as they tend not to have any duration exposure in the first place (Lu and Wallen, 2024).

A primary advantage of the Fed taking this hedged approach to bond-buying is that it avoids the need to pre-specify an unwind date for the policy. It has been argued by, e.g., English and Sack (2024) that an important imperative for market-function bond purchases is that they be clearly distinguished from monetary-policy-motivated purchases. Duffie and Keane (2023) suggest that one way to do so is to require the central bank to commit in advance to liquidating securities when market functionality is sufficiently restored. However, it can be challenging for the central bank to commit in advance to a fixed schedule for liquidating bonds, to the extent that it does not know how long a period of market stress will last. Our hedged-purchase approach effectively finesses this problem by embedding the duration-neutrality, and hence the crucial distinction from monetary policy, in the short derivatives position. This eliminates the need for the Fed to specify when it will begin selling bonds and allows it to keep helping with market function for as long as needed, without inadvertently generating any signal about the stance of monetary policy.[8]

Shorting futures alongside purchases of bonds is also consistent with the Fed's current playbook. The Fed regularly engages in repo transactions, either through standing facilities or temporary open market operations. Like the closing leg of a repo, futures represent a contractual agreement to sell securities on a future date at a price agreed to at the time of trade. Basis trades of the sort we have in mind involve a spot purchase and future sale. This makes them conceptually very similar to repo transactions, with the key difference between the two being different counterparties for the purchase and sale. To be clear, the specific legality of our proposal in the context of the Fed's current understanding of its own statutory constraints is an important question, but beyond the scope of this discussion.[9] We focus on the economic rationale for such actions.

[8] Another point is that if term premia are not entirely forward-looking and are determined not only by the expected future amount of duration removed, but by current flows, then pre-announcing the future reversal of an unhedged bond-buying policy will not neutralize the immediate impact of current purchases on the term premium. And this term premium impact will again raise the specter of monetary policy. Hedged purchases get around this problem as well.

[9] The FOMC has repeatedly authorized the New York Fed to transact in foreign exchange derivatives such as forward contracts (e.g., FOMC, 2022). Also, in one instance in 1974, the New York Fed assumed a large portfolio of foreign exchange derivatives from Franklin National Bank to avoid exacerbating stress in the market at the time (Brimmer, 1976). Notably, it did so prior to Franklin's failure in October of that year. It is also worth noting that Section 4 of the Federal Reserve Act empowers the Federal Reserve Banks to "make contracts" and grants "such incidental powers as shall be necessary to carry on the business of banking within the limitations prescribed by this Act." Both have been used at times to justify actions similar to those considered here, including repo (Menand and Younger, 2023) and derivative exposures taken on during the Fed response to the 2008 Global Financial Crisis (Alvarez et al., 2008).

Moral hazard is a natural concern for a policy which removes the main risk that hedge funds face when taking leveraged positions in cash-futures basis. We discuss this issue in detail below, but two points are worth flagging up front. First, in contrast to unhedged bond purchases (i.e., quantitative easing), the prospect of hedged purchases does not have the same potential to create a "Fed put" with respect to interest-rate risk (Haddad, Moreira, and Muir, 2024) and so is less distortive in this sense. Second, any remaining moral hazard issues can be partially mitigated with a Bagehot (1873)-like design whereby the Fed stops short of fully insulating the hedge funds from losses while still limiting broader spillovers to the rest of the system.

The remainder of the paper is organized as follows. In Section II we develop our model and flesh out its distinctive empirical content. In Section III we present a range of evidence, in an effort to provide support for the model's main premises and predictions. Section IV discusses the policy implications of our framework, and Section V concludes.

II. A Model of Treasury-Market Fragility

A. Demand Curves for Cash Treasuries and Treasury Derivatives

We develop a simple static model of the Treasury market with two traded securities: long-term zero-coupon cash Treasury bonds, which are available in supply S_T, and derivatives on these same bonds, which are in zero net supply. These derivatives can be thought of as representing either Treasury futures or interest-rate swaps on Treasuries; given that our model lacks multiple trading periods, it does not allow for a clear distinction between the two.[10] To keep things simple, we label these derivatives "futures" throughout what follows. The futures and cash bonds in our model always have the same dollar duration, and therefore perfectly hedge each other. There is also a short-term riskless asset available in perfectly elastic supply. This riskless asset has a return of r_{short}, which is exogenous and can be thought of as determined by monetary policy.

Denote the price of the zero-coupon Treasury bond as P_T, and the price of the one-period-ahead futures contract as P_F. In the absence of arbitrage, spot-futures parity would imply that:

[10] Both futures and swaps are derivatives that provide exposure to interest rate risk. A futures contract provides an investor with a claim to a Treasury to be delivered at a future date. A swap contract pays an investor (the "fixed receiver") a series of fixed interest rate payments in exchange for a series of floating interest rate payments. Swaps tend to be longer maturity contracts than futures so that investors in futures typically face greater rollover risk if they opt to maintain their positions over longer horizons. Our static model does not speak to these multi-period issues.

$$P_F = P_T(1 + r_{short}) \tag{1}$$

We are going to consider scenarios where this parity condition is violated. In such scenarios, we define a Treasury cash-futures basis, denoted x, by:

$$P_F = P_T(1 + r_{short} + x) \tag{2}$$

Thus, the return from the arbitrage trade of buying cash Treasuries and selling futures is: $\frac{P_F}{P_T} - 1 = r_{short} + x$, which is the risk-free rate plus the Treasury cash-futures basis. Our analysis below solves for the endogenous value of x.

There are three types of market participants, all of whom are active in both securities: dealers *D*, hedge funds *H*, and asset managers *A*. We describe each of them in turn.

Dealers are atomistic, perfectly competitive, and present in unit measure. They fully hedge interest-rate risk, so their long demand for cash Treasuries is equal to their short position in futures: $D_{DT} = -D_{DF}$; we confirm this full-hedging assumption empirically below. Dealers perform two basic functions: (i) they engage in *intraday* market making; and (ii) they may also take a position in the Treasury-futures basis, that is, they may arbitrage differences in the returns on cash Treasuries and futures. Such arbitrage positions are held *overnight.*

Intraday market-making works as follows: at the beginning of each day, each dealer sets aside an amount of balance-sheet space *M* for that day's market-making activity. Per unit of capital, they earn an expected return above the risk-free rate of $\phi s(M)$, where ϕ is a productivity parameter, and $s(M)$ is the bid-ask spread in the cash Treasury market. Competition among dealers implies that $s(M)$ is declining in the *aggregate* market-making capital *M* of the entire dealer sector, although each individual dealer takes *s* as exogenously given—i.e., they are price-takers. To keep things simple, we assume that at the aggregate dealer sector level, $s(M) = a - bM$: bid-ask spreads are linearly declining in the total capital devoted to market-making.

Dealers may also arbitrage the Treasury cash-futures basis, by buying cash Treasuries and shorting futures. In undertaking these two activities, dealers face a balance sheet constraint, which implies that their long demand for Treasuries (those which they hold overnight to engage in the Treasury-futures basis trade), plus their capital devoted to intraday market-making, cannot exceed some fixed capacity constraint K_D. Thus, we have: $D_{DT} + M \leq K_D$.

The optimization problem of the dealers is therefore to maximize $D_{DT}(r_{short} + x) + M(r_{short} + \phi s(M))$, subject to: $D_{DT} + M \leq K_D$. It follows from the dealers' first-order condition that if the balance-sheet constraint binds $x = \phi s(M)$. Simply put, when balance-sheet capacity is scarce, dealers equalize the excess returns from allocating this capacity to the two activities. This suggests an immediate empirical implication: in times of stress, when the balance-sheet constraint is most likely to be binding, we should expect the Treasury-futures basis, and measures of Treasury market liquidity, to co-move closely together.

Given that $s(M) = a - bM$, we can substitute this into the first-order condition to get $M = \frac{a}{b} - \frac{x}{b\phi}$. Intuitively, a bigger Treasury-futures basis means less capital devoted by dealers to market-making. We then have the following expression for dealer Treasury demand:

$$D_{DT} = K_D - \frac{a}{b} + \frac{x}{b\phi}\,. \qquad (3)$$

For dealers to choose to allocate some of their scarce capacity to both market-making and cash-futures arbitrage, we require $0 < D_{DT} < K_D$, which in turn requires $bK_D + \frac{x}{\phi} > a > \frac{x}{\phi}$. Intuitively, if the first unit of market-making is too profitable, dealers would be at a corner doing only market-making; if it is too unprofitable, dealers would be at a corner doing no market-making.

In the context of our model, **Hedge funds** should be thought of as representing the subset of these funds which focus on relative value strategies.[11] Relative value strategies seek to profit from small price discrepancies between similar securities rather than from outright directional bets. Therefore, the hedge funds in our model are like the dealers in that they too fully hedge against interest-rate risk, and they too face a capacity constraint, which in this case can be thought of as determined by how much equity they have raised from their investors. The one key difference is that hedge funds lever their Treasury positions by borrowing against these Treasuries in the repo market at the short-term rate of r_{short}, so they only need to put up a small fraction $\gamma \ll 1$ of their equity for each unit of a long Treasury position.[12] Hence their balance-sheet constraint is: $\gamma D_{HT} +$

[11] This is a significant subset of hedge funds. Statistics published by the SEC showed \$1.3 trillion in net assets at relative value funds as 2024 Q2, including \$900 billion focused specifically on sovereign bond arbitrage. That is comparable to other categories of hedge fund strategies such as long/short equity funds (\$1.2 trillion) and global macro funds (\$1.2 trillion). https://www.sec.gov/files/investment/private-funds-statistics-2024-q2.pdf

[12] More broadly, γ should be interpreted as the total capital required to maintain the relative value trade by the hedge fund, inclusive of repo haircuts, futures initial margin, and firm-specific risk limits.

$X_H \leq E_H$, where X_H represents other (proprietary) equity-financed hedge-fund investments, and E_H is hedge-fund equity capital. In this case, we assume that these other investments are not perfectly scalable at the individual hedge-fund level, and that each fund is aware of the fact that taking on more of these investments lowers their excess returns relative to the short rate. In particular, each hedge fund understands that $r_H(X_H) = r_{short} + c - \beta X_H/2$, where c is a proxy for the quality of the hedge-fund opportunity set.

Given our assumptions, each hedge fund earns a net dollar return given by:

$$D_{HT}\big((1-\gamma)x + \gamma(x + r_{short})\big) + X_H r_H(X_H). \tag{4}$$

Equation (4) reflects the fact that hedge funds use a mix of repo borrowing and their own equity to fund their basis-trading positions. For the fraction $(1-\gamma)$ funded at the repo rate r_{short}, the hedge fund earns the cash-futures basis x. For the fraction γ funded with equity, the hedge fund earns the cash-futures basis plus the risk-free rate $(x + r_{short})$, since in this case they do not have to repay any borrowing.

