BIS

BIS Bulletin

No 2

Leverage and margin spirals in fixed income markets during the Covid-19 crisis

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2 April 2020

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The editor of the BIS Bulletin series is Hyun Song Shin.

This publication is available on the BIS website (www.bis.org).

ISSN: 2708-0420 (online)
ISBN 92-9197-356-8 (online)

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Key takeaways

- *For a two-week period in mid-March 2020, government bond markets experienced uncharacteristic turbulence, sometimes selling off sharply in risk-