Each hedge fund seeks to maximize its net return in (4) subject to the constraint that $\gamma D_{HT} + X_H = E_H$, taking into account that $r_H(X_H) = r_{short} + c - \beta X_H/2$. This yields the following expression for hedge-fund Treasury demand:

$$D_{HT} = \frac{E_H}{\gamma} - \frac{c}{\beta\gamma} + \frac{x}{\beta\gamma^2}. \tag{5}$$

We require $\beta E_H + \frac{x}{\gamma} > c > \frac{x}{\gamma}$ to ensure that hedge funds allocate some of their portfolios to both activities. In words, the return on the first unit of the alternative investment has to exceed the levered return on the Treasury-futures basis (so that hedge funds do some of the alternative investment), but it cannot be too high (or hedge funds will not do any basis trading).

Asset managers can be thought of as representing "real money" investors such as bond mutual funds, pension funds, and insurance companies**.** They are the only agents in our model who bear interest-rate risk. We assume that they do so by taking long positions in both Treasury securities and Treasury futures. For simplicity, we assume a fraction θ of that total position is in futures, i.e., their allocation across futures and securities is invariant to the basis. But their activity will affect the pricing of the basis, with increased demand for futures increasing the basis, x.

These assumptions are intended to capture key aspects of the incentives and constraints facing two different subgroups of asset managers. The first subgroup are liability-driven investors (LDIs), primarily insurance companies and pension funds. These institutions typically have very long-dated liabilities: roughly 15 years for pensions and often longer for life insurance companies. This gives them a risk-management motive to hold long-duration assets. But they also want significant exposure to corporate credit risk, in order to generate higher yields to cover their costs. Thus, the ideal asset for them would in principle be a very long-dated corporate bond.

The market, however, produces far less long-maturity high-grade corporate credit than needed to meet potential LDI demand. As of 2024 Q3, Fed Flow of Funds data show approximately \$16.2 trillion of defined-benefit pension fund liabilities (\$3.2 trillion for private plans and \$13 trillion for public plans) and \$9.9 trillion of life-insurance liabilities.[13] By contrast, of the more than \$8.6 trillion of investment-grade corporate debt outstanding at that time, only \$2.8 trillion had a remaining maturity greater than 10 years.[14] LDIs therefore have an incentive to hold some of their cash portfolio in shorter-maturity corporate bonds and to use interest-rate derivatives to synthetically extend their overall asset-side duration so as to better match the duration of their liabilities. Given extensive disclosure of their exposures, life insurance companies provide a good test of this hypothesis: as of the end of 2023, roughly half of the \$3.1 trillion notional of over-the-counter derivatives in their portfolio were interest-rate positions (Raimondi and Piccin, 2024).

Bond funds are the other important subgroup of asset managers. Mutual funds own roughly \$5.5 trillion of debt securities and exchange-traded funds own \$1.7 trillion.[15] Approximately \$900 billion of that is actively managed (TBAC, 2024). Much like life insurers and pension funds, actively managed bond funds often seek higher returns by overweighting short-term credit and using derivatives to extend the maturity of these positions so that their interest rate risk is not too far off from benchmarks such as the Bloomberg U.S. Aggregate Index. However, it is worth noting that, unlike LDIs, bond funds predominantly use exchange-traded futures, rather than over-the-counter swaps, for this purpose. Barth et al. (2023) document that mutual funds made up 53% of

[13] FRB Z.1 FL574190043, and FRB Z.1 FL544190005, respectively.
[14] Taken from the J.P. Morgan Global Aggregate Bond Index as of September 2024 month-end.
[15] FRB Z.1 LM654022005

all asset-manager long Treasury futures positions in June 2023, and that between 2021 and 2023, they accounted for 62% of the increase in total open interest in long Treasury futures.

Although these are the specific stories we have in mind, for simplicity we take a shortcut and do not explicitly incorporate the credit-risk aspect of asset managers' decision. Instead, we just assume that asset managers as a broad group have an aggregate demand for duration risk that depends on the excess return to bearing this risk. A simple mean-variance formulation yields:

$$D_{AT} + D_{AF} = A(\theta r_F + (1-\theta)r_T - r_{short}), \tag{6}$$

where we have normalized the variance of interest-rate risk to unity, and A is the risk-tolerance-adjusted scale of the asset-management industry. Here r_T is the yield on the cash Treasury bond, and r_F is defined by $r_F = r_T - x$, which is the Treasury yield less the cash-futures basis. In our model, asset managers pay the Treasury cash-futures basis for the convenience of holding Treasuries off-balance sheet—i.e., in futures rather than securities. Thus r_F is the implied rate of return on their long futures position, which is less than that on the cash Treasury security.

B. Market Clearing

Given equations (3), (5), and (6), we can now equate supply and demand in the two markets. The cash Treasury market clears when $D_{DT} + D_{HT} + D_{AT} = S_T$. This implies:

$$K_D - \frac{a}{b} + \frac{x}{b\phi} + \frac{E_H}{\gamma} - \frac{c}{\beta\gamma} + \frac{x}{\beta\gamma^2} + (1-\theta)A(\theta r_F + (1-\theta)r_T - r_{short}) = S_T \tag{7}$$

The futures market clears when $D_{DT} + D_{HT} = D_{AF}$, so that the short futures positions of the dealers and the hedge funds equal the long positions of the asset managers. This implies:

$$K_D - \frac{a}{b} + \frac{x}{b\phi} + \frac{E_H}{\gamma} - \frac{c}{\beta\gamma} + \frac{x}{\beta\gamma^2} = \theta A(\theta r_F + (1-\theta)r_T - r_{short}) \tag{8}$$

Solving, we have:

$$(\theta r_F + (1-\theta)r_T) - r_{short} = S_T/A \tag{9}$$

In other words, the term premium—expressed as a weighted average of long-term Treasury and implied futures rates less the short rate—is pinned down by the supply of Treasuries S_T relative to the aggregate risk tolerance A of the asset-management sector. This makes intuitive sense, as the asset-management sector is the only one that absorbs duration risk, and hence it is the only one whose preferences should matter for the term premium.

With the term premium thus pinned down as in (9), the dealers and the hedge funds determine the size of the basis x to be:

$$x = \left[\frac{b\phi\beta\gamma^2}{b\phi+\beta\gamma^2}\right]\left(\theta S_T - K_D - \frac{E_H}{\gamma} + \frac{a}{b} + \frac{c}{\beta\gamma}\right) \tag{10}$$

Unpacking equation (10) helps us understand the economic determinants of the basis. First, the basis is increasing in Treasury supply S_T. As S_T rises, asset manager demand for futures goes up. This demand must be accommodated by the dealers and the hedge funds, who sell them the futures and take offsetting positions in cash Treasuries. Effectively, the dealers and the hedge funds must in equilibrium be compensated for using their scarce balance-sheet capacity to hold the cash Treasuries that the asset managers are themselves unwilling to hold.[16] It therefore makes sense that this compensation, i.e., the basis, is reduced when either dealer balance-sheet capacity K_D or hedge-fund equity E_H is larger, or when the alternative investment opportunities for these two players, as indexed by a and c respectively, are less attractive.

Note too that as Treasury supply S_T goes up, and the basis x widens, the scale of hedge funds' levered positions in the Treasury-futures arbitrage trade increases. This is apparent from equation (5). And as we will argue momentarily, it is an important reason an expanded supply of Treasuries can make the market more fragile.

[16] Again, in the more elaborate story that we have in mind, asset managers would prefer not to take all of their duration risk in the form of cash holdings of Treasuries, because they want to also save space in the cash portion of their portfolios for credit-risky corporate bonds. Being on the wrong side of the Treasury-futures basis is the price they pay to dealers and hedge funds for allowing them to expand their risk-taking beyond what their balance sheets alone allow.

C. Is the Basis Always Positive?

In our model, the Treasury-futures basis x is always positive. This is because the asset-manager sector is assumed to have a structural demand to be long Treasury futures, which pushes the price of these futures up, and the rate down, relative to that on cash Treasuries. As we document below, the basis has indeed been largely positive since the Global Financial Crisis (GFC). Prior to that time, however, it was often negative, sometimes significantly so. This is seen most clearly in the matched-maturity swap spread, or the differential between the yield to on a recently issued Treasury bond and the fixed rate on a swap with the same maturity date. These swap rates were higher than Treasury yields in the period prior to the GFC, in contrast to the current configuration (He et al., 2022; Du et al., 2023). Indeed, the hedge fund Long-Term Capital Management famously had a huge position in the reverse of the basis trade in the late 1990s, being short cash Treasuries and long Treasury derivatives—a trade which helped to precipitate its downfall in 1998 when, in the wake of a Russian sovereign-bond default, there was a flight to cash Treasuries which pushed down their yields sharply relative to the rates on the corresponding derivatives.[17]

What explains the difference in the sign of the basis pre- and post-GFC? Although it is hard to provide a completely definitive explanation, Hanson, Malkhozov and Venter (2024) suggest that the role of the government-sponsored enterprises (GSEs) is an important part of the story. In particular, prior to the GFC, the GSEs had large portfolios of mortgage-backed securities, whose interest-rate risk they sought to hedge by taking short positions in derivatives, i.e., the reverse of what we see today from asset managers.[18] Another possible factor pre-GFC was structural demand for long positions in cash Treasuries from foreign central banks which at the time were rapidly accumulating foreign exchange reserves that were predominantly invested in U.S. dollars (see e.g., Zhang and Martínez García, 2024). Both of these forces have reversed since the GFC: the GSEs have unwound most of their retained portfolio of mortgage-backed securities, foreign exchange reserve accumulation has slowed, and foreign central banks have been diversifying the currency exposure of their reserves away from U.S. dollar investments.

[17] See President's Working Group on Financial Markets (1999).

[18] More generally, Hanson, Malkhozov and Venter (2024), and Du, Hebert, and Li (2023) show that prior to the GFC, dealers tended to be short cash Treasuries on net, rather than long, as they are in the current environment. This is what one would expect from their arbitrage role if the sign of the basis were reversed.

D. The Treasury Market Under Stress

To see how Treasury-market fragility plays out in our model, consider an adverse shock that hits the hedge-fund sector and forces them to unwind their highly leveraged positions. To keep the math as simple as possible, assume that this is an "MIT shock," meaning that it is unanticipated *ex ante*, so that the preceding expressions for prices prior to the realization of the shock are unchanged. One plausible shock could be an unexpected and large increase in the margins required for the hedge funds to maintain their futures positions.

Margin generally comes in two forms: initial and variation. Variation margin is driven by the *actual* mark-to-market gains or losses of any given position. Initial margin is required regardless of the mark-to-market of the position (e.g., at inception of a trade, when there are not yet any realized gains or losses) and ensures that counterparties are overcollateralized with respect to any *potential* losses in the event of a failure. When volatility in markets increases, the dealers and centralized counterparties offering leverage through both cash lending (e.g., repo) and derivatives (e.g., futures and swaps) think of themselves as more exposed to such losses, and hence increase initial margin requirements (see e.g., Heckinger et al., 2016; BIS, 2022).

Although margin calls are a danger in any highly levered position, the risk of this form of forced de-levering is particularly acute in basis trades (Younger, 2021). This is because the two legs of the trade are separately margined. A basis position that is fully hedged against interest rates when viewed as a whole will have gains on one leg *vis-a-vis* one counterparty offset by losses with another counterparty. In the event the hedge fund defaults, the counterparty with unrealized losses has no claim on the counterparty with unrealized gains and is thus exposed to the risk of loss on only the leg of the trade in which they directly participate. This segmentation of collateral means that, as interest-rate volatility rises, hedge funds find themselves the subject of margin calls on both legs of the trade, despite having no overall interest rate risk or any unrealized gains or losses.

This is precisely what happened in March 2020. Rising volatility led clearinghouses to rapidly increase initial margin requirements on futures contracts, particularly on those on longer maturity Treasuries.[19] While prudent from the perspective of their own risk management, this

[19] Initial margin requirements for some Treasury futures contracts more than tripled in a few days (Younger 2021). Cunliffe (2022) reports that, across all central counterparties, "initial and variation margin increased significantly, with the increase in IM totaling around $300 billion in March 2020 and the increase in VM flows peaking at $140 billion during the height of the stress in mid-March."

decision amplified volatility. Margin calls act as a negative wealth shock, forcing hedge funds to raise cash by either unwinding positions or selling other assets (Aramonte et al., 2023).

Apart from this margins-based dynamic, one can also imagine various other mechanisms that lead to unwinds of hedge-fund basis trades. For example, diversified hedge funds might experience negative returns on their other, non-Treasury trades, and be forced to cut back their positions across the board, either as a means of risk management, or because of withdrawals of investor capital (Shleifer and Vishny 1997). Alternatively, an initial exogenous increase in the demand for dealer market-making services, as parametrized by a in the model, could lead dealers to shift capacity away from arbitraging the basis, thereby causing an initial widening of the basis that, given their leverage, could have a powerful impact on hedge-fund capital.

For starkness, let us consider the extreme case where the hedge fund sector is forced to exit the basis trade entirely. This leaves broker-dealers as the only remaining agents available to arbitrage the basis, which widens sharply as a result of this fire sale. Specifically, the post-stress level of the basis is now given by:

$$x = b\phi\left(\theta S_T - K_D + \frac{a}{b}\right) \tag{11}$$

Comparing (10) and (11), the widening of the basis will be most pronounced when γ is small, i.e., when hedge funds use more leverage in the pre-shock period; high pre-shock leverage makes the post-shock deleveraging effect particularly powerful. Moreover, because the dealers' first order condition $x = \phi s(M)$ continues to hold, the widening of the basis is accompanied by a commensurately large erosion in the secondary-market trading liquidity of Treasury securities.

It should be emphasized that these deleveraging effects occur even when we assume—as we have thus far—that the repo market continues to function frictionlessly in the stress scenario. That is, we have so far maintained the premise that hedge funds are able to borrow in the repo market at the short-term riskless rate r_{short} even under stress; their unwinding of their positions is due only to a shock to their capital, not to any contraction in their access to funding. Of course, any deterioration in repo market access for hedge funds will only increase the pressure on them to unwind their basis trades. We turn to this possibility next.

E. Endogenizing Repo Market Conditions

Rather than assuming that hedge funds can always borrow in the repo market at the riskless short-term rate r_{short}, we can add a bit of realism by having broker-dealers intermediate any repo market lending to hedge funds. Concretely, assume that dealers have a unique advantage in that they alone can borrow on a collateralized basis against cash Treasury securities at r_{short}—one can think of them as borrowing from a set of unmodelled money-market funds with whom they have well-developed relationships. The dealers then turn around and lend on a collateralized basis to the hedge funds at a higher rate r_{repo}, which is endogenously determined; the premise here is that the hedge funds, lacking the same relationships, are unable to borrow directly from the money funds and hence require the dealers to intermediate the repo lending for them.

Denote the amount of capital allocated to repo-market intermediation by R, where each unit of capital earns ψ units of the repo intermediation spread $(r_{repo} - r_{short})$ on top of the short rate. The dealers' revised optimization problem therefore is to maximize:

$$D_{DT}(r_{short} + x) + M(r_{short} + \phi s(M)) + R(r_{short} + \psi(r_{repo} - r_{short})), \qquad (12)$$

subject to $D_{DT} + M + R \leq K_D$.From this new first-order condition, we have that when the balance-sheet constraint binds, $\psi(r_{repo} - r_{short}) = x = \phi s(M)$. When balance-sheet capacity is scarce, dealers equalize the excess returns from allocating this capacity across all three activities: market-making, the Treasury-futures basis trade, and repo lending to hedge funds. This suggests in times of stress, when the balance-sheet constraint is most likely to be binding, we should expect all three of the Treasury-futures basis x, the repo intermediation spread $(r_{repo} - r_{short})$, and measures of market liquidity $s(M)$ to co-move closely together.

This endogenous behavior of the repo spread adds another amplification mechanism to the fire-sale spiral that hits the Treasury-futures basis when an adverse shock hits. As the basis initially widens and hedge funds begin to liquidate their positions, broker-dealers withdraw from intermediating the repo market, putting another source of pressure on the hedge funds to unwind.

On the one hand, this logic makes clear why there have been calls to have the Federal Reserve lend against Treasury securities directly to entities like hedge funds at times of market stress, thus bypassing the need to have broker-dealers, with their limited balance-sheet capacity, intermediate this lending.[20] On the other hand, while helpful, such direct Fed repo lending is unlikely to be a panacea. We have argued that sharp unwinds by hedge funds of their highly leveraged Treasury-futures basis trades can occur even in a frictionless repo market that offers unchanging rates and access in a stress scenario; the root source of these unwinds can be various shocks to hedge fund capital, not limitations on their ability to borrow against Treasury collateral.

F. Summary of Model Implications

To briefly summarize the model's key premises and predictions, we have five maintained assumptions that form the starting point for our analysis, and four testable hypotheses that emerge from it. The maintained assumptions are:

A1: Broker-dealers may have large inventories of cash Treasuries, but will be largely hedged in the derivatives market, so that their net exposure to interest-rate risk is relatively small.

A2: In the post-GFC period, hedge funds will generally be long cash Treasuries—with these positions largely funded by highly leveraged repo borrowing—and short Treasuries futures.

A3: In the post-GFC period, broker-dealers will also be short Treasury futures, while asset managers will have long positions that roughly offset those of the dealers and the hedge funds.

A4: Asset manager long positions in Treasury derivatives are in part a reflection of the lack of availability of long-maturity corporate bonds, and their consequent desire to create a synthetic alternative by combining shorter-maturity corporate bonds with Treasury derivatives.

A5: In the post-GFC period, cash Treasuries will generally be cheap relative to Treasury derivatives—i.e., cash Treasuries will have higher yields than those implicit in the corresponding derivatives contracts.

The testable hypotheses that emerge from the model are:

[20] See, e.g., G30 (2021), and Logan (2020).

H1: Increases in the supply of Treasury bonds will induce hedge funds to take larger leveraged positions in the Treasury-futures basis trade, thereby exacerbating market fragility.

H2: In times of stress, hedge funds will unwind their arbitrage positions, so that their long positions in cash Treasuries and their short positions in Treasury futures are simultaneously reduced. In the short run, broker-dealers will take the other side of this unwind, so that their short positions in Treasury futures increase alongside their long positions in cash Treasuries.

H3: In times of market stress, this unwind by the hedge funds will lead cash Treasuries to cheapen sharply relative to Treasury derivatives.

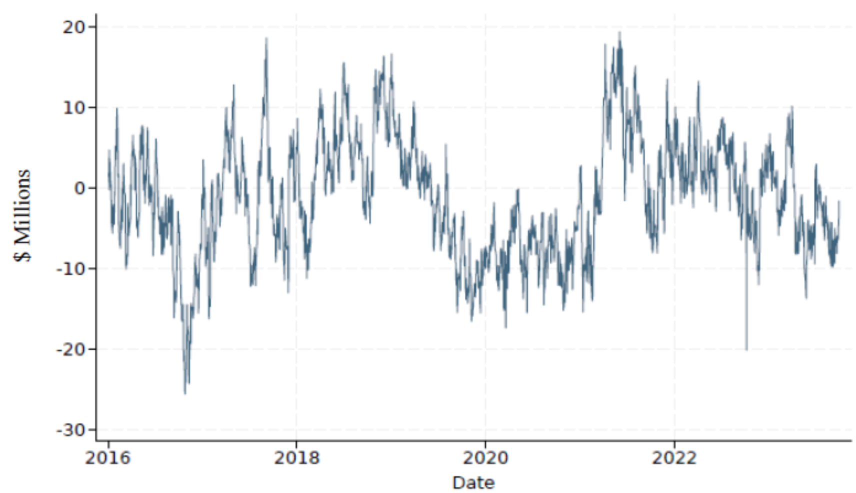
H4: In times of market stress, measures of Treasury market illiquidity and the repo intermediation spread will co-move closely with the Treasury-futures basis and hence will also spike up.

In the next section, we try to shed empirical light on each of these propositions.

III. Evidence

Figures 2 and 3 speak to A1. Figure 2 is taken from Lu and Wallen (2024), who use regulatory data from the Federal Reserve to obtain daily risk-exposure measures at the individual trading-desk level for the five largest U.S. bank-affiliated dealers. The figure displays the time series of cumulative net interest-rate-risk exposure, over the period 2016-2023, across all desks at these five firms, where this exposure is measured by DV01, which is the profit sensitivity to a one-basis point increase in interest rates. This DV01 value nets all long and short positions from both cash and derivatives positions (i.e., futures and swaps), and so gives a picture of the overall hedged interest-rate risk of dealers' books. To interpret the magnitudes in the figure, note that a DV01 of \$10 million is the exposure that one would get from an unhedged long position of \$10 billion in bonds with duration of 10 years. Thus, the figure implies that over the sample period, the largest single-day aggregate net interest-rate risk of these five firms was equivalent to an unhedged long position of \$26 billion in 10-year duration bonds. And notably, this conclusion holds even during the market stress period of March 2020, when broker-dealers were subject to an enormous wave of selling of cash bonds; their DV01 exposure during this month was if anything just a tiny bit negative, but for all intents and purposes essentially zero.

Figure 2: Large Dealer-Bank Net Interest-Rate Exposure



This figure is from Lu and Wallen (2024) and shows the DV01 of large U.S. dealer banks. DV01 is the sensitivity of profits to a 1 basis point increase in the level of the yield curve at all points. The sample of large U.S. dealer banks includes Bank of America, Citigroup, Goldman Sachs, JP Morgan, and Morgan Stanley. The data are daily from January 2016 to September 2023. A -20 million dollar exposure is approximately equivalent to a long position of $20 billion of Treasury securities with a 10-year duration.

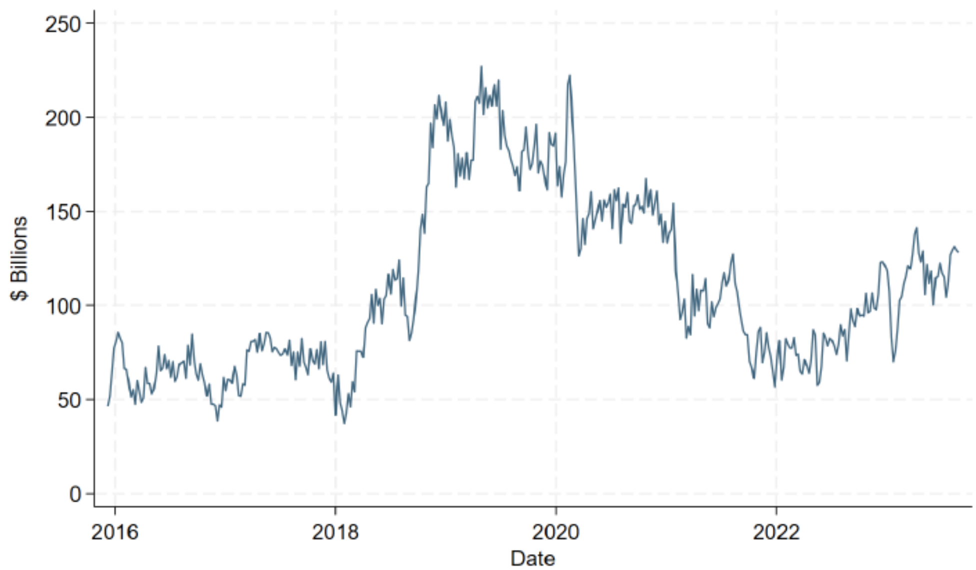
By contrast, Figure 3 shows the *net holdings of cash Treasury bonds* for primary dealers. Because this measure nets long and short positions in cash bonds, it still understates gross long positions in cash, but it excludes any hedging coming from derivatives. As can be seen, the magnitudes of these net cash positions are on the order of $150 billion to $200 billion, or nearly 10 times larger than the largest observed post-derivatives hedging position.[21] Thus, consistent with our premise in A1, it appears that broker-dealers use derivatives to hedge the vast majority of the interest-rate risk associated with their net long positions in cash bonds.[22]

---

[21] Because of data limitations, Figure 2 refers to the risk exposures of the five major U.S. dealers in Lu and Wallen (2024), while Figure 3 refers to the net Treasury holdings of *all* primary dealers, so the magnitudes are not directly comparable. However, Cochran et al. (2024) reports that as of June 2024, the five major U.S. dealers had about 70% of the net Treasury holdings of the entire primary dealer sector.

[22] To be clear, this extreme-hedging conclusion applies at the level of the *dealer subsidiary* of these bank holding companies. It does not apply to their commercial banking subsidiaries, which typically have large unhedged positions in Treasury bonds and MBS.

Figure 3: Primary Dealer Net Holdings of Treasury Securities

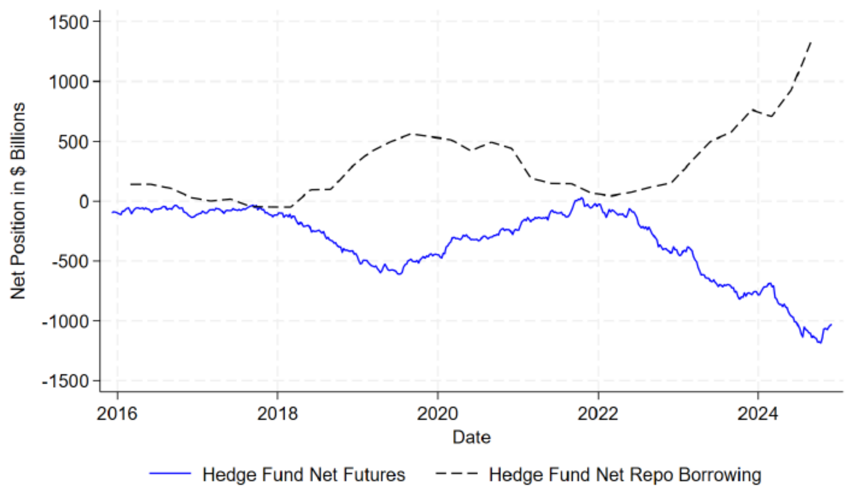


This figure shows primary dealer net holdings of Treasury coupon bonds. The data are weekly from January 2016 to September 2023. Source: Federal Reserve Bank of New York Federal Reserve primary dealer statistics.

Figure 4 sheds light on A2, using SEC data to plot hedge-fund repo borrowing against cash bonds, along with CFTC data on their futures positions over the period 2016 to 2024. The repo-borrowing and the short futures positions are virtual inverses of one another, suggesting that consistent with A2, essentially all repo-financed long positions in cash bonds are hedged with short positions in futures, and that most of the time-variation in these series is variation in the magnitude of their leveraged bond-futures arbitrage position. This is further corroborated by Glicoes et al. (2024) who use regulatory data on Treasury transactions to show that hedge funds are engaging in bundled trades of long cash Treasuries and short futures.

Figure 5 shows futures net positioning among hedge funds, dealers and asset managers. Hedge-fund positioning in futures closely mirrors the inverse of asset managers, consistent with A3. Strikingly, hedge funds at the end of 2024 were net short over $1 trillion in futures, or roughly double the position that they had leading up to the period of market turmoil in March 2020. Recall that this futures position is likely the other side of an equal-sized long position in cash Treasuries, one that is financed almost entirely with overnight repo borrowing, as suggested by Figure 4.

Figure 4: Hedge Fund Treasury Futures Position and Repo Borrowing

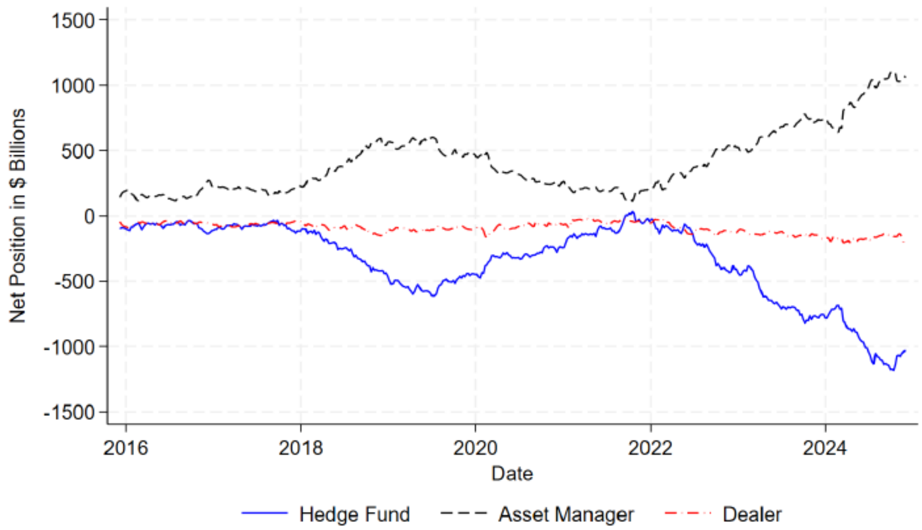


This figure shows hedge fund net repo borrowing and net Treasury futures positions. The hedge fund net repo borrowing is aggregated from the SEC Form PF data by the Office of Financial Research and is quarterly from January 2016 to September 2024. The net Treasury futures position data is weekly and is taken from the CFTC, where we take the reported data for "leveraged money positions" to be hedge funds. The data are from January 2016 to December 2024.

Also consistent with A3, broker-dealers are also consistently short futures, though their position is an order of magnitude smaller than that of the hedge funds. In other words, it appears that hedge funds are the front-line players in providing the inventorying-of-cash-bonds service to the asset managers.[23] In this vein, a regression in weekly changes over the sample period January 2016 to December 2024 reveals that a \$100 increase in long positions by asset managers is associated with a \$78 increase in short positions by hedge funds, and just a \$17 increase in short positions by broker-dealers. This suggests that if the dealers are forced to absorb a significant portion of the hedge-fund book in a rapid unwind, this would represent a proportionately very large increase in their commitment to the cash-futures arbitrage trade, and hence a potentially serious impingement on their ability to devote resources to market-making and repo intermediation.

[23] It is interesting to ask how we arrived at this institutional arrangement—i.e., one where hedge funds, not dealers, are the primary providers of the service of inventorying cash bonds and thereby policing the Treasury cash-futures basis. Some observers have attributed this to post-GFC changes in financial regulation, such as the Supplementary Leverage ratio (SLR) or the Volcker Rule. See, e.g., Duffie (2023), and Aramonte, Schrimpf and Shin (2023).

Figure 5: Dealer, Hedge-Fund and Asset Manager Positions in Treasury Futures

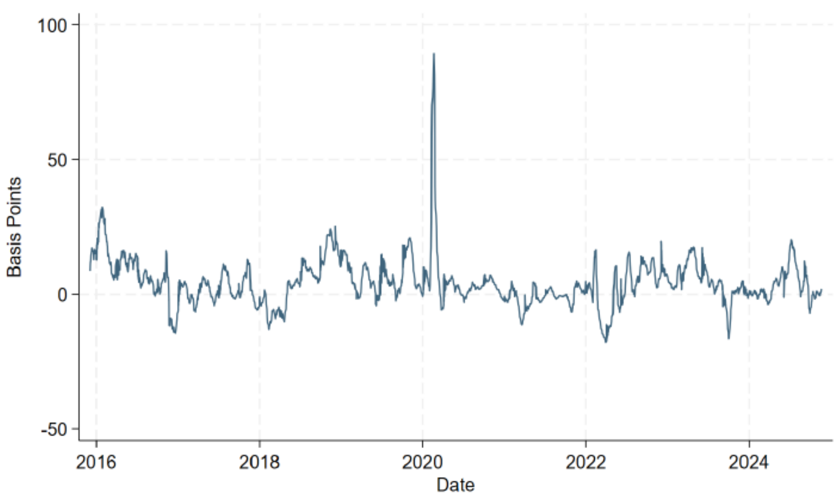


This figure shows hedge fund, asset manager, and dealer net positions in Treasury futures. The data are from the CFTC and are weekly from January 2016 to December 2024. The hedge fund positions correspond to those labeled "leveraged money positions" in the CFTC data.

Regarding A4, we have already referenced the Flow of Funds data on the size of pension fund and life insurers' balance sheets. Together they have over $25 trillion in liabilities, while the entire universe of investment grade global dollar-denominated corporate bonds with maturities greater than 10 years is under $3 trillion. So it is simply not possible for these asset managers to find enough long-term high-grade corporate debt to match the maturity of their liabilities. Which is why, if they wish to have some exposure to corporate credit while at the same time doing this maturity matching, they will have to resort to taking long positions in interest-rate derivatives.

Figure 6 shows the Treasury cash-futures basis since 2016. We measure the basis for the 10-year Treasury futures contract as the difference between the cash-futures implied interest rate on the one hand, and a maturity-matched term repo rate on the other hand. On any given trading date, there are multiple futures contracts of varying maturities that hedge funds can trade. We restrict our analysis to the most liquid contracts with maturities between 20 and 150 trading days and report the largest arbitrage spread (in annualized basis points) among the contracts.[24] The basis, as posited in A5, is typically positive, with an average value of 5 basis points over the sample period. The dramatic spike in March of 2020 stands out; we will come back to this point momentarily.

Figure 6: The Treasury Cash-Futures Basis



This figure shows the Treasury cash-futures basis in annualized basis points. This basis is the difference between the cash-futures implied risk-free rate and the maturity-matched term repo rate for the 10-year Treasury futures. We show the largest spread for contracts with tenors between 20 to 150 days to delivery, where the average tenor is three months. The underlying data are daily from January 2016 to December 2024 and were provided by Citadel Securities.

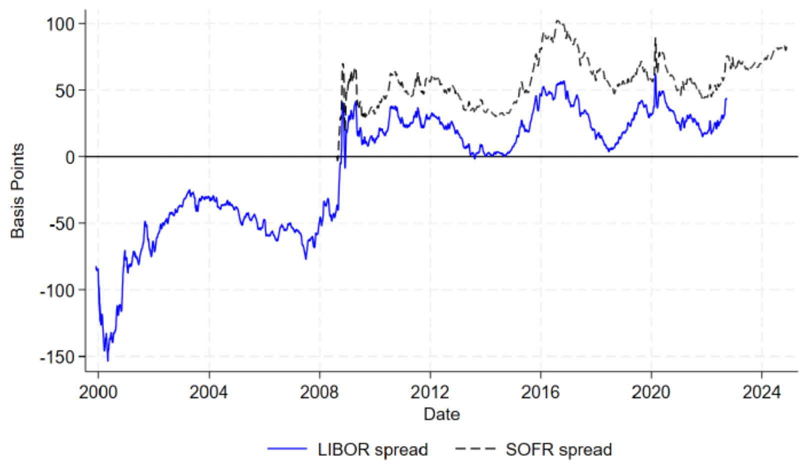
Figure 7 shows the Treasury swap spread, which we are able to obtain over a longer sample period of 2000 to 2024. The swap spread is the difference between the yield on a 30-year Treasury security and the fixed rate on a 30-year swap. We show two swap rates, where the blue solid line represents a swap where the floating-rate leg is based on 3-month LIBOR rates, and where the black dashed line represents a swap where the floating-rate leg is based on the secured overnight funding rate (SOFR). Since the GFC, the LIBOR swap spread has averaged 25 bps and the SOFR swap spread has averaged 58 bps.[25] The positive values of the swap spread tell the same story as

[24] The Treasury futures basis is challenging to measure because of synchronicity and optionality issues. To accurately measure the basis, we need synchronous prices for cash Treasuries and futures contracts. Treasury futures contracts also contain a cheapest to deliver option, where one of many Treasuries within a maturity bucket can be delivered.

[25] Due to data limitations and the transition from LIBOR to SOFR, the Bloomberg series on the LIBOR swap spread ends on October 10th, 2022, while the SOFR swap spread extends to the end of our sample in December 2024.

the positive values of the Treasury-futures basis in Figure 6. As was discussed earlier, the swap spread undergoes a pronounced regime shift around the time of the GFC, shifting from consistently negative territory before the GFC to consistently positive territory in the years since.

Figure 7: The Treasury Swap Spread



This figure shows the Treasury swap spread in annualized basis points. The swap spread is the difference between a 30-year Treasury security and the fixed par rate on a 30-year swap (where the floating leg is LIBOR in the solid blue line and SOFR in the dashed black line). The data are daily from January 2000 to December 2024. Source: Bloomberg.

Having established that the premises underlying the model are satisfied, we turn to its four main predictions. H1 gets to the heart of our model's implications about the potential consequences of an expanding Treasury market. It holds that ongoing increases in the supply of Treasury bonds will induce hedge funds to take larger leveraged positions in the Treasury-futures basis trade. In an effort to test this proposition, in Table 1 we run weekly regressions of the following form:

$$\Delta HF_{i,t} = \alpha_i + \alpha_t + \beta \Delta Q_{i,t} + \epsilon_{i,t}, \tag{13}$$

where $\Delta HF_{i,t}$ is the dollar change in hedge-fund net futures positions for contract maturity $i \in \{5,7,10,20,30\}$ and week t, and where $\Delta Q_{i,t}$ is the dollar quantity of Treasuries auctioned that fit the delivery specifications of contract i between $t-1$ and t. The α's are contract maturity and time fixed effects. The sample runs from March 8, 2016, to August 27, 2024. Consistent with the model, we see in columns (1) and (2) that an increase in Treasury supply of $100 leads to hedge-fund short positions going up by approximately $5, where column (1) includes contract fixed effects and column (2) in addition includes time fixed effects. Columns (3) and (4) make the point that this effect is entirely driven by the majority of months and tenors where hedge funds start out with short positions. In column (3) the regression is run only over the observations when hedge funds had a net short position in the prior month and tenor, and the estimated coefficient is very similar to that for the full sample. In contrast, column (4) estimates the regression only over the observations when hedge funds had a net long position in the prior month and tenor (which happens in just about 10% of observations). In these cases, changes in Treasury supply have no effect.

Table 1: Treasury Supply and Hedge-Fund Futures Positions

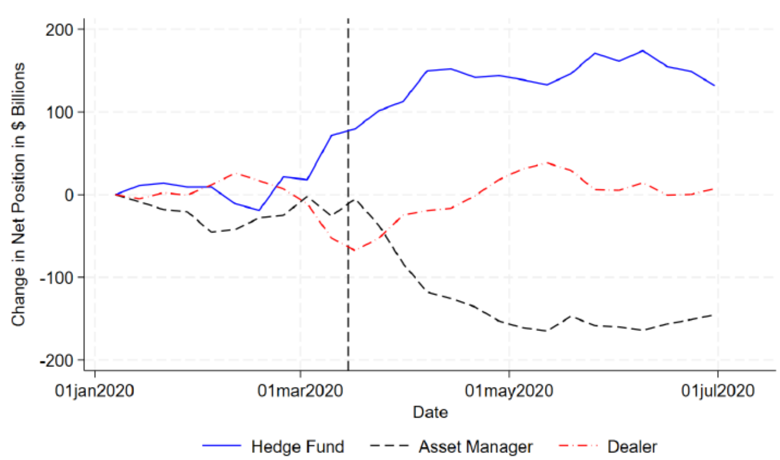
	Δ Hedge Fund Net Futures			
	(1)	(2)	(3)	(4)
Δ Treasury Supply	-0.053***	-0.042***	-0.054***	0.007
	(0.010)	(0.011)	(0.013)	(0.032)
Tenor FE	Y	Y	Y	Y
Time FE	N	Y	Y	Y
Adjusted R^2	2%	8%	8%	10%
N	2,336	2,336	1,904	264

Table 1 shows the estimates of equation 10, where we estimate the association between changes in Treasury issuance (ΔQ) and changes in hedge fund net Treasury futures positions. We estimate this for a panel of weekly data from January 2016 to December 2024, where we match issuance by tenor to hedge fund futures positions by tenor. The set of tenors include maturities of 5, 7, 10, 20, and 30 years. Column 1 includes a tenor fixed effect; column 2 adds a time fixed effect; column 3 limits the sample to the tenors and weeks for which one-week lagged hedge fund net futures positions are negative; column 4 limits the sample to the tenors and weeks for which one-week lagged hedge fund net futures positions are positive. Source: CFTC as described in Figure 4 and the Treasury department.

Although there are obviously numerous caveats in terms of extrapolating from these weekly-frequency regressions, the magnitudes that they imply are economically meaningful in the context of a Treasury market that is expected to grow by roughly $20 trillion over the coming decade. Taken at face value—and again, there are many reasons not to—our regression estimates would imply that this would increase hedge-fund cash-futures basis positions by about $1 trillion.

Figure 8 speaks to H2, regarding the dynamics of hedge-fund unwind in a period of market stress. In March 2020, we see a sharp reduction in hedge fund short positions in Treasury futures. Specifically, over the brief interval from March 3rd to 17th, hedge funds reduce these short positions by $62 billion. Subsequent analysis revealed a similar decline in their repo-financed securities holdings (Kruttli et al., 2021). Over the same time frame, broker-dealers increased their short positions in the same futures contracts by $57 billion, effectively serving as the front-line shock absorbers for this fire sale of the hedge-fund arbitrage book. Consistent with the idea that taking on this book was a difficult stretch for the dealers, over the next several weeks, dealer positions in futures begin to revert, and asset managers take on a secondary role in accommodating the unwind. In particular, as hedge funds continue to shrink their short positions in futures, asset managers start to scale back their long positions significantly, presumably in response to the widening of the cash-futures basis, which implies that it has become even more expensive than before for them to take a long duration position via futures instead of in cash Treasuries.

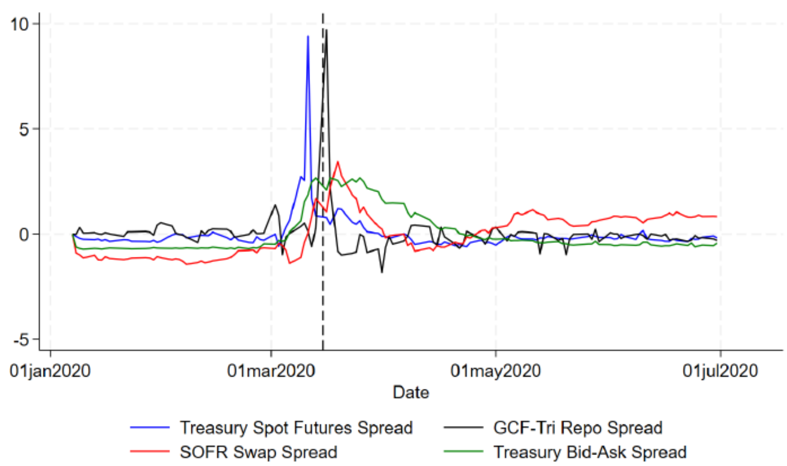
Figure 8: The Hedge-Fund Basis-Trade Unwind, March 2020



This figure shows hedge fund, asset manager, and dealer net positions in Treasury futures. The positions are normalized to be 0 as of January 7th, 2020. The data are weekly from January 7th, 2020, to June 30th, 2020. The reference line marks March 15th, 2020, which is when the Federal Reserve had an emergency meeting and lowered interest rates and announced plans to begin purchasing Treasury securities. The data source is the CFTC, as described in Figure 5.

Figure 9 addresses H3 and H4, plotting four series in the months surrounding March 2020: (i) the Treasury cash-futures basis; (ii) the Treasury SOFR swap spread; (iii) Treasury bid-ask spreads; and (iv) the spread between GCF and tri-party repo rates.[26] All series are normalized to be zero as of January 7th, 2020, and to have unit standard deviation. During this period of market stress, the cash-futures basis jumps by 9 standard deviations and the swap spread increases by 3.5 standard deviations, confirming H3. Moreover, consistent with spillover effects to other broker-dealer activities as in H4, we find that repo intermediation spreads and bid-ask spreads widen by 10 standard deviations and 2.7 standard deviations, respectively. Notably, the cash-futures basis spike is the first shoe to drop, occurring nearly a week before spreads widened in the repo market. This suggests a direction of causality where, as in our model, the broad set of disruptions in the Treasury market originated from an unwind of the hedge fund trade in Treasury futures.

Figure 9: Co-movement of Treasury-Futures Basis, Treasury-Swap Spread, Market Liquidity and Repo Intermediation Spreads, March 2020



This figure shows the Treasury cash-futures basis, the Treasury SOFR swap spread (inverted for visual convenience), Treasury bid-ask spreads, and the spread between GCF and Tri-party repo rates. All four series are normalized to be 0 as of January 7th, 2020, and to have unit standard deviation. Both the Treasury cash-futures basis and the GCF-Tri Repo spread exhibit spikes of nine standard deviations on March 11th and March 16th, 2020, respectively. The Treasury SOFR Swap spread and Treasury bid-ask spreads show smaller but more protracted increases over two to four weeks. The reference line marks March 15th, 2020, which is when the Federal Reserve had an emergency meeting and lowered interest rates and began quantitative easing.

[26] The spread between GCF and tri-party repo rates can be thought of as the difference between the rate at which a broker-dealer firm borrows from a money fund in the tri-party market, and the rate at which it lends to, e.g., a hedge fund in the so-called general collateral market. In other words, it is the repo-market intermediation spread.

IV. Policy Implications

There are several policy approaches that might be helpful in addressing Treasury-market fragility. Some of these have been the subject of considerable prior attention from a range of commentators. These include modifying the Supplementary Leverage Ratio (SLR); creating a standing, broad-access Federal Reserve repo facility; and imposing centralized clearing and harmonized universal margin requirements on Treasury securities. However, the logic of our model suggests a novel approach which we believe can be a valuable addition to the policy toolkit, namely hedged purchases of Treasuries by the Fed in times of extreme market stress. We begin with a discussion of this new idea and some of the questions it raises. We then briefly summarize how it relates to some of the other policy proposals that have been previously put forward.

A. *Hedged Central-Bank Purchases of Treasuries*

In response to the Treasury-market turmoil of March 2020, the Federal Reserve initiated an extraordinarily aggressive program of buying cash Treasuries: between the beginning of March and the end of May, the Fed bought approximately $1.6 trillion of Treasury bonds. Given the apparent success of this program in restoring market function, a number of authors have since argued that such market-function-motivated bond purchases should become a standard part of central bankers' crisis-management toolkits, and that more thought should be given to design considerations such as: (i) under what precise conditions such purchases should be triggered; (ii) how to make clear the distinction with monetary-policy-motivated bond purchases; and (iii) how to commit to unwinding the purchases in a relatively timely manner (Hauser 2022; Duffie and Keane 2023; Duffie 2023; Kashyap 2024).

Our theory and evidence suggest an alternative, more surgical approach that may have a number of advantages over simple purchases of cash securities by the Fed. The key insight is that the fire sale by hedge funds, which in turn creates the severe strain on dealer balance sheets, is not an outright liquidation of cash Treasuries. Rather, it is an unwinding of a *hedged* long-cash-Treasuries/short-derivatives position. Thus to relieve the stress on dealers, it would be sufficient for the Fed to take the other side of this hedge-fund unwind, by purchasing cash Treasuries, and fully hedging this purchase with an offsetting short position in Treasury derivatives. Simply buying unhedged cash bonds from the dealers—i.e., taking duration risk off of their hands—does not provide them with any extra relief relative to this hedged approach, since, as we have seen, they tend not to have any duration exposure in the first place, even in times of extreme market stress.

One important advantage of this hedged approach to bond-buying is that it would make transparently clear the distinction between market-function interventions and those intended to serve a monetary-policy objective: if the Fed hedges its bond purchases with derivatives, it is not removing net duration from the market, and hence to a first approximation not attempting to exert downward pressure on long-term interest rates. This draws a key distinction between market-functioning purchases, which are designed to stabilize market conditions by providing a buyer of last resort over the short term, and quantitative easing, which is intended to supplement traditional forms of monetary policy (see e.g., Gagnon et al., 2011; Bernanke, 2020). As a by-product, hedged purchases allow the Fed to intervene to support market function without exposing it to undue interest-rate risk, something which came back to bite it when rising policy rates in 2022 and 2023 generated large losses on the bonds that the Fed had bought over the prior couple of years.

As noted above, a basis purchase facility of the sort we have in mind is not that far afield from current open market operations. The Federal Reserve's Standing Repo Facility (SRF), for example, purchases Treasury securities under a contractual agreement to resell them in the future at a price specified at the time of trade. In the early years of Fed repo offerings, the authority to enter into such contracts was cited as an important enabling clause of the Federal Reserve Act (Menand and Younger, 2023). Treasury futures similarly represent a contractual agreement to sell a defined set of Treasury securities at a price specified at the time of trade. The one key difference is that, in a repo contract, the seller in the opening leg and buyer in the closing leg are the same counterparty; in a basis position, they are potentially different parties.[27]

Moral hazard considerations

A natural reaction to our proposal is to worry about the specter of moral hazard. If the Fed effectively takes hedge funds' arbitrage trade off their hands when the trade is going bad, won't this implicit backstop lead the hedge funds to be more aggressive ex ante, i.e., to take even larger leveraged positions in the trade, thereby amplifying the risk of a disorderly unwind?

[27] As noted above, we do not take a stance on the specific legality of this proposal under the current interpretation of the relevant clauses of the Federal Reserve Act.

Although we certainly do not intend to dismiss moral hazard considerations entirely, it is important to note that they are more nuanced in this particular case than they might appear at first glance, and almost certainly less severe than in the case of unhedged bond purchases such as those undertaken in March of 2020. If market participants come to expect the Fed to implement unhedged purchases at times of market stress—thereby removing substantial amounts of duration from the market—this would be expected to have a first-order impact on the pricing of interest-rate risk and hence on the term premium. In effect, the market would anticipate a more powerful Fed put with respect to interest-rate risk, particularly to the extent that episodes of market dysfunction are expected to coincide with general upwards pressure on rates.

By contrast, our hedged-purchase approach to a first approximation does not create any such Fed put on interest rates, as it is a duration-neutral policy. But by bailing out the hedge funds, does it nevertheless still not create some sort of distortion? To see why this is a somewhat subtle question, it is useful to start with a limiting case. Suppose hedge funds conjecture that the Fed will step in with certainty and take the arbitrage trade off their hands when the spread widens by a given amount. With this source of tail risk eliminated, we might expect them to trade more aggressively ex-ante. In the limit where they become risk neutral and there is perfect competition, this more aggressive behavior will drive the Treasury-futures basis x, and hence expected hedge-fund profits, to zero. It is of course true that there will still be states of the world where the Fed has to take over a potentially large hedge-fund book, but if the Fed is perfectly hedged with respect to interest rate risk, and given that it can never be forced out of its position prematurely, the social cost of having to assume this hedged position is arguably negligible. Thus in this limit case, the policy creates no distortions with respect to the pricing of interest-rate risk, eliminates hedge-fund arbitrage profits, and imposes no costs on the Fed or society as a whole. In other words, there is no moral hazard effect to speak of.

Indeed, in this limiting case, a policy of certain ex-post intervention that effectively removes the tail risk to the hedge funds is isomorphic to one in which the Fed itself—rather than the hedge funds—polices the Treasury-futures basis ex-ante, by continuously maintaining a large enough position in the hedged cash-derivatives trade that the basis is always forced to zero. In this case, there is no incentive for leveraged hedge funds to enter the market in the first place, and hence no risk of disorderly unwinds. While such an arrangement may sound unrealistic from a political-economy perspective, it is a useful conceptual benchmark because it can be thought of as an application of the Friedman (1969) rule. Recall that Friedman advocates that a central bank should reduce the opportunity cost of holding fiat money to zero to the extent that it can produce fiat money at zero social cost. Similarly, the logic here would be that the central bank should reduce the cost that asset managers pay to others to hold cash Treasuries on their behalf to zero, since—by virtue of its ability to create money and hence never be forced out of a hedged trade prematurely—it can perform this balance-sheet rental service at near-zero social cost, whereas leveraged hedge funds manifestly cannot.

To be clear, the limit case considered above is too strong, and we would not want to argue that a policy whereby the Fed intervenes ex-post to stabilize the Treasury-futures basis is completely without moral hazard complications. In particular, many of the hedge funds that engage in this arbitrage trade are broadly diversified and have a variety of other positions in place as well. So if they are induced by the prospect of ex-post Fed action to trade more aggressively against the Treasury-futures basis than they otherwise would, an adverse shock to this spread may force them to fire-sell other assets that they would not have otherwise had to unload. And these fire sales may in turn have knock-on effects in markets that are not easily stabilized with existing policy tools.

In thinking about how to mitigate this remaining source of moral hazard, it is tempting to invoke the spirit of Bagehot (1873), and ask whether one can impose some sort of "penalty rate" on the hedge funds in the state of the world where the central bank bails them out of the Treasury-futures arbitrage trade. It turns out that this is straightforward to do. Recall from Figure 7 that in March 2020, the Treasury-futures basis spiked to a level 9 standard deviations above its typical mean value. If a future FOMC were to intervene with hedged bond purchases to offset such a dramatic spike, they need not compress the basis all the way back to a normal-times mean value. A lender of last resort seeks to lend at a penalty rate higher than would prevail level in ordinary market conditions, but below the currently stressed market level; the Fed could similarly aim to push the basis only partway back to where it was before market became dysfunctional. To take a concrete example, it could choose to allow the basis to rise by say just two standard deviations, but no more than that. By doing so, it would purposefully leave a meaningful amount of risk on the table for the hedge funds, but at the same time mitigate the worst-case unwind outcomes.

As a practical matter, this Bagehot-style outcome could be implemented with a standing facility that acts to create a cap on the Treasury-futures basis and thereby eliminate just the most extreme spikes. If, for example, the cap was set at 25 basis points, the Fed could simply enter the market any time the basis threatened to breach the cap, buy the requisite amount of cash bonds through a conventional open market operation, and short the equivalent amount of futures via a transaction with a futures exchange. Indeed, such a facility would be closely analogous to a standing repo facility that aimed to cap spikes in repo spreads.

Alternatively, and perhaps somewhat more elegantly, the same objective could be accomplished by having the Fed conduct auctions of bundled basis packages in which primary dealers submit both the cash Treasury security they intend to sell and the futures contract they intend to buy at a specified gross basis. The Fed could then set a minimum bid price on the submitted bundles as a means to impose the desired cap on the basis.

B. Other Policy Proposals

Dialing back the leverage ratio

The SLR has been criticized repeatedly in prior work by many others (see e.g., Liang and Parkinson, 2020; G30, 2021; Duffie, 2023 and references therein), for among other things, its potentially adverse effects on Treasury-market liquidity. When it is binding, the SLR—which is an unweighted capital requirement that for the most part treats all bank assets similarly—effectively subjects banks and their dealer arms to significant capital charges on their holdings of Treasury securities and central bank reserves, and on their provision of Treasury-market repo intermediation. And even when the SLR is not currently binding, the anticipation that it may bind in the future can still have significant effects. Recognizing this problem, the Fed temporarily excluded Treasuries and reserves from the calculation of the SLR in 2020. However, this exclusion was allowed to lapse a year later, so the full SLR remains in force today.

In the language of our model, the SLR can be thought of as one factor that causes dealer balance-sheet constraints—particularly with respect to the Treasury-market activities of interest to us here—to be tighter than they otherwise would be, which in turn exacerbates fire-sale effects in the face of a hedge fund unwind, with the attendant consequences for market liquidity and repo intermediation spreads. So the logic of the model is clearly supportive of efforts to make the SLR less binding. This could be accomplished by, e.g., permanently excluding Treasuries (either all or just those in trading books; see Menand and Younger, 2023) and/or central-bank reserves from the denominator of the leverage ratio. Or alternatively, by dialing back the current 5% requirement applicable to the eight largest U.S. bank holding companies to some lower value, say the international standard of 3%. This need not result in any reduction in overall bank capital levels, which could be maintained by making an appropriate compensating adjustment to the risk-based capital regime—as the Bank of England did when it exempted reserves for UK banks.

At the same time, it is far from clear that such a dialing-back of the leverage ratio would by itself solve substantially all, or even much of the problem we have been concerned about. Although there is still considerable debate, some researchers have recently argued that the temporary exclusion of Treasuries from the SLR in 2020-21 did not materially improve market-making capacity (Cochran et al., 2023). Further, given a massive unwind of the hedge-fund Treasury-futures arbitrage position, it seems unlikely that it is just the SLR that would make it costly for broker-dealers to step in and take the other side of this unwind. The Treasury-futures basis trade faces the usual convergence and liquidity risks that bedevil many such arbitrage trades. Thus standard limits-of-arbitrage arguments a la Shleifer-Vishny (1997) suggest that even dealers unconstrained by regulatory-capital charges would tend to proceed cautiously in terms of blowing up their positions, particularly at a time of extreme market stress when measures of volatility are spiking and their internal risk limits are tightening (Hanson, Malkhozov, and Venter, 2024).

Creating a broader access repo facility

In the wake of the March 2020 market disruptions, the Federal Reserve created two standing repo facilities to provide financing on a collateralized basis against Treasury securities: one, the SRF, for which only banks and primary dealers are eligible, and the other, the FIMA, for just foreign central banks and other foreign monetary authorities.[28] Here we consider two potential improvements to the SRF designed to lessen the probability and impact of a basis trade unwind.

First, policy makers could expand the set of eligible counterparties for the SRF. For example, a G30 Working Group (G30, 2021) recommended that a Fed standing repo facility should be made available not just to banks and broker-dealers, but to essentially any market participant who can pledge Treasury securities to the Fed. The rationale for such a broader-access repo facility follows closely from the logic in our model: it is precisely at times of market stress that banks and

[28] Another major source of Treasury selling pressure in March of 2020 came from foreign central banks and reserve managers who were not leveraged, but who were rushing to convert their longer-term Treasuries to cash (Vissing-Jorgensen, 2021). The FIMA facility, which would allow these foreign official investors to monetize their Treasuries without having to sell them, is a potentially quite helpful solution to this specific problem.

dealers, who are themselves severely balance-sheet constrained, find it especially difficult to provide repo-market intermediation. Thus one cannot count on them borrowing from the Fed and turning around and on-lending to e.g., hedge funds who are struggling to finance their Treasury holdings. So allowing these hedge funds to borrow directly from the Fed and thereby bypass the temporarily clogged pipe of dealer intermediation might significantly ease funding constraints at a time when doing so is particularly helpful.

Another improvement to the SRF would be to clear its transactions through a centralized counterparty. That would allow dealers to net their borrowings from the facility against lending to hedge funds for regulatory reporting purposes (Yadav and Younger, 2025). Reducing the regulatory capital that is consumed when dealers intermediate funding obtained from the SRF would enable them to pass that funding along more efficiently to other market participants.

We believe that removing frictions to repo-market intermediation could be quite helpful, and we are supportive of broadening SRF access. But it is also important not to exaggerate what such changes can do in the face of a major market-stress episode like March of 2020. Recall that in our baseline model, there can be powerful fire-sale effects even when the repo-market is working completely frictionlessly, and hedge funds have undiminished access to repo funding throughout the episode. This is because the primary problem that drives the effects is one of capital, not funding: on the one hand, hedge funds are forced to liquidate their arbitrage positions because either futures-market margin calls, losses on their trades, and/or investor outflows have impaired their capital position, and on the other hand, broker-dealers are reluctant to absorb these positions without large price concessions because of the scarcity of their own capital. It is certainly true that piling funding constraints on top of these capital shortages would make things worse, which is why addressing the funding issue with something like a broad-access repo facility is desirable. But doing so cannot be expected to be a cure-all, especially in more extreme circumstances.

Regulatory minimum margin requirements on Treasuries

Metrick and Tarullo (2021) argue for the imposition of regulatory minimum margin (or "haircut") requirements on a broad set of market players undertaking Treasury financing transactions. Thus, for example, under their proposal a hedge fund borrowing against its portfolio of Treasuries would face an effective margin requirement similar to the 5% capital charge imposed on the dealer arm of a bank holding company under the SLR. The fundamental principle driving their argument is one of regulatory congruence. To the extent that e.g., hedge funds are more lightly regulated than dealer firms, this will tend to drive activity into the most vulnerable and highly-leveraged parts of the financial sector and thereby increase systemic risk; this is an undesirable outcome, and the goal of any regulatory regime should be to lean against it wherever possible.

As Metrick and Tarullo (2021) discuss at length, achieving this sort of regulatory congruence in the U.S. institutional setting is likely to be extremely challenging as a practical matter, given the diversity and complexity of market arrangements, and the highly fragmented nature of regulatory authority over the different players. Nevertheless, it is worth asking whether, in a perfect world where one could directly impose the equivalent of a universal margin requirement on all Treasury-collateralized borrowing, this would in fact make a decisive difference in a market unwind-scenario of the sort we have been entertaining.

It turns out the answer to this question is a bit more subtle than might be expected at first glance and depends on some specific assumptions. To see why, it is useful to consider a simple example. Suppose that in an initial unregulated case, haircuts on Treasury repo transactions are 2%, and there is a set of hedge funds that collectively are long $1 trillion of Treasuries supported by $20 billion of investor capital. To keep the example as simple as possible, ignore the margin requirements on their offsetting short futures positions, though as emphasized above, these are also important in reality. Now imagine a shock that depletes $5 billion, or 25%, of hedge-fund capital. This shock could come from a number of sources, but it is perhaps easiest to think of it as representing an unexpected withdrawal by hedge-fund limited partners.

If nothing else changes, and haircut requirements remain at 2%, the remaining $15 billion of hedge-fund capital can now support only $750 billion of Treasury long positions (750 = 15/.02), and hence hedge funds will be forced to fire-sell $250 billion of Treasury securities. However, this is an unrealistically optimistic case, since as the March 2020 CME example makes clear, private-market-determined margins are highly cyclical, with lenders and clearinghouses seeking to better protect themselves when market volatility spikes up. If the haircut requirement doubles to 4%, the hedge fund sector will now only be able to maintain a long position of $375 billion (375 = 15/.04) and so will be forced to fire-sell $625 billion of Treasuries, or 62.5% of their initial position.

Now consider how a regime with regulatory minimum margin requirements might work. Suppose that regulators impose a 5% margin in good times, so that, in the spirit of Metrick and Tarullo, there is alignment between this number and the SLR capital charge on dealer firms' holdings of Treasuries. With this higher haircut requirement, the arbitrage trade presumably becomes less attractive to hedge funds, so it seems reasonable to posit that in equilibrium they would do it in less size, and that spreads would widen as a result. For the purposes of illustration, let us assume that they now devote $30 billion of capital, which allows them to be long $600 billion of Treasuries.

Imagine that the hedge funds are hit with the same 25-percent outflow from investor withdrawals as before, which now implies a $7.5 billion loss of capital. Assume further that now margins do not have to go up as much in percentage terms in the stress scenario, i.e., the cyclicality in margins is mitigated. This is the presumptive benefit of the higher initial margin, in that it reduces the imperative for private actors to further raise margins under stress. For concreteness, let us suppose that margins go from 5% to 7.5%; this is a 50 percent increase, as opposed to the 100 percent increase in the unregulated case. Now the shock leaves hedge funds with $22.5 billion of capital, which can support $300 billion in long Treasuries (300 = 22.5/.075) and which therefore implies a fire sale of $300 billion, or exactly half of their initial position. This is clearly better both in absolute and relative terms than in the unregulated case, but at the same time still quite significant.

The difficulty here is directly analogous to a problem with bank capital regulation. As Hanson, Kashyap and Stein (2011), and Greenwood et al (2017) point out, high initial capital requirements alone are not sufficient to prevent large reductions in bank lending when banks suffer an adverse shock to their capital. In order to prevent this credit-crunch effect, there needs to be dynamic adjustment on at least one of two margins: (i) the capital requirement actually needs to be reduced when an adverse shock hits; or (ii) banks need to raise significant amounts of new capital at this time. Similarly, unless one can design a regulatory regime where haircuts fall in the midst of an episode of market turmoil, and/or hedge funds raise new equity capital, there is always going to be something of a fire-sale concern with significant initial leverage. This is not to say that reform along the Metrick-Tarullo (2021) lines is not desirable. But as with SLR reform and a broader-access Fed standing repo facility, one would not want to count on it being the sole line of defense.

Mandated central clearing

One early proposal for improving the resiliency of the Treasury market in response to the Covid shock was mandated central clearing (Duffie, 2020). This refers to a structure in which trades between market participants are transferred to a central counterparty. That central counterparty reduces the risk created by the default of a participant, by mutualizing losses among its members, which tend to be large, well-capitalized financial institutions. Mandated central clearing rules for Treasuries were finalized in late 2023 and are scheduled to be phased in over the next three years.[29]

Although central clearing may indeed have significant benefits, these benefits are largely orthogonal to the issues of concern here; we have assumed away the possibility of anyone defaulting on an obligation to their counterparties. The one exception is that central clearing may facilitate the cross-margining of cash and derivative transactions (Younger, 2021; Kahn and McCormick, 2025). As discussed above, when volatility increases, margin requirements can increase as well, potentially triggering forced unwinds. One way to reduce this risk is to set overall margin based on the net economic exposure of the counterparty, not separately on the two legs of the trade. The benefits of such cross-margining can only be achieved, however, if market participants are commonly clearing both legs of their basis trades (see Yadav and Younger 2025).

V. Conclusions

We have identified the cash-futures basis trade as a potentially critical source of instability in the Treasury market. Data suggest that hedge funds currently have on the order of $1 trillion of highly leveraged long positions in cash Treasury securities tied up in this specific arbitrage trade—positions that are at risk of being rapidly unwound if these hedge funds are hit by any one of a number of different possible shocks. Given that such an unwind would have to be absorbed in the short run by a broker-dealer sector that is itself capital-constrained, it would likely lead to significant disruption in other activities for which broker-dealer firms are central, such as providing liquidity to the secondary market for Treasuries and intermediating the market for repo borrowing and lending. Moreover, our theory suggests that the continuing rapid growth of the Treasury market should be expected to further increase the size of the leveraged hedge-fund presence, thus amplifying these risks.

Although we believe that another round of large-scale bond-buying by the Federal Reserve should be seen as a last resort in any future episode of Treasury-market dysfunction, the limitations of some of the other currently available policy tools suggest that one should not rule out its use in a relatively extreme scenario. And our main point has been that in such a scenario, it would be

[29]See https://www.sec.gov/files/rules/final/2023/34-99149.pdf; https://www.sec.gov/newsroom/press-releases/2025-43.

preferable for any bond purchases to be undertaken on a fully hedged basis, so that while cash bonds are removed from the market, on net no duration risk is taken out of public hands.

Implementing the policy this way has several advantages relative to the unhedged form of market-function QE that was done in March of 2020: (i) it makes clear the distinction with monetary-policy-motivated QE; (ii) it is essentially self-liquidating, and thus removes the need to make commitments about the timing of future bond sales; (iii) it shields the Fed from taking on interest-rate risk that it may prefer not to bear; and (iv) it eliminates an ex-ante form of moral hazard, whereby the anticipation of future unhedged bond purchases distorts the market's pricing of interest-rate risk. For all these reasons, we hope that policymakers will give this option serious consideration going forward.

References

Alvarez, Scott G., Richard M. Ashton, Mark Van Der Weide, and Heatherun S. Allison. 2008. "The Authority of the Federal Reserve." Legal Memorandum to the Board of Governors.

Aramonte, Sirio, Andreas Schrimpf, and Hyun Song Shin. 2023. "Margins, Debt Capacity, and Systemic Risk." BIS Working Paper No. 1121.

Bagehot, Walter. 1873. *Lombard Street: A Description of the Money Market*. King.

Barth, Daniel, R. Jay Kahn, Phillip Monin, and Oleg Sokolinskiy. 2024. "Reaching for Duration and Leverage in the Treasury Market." Working Paper, Federal Reserve Board.

Barone, Jordan, Adam Copeland, Cullen Kavoussi, Frank M. Keane, and Seth Searls. 2022. "The Global Dash for Cash: Why Sovereign Bond Market Functioning Varied Across Jurisdictions in March 2020." Federal Reserve Bank of New York Staff Report No. 1010.

Bank for International Settlements (BIS). 2022. "Review of Margining Practices."

Bernanke, Ben S. 2020. "The New Tools of Monetary Policy." *American Economic Review* 110 (4): 943-83.

Brimmer, Andrew. 1976. "International Finance and the Management of Bank Failures: Herstatt vs. Franklin National." Paper presented at the American Economic Association and the American Finance Association.

Cochran, Paul, Sebastian Infante, Lubomir Petrasek, Zack Saravay, and Mary Tian. 2023. "Dealers Treasury Market Intermediation and the Supplementary Leverage Ratio." FEDS Notes, Board of Governors of the Federal Reserve System.

Cochran, Paul, Lubomir Petrasek, Zack Saravay, Mary Tian, and Edward Wu. 2024. "Assessment of Dealer Capacity to Intermediate in Treasury and Agency MBS Markets." FEDS Notes, Board of Governors of the Federal Reserve System.

Cunliffe, Jon. 2022. "Learning from the Dash for Cash – Findings and Next Steps for Margining Practices." Keynote address delivered at the FIA & SIFMA Asset Management Derivatives Forum.

Du, Wenxin, Benjamin Hébert, and Wenhao Li. 2023. "Intermediary Balance Sheets and the Treasury Yield Curve." *Journal of Financial Economics* 150 (3):103722.

Duffie, Darrell. 2020. "Still the World's Safe Haven? Redesigning the U.S. Treasury Market After the COVID-19 Crisis." Brookings Institution Working Paper.

Duffie, Darrell and Frank M. Keane. 2023. "Market-Function Asset Purchases." Federal Reserve Bank of New York Staff Report 1054.

Duffie, Darrell. 2023. "Resilience Redux in the U.S. Treasury Market." Paper presented at the Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

English, William, and Brian Sack. 2024. "Challenges Around the Fed's Monetary Policy Framework and Its Implementation." *Brookings Papers on Economic Activity*, September.

Fleming, Michael J., Haoyang Liu, Rich Podjasek, and Jake Schurmeier. 2021. "The Federal Reserve's Market Functioning Purchases." Federal Reserve Bank of New York Staff Report No. 998.

Federal Open Market Committee (FOMC). 2022. "Authorization for Foreign Currency Operations."

Friedman, Milton. 1969. *The Optimum Quantity of Money and Other Essays*. Aldine Press.

Gagnon, Joseph, Matthew Raskin, Julie Remache, and Brian Sack. 2011. "The Financial Market Effects of the Federal Reserve's Large-Scale Asset Purchases." *International Journal of Central Banking 7 (1):45-52.*

Glicoes, Jonathan, Benjamin Iorio, Phillip Monin, and Lubomir Petrasek. 2024. "Quantifying Treasury Cash-Futures Basis Trades." Working Paper, Federal Reserve Board.

Greenwood, Robin, Jeremy C. Stein, Samuel G. Hanson, and Adi Sunderam 2017. "Strengthening and Streamlining Bank Capital Regulation." *Brookings Papers on Economic Activity* 2017(2): 479-565.

Group of Thirty Working Group on Treasury Market Liquidity (G30). 2021. "U.S. Treasury Markets: Steps Toward Increased Resilience." Group of Thirty.

Haddad, Valentin, Alan Moreira, and Tyler Muir. 2024. "Asset Purchase Rules: How QE Transformed the Bond Market." Working Paper, UCLA, Rochester, and USC.

Hanson, Samuel G., Anil K. Kashyap, and Jeremy C. Stein. 2011. "A Macroprudential Approach to Financial Regulation." *Journal of Economic Perspectives* 25 (1): 3–28.

Hanson, Samuel G., Aytek Malkhozov, and Gyuri Venter. 2024. "Demand-and-Supply Imbalance Risk and Long-Term Swap Spreads." *Journal of Financial Economics* 154: 103814.

Hauser, Andrew. 2022. "Thirteen Days in October: How Central Bank Balance Sheets Can Support Monetary and Financial Stability." Speech at ECB's conference on money markets.

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

Heckinger, Richard, Robert Cox, and David Marshall. 2016. "Cleared Margin Setting at Selected CCPs." *Federal Reserve Bank of Chicago Economic Perspectives* 40 (4):1-5.

Inter-Agency Working Group. 2021. "Recent Disruptions and Potential Reforms in the U.S. Treasury Market: A Staff Progress Report."

Kahn, R. Jay, and Matthew McCormick. 2025. "Proportionate Margining for Repo Transactions." FEDS Notes

Kashyap, Anil. 2024. "Monetary Policy Implications of Market Maker of Last Resort Operations." Jackson Hole Economic Symposium, Federal Reserve Bank of Kansas City.

Kruttli, Mathias S., Phillip J. Monin, Lubomir Petrasek, and Sumudu W. Watugala. 2021. "Hedge Fund Treasury Trading and Funding Fragility: Evidence from the COVID-19 Crisis," Finance and Economics Discussion Series 2021-038.

Levin, Andrew T., Brian L. Lu, and William R. Nelson. (2022). "Quantifying the Costs and Benefits of Quantitative Easing." National Bureau of Economic Research Working Paper 30749.

Liang, Nellie, and Pat Parkinson. 2020. "Enhancing Liquidity of the U.S. Treasury Market under Stress." Brookings Institution Working Paper.

Lu, Lina, and Jonathan Wallen. 2024. "What Do Bank Trading Desks Do?" Harvard Working Paper.

Logan, Lorie K. 2020. "Treasury Market Liquidity and Early Lessons from the Pandemic Shock." Remarks at Brookings-Chicago Booth Task Force on Financial Stability (TFFS) Meeting, Panel on Market Liquidity.

Menand, Lev, and Joshua Younger. 2023. "Money and the Public Debt: Treasury Market Liquidity as a Legal Phenomenon." *Columbia Business Law Review*: 224.

Menand, Lev, and Joshua Younger. 2025. "One System, Two Mandates: The Federal Reserve and the Public Debt." *Columbia Law School Working Paper.*

Metrick, Andrew, and Daniel Tarullo. 2021. "Congruent Financial Regulation." *Brookings Papers on Economic Activity*. 2021 (1):143-81.

President's Working Group on Financial Markets (PWG). 1999. "Hedge Funds, Leverage, and the Lessons of Long-Term Capital Management."

Raimondi, Elena, and Enrico Piccin. 2024. "American OTC Derivatives Market within the Life Insurance Sector." SandP Global Market Intelligence.

Schrimp, Andreas, Hyun Song Shin, and Vladyslav Sushko. 2020. “Leverage and Margin Spirals in Fixed Income Markets During the Covid-19 Crisis.” BIS Bulletin No. 2.

Shleifer, Andrei, and Robert W. Vishny. 1997. “The Limits of Arbitrage.” *Journal of Finance* 52(1): 35-55.

Treasury Borrowing Advisory Committee (TBAC). 2024. “Discussion of Treasury Futures Positions Across Different Investor Types.”

Vissing-Jorgensen, Annette. 2021. “The Treasury Market in Spring 2020 and the Response of the Federal Reserve.” *Journal of Monetary Economics* 124: 19-47.

Yadav, Yesha, and Joshua Younger. 2025. “Central Clearing in the U.S. Treasury Market.” *University of Chicago Law Review* (forthcoming).

Younger, Joshua. 2021. “Cross-Margining and Financial Stability.” *Yale Program on Financial Stability Blog*.

Zhang, Yixiang, and Enrique Martínez García. 2024. “The Contribution of Foreign Holdings of U.S. Treasury Securities to the U.S. Long-Term Interest Rate: An Empirical Investigation of the Impact of the Zero Lower Bound.” *Federal Reserve Bank of Dallas Globalization Institute Working Paper* 430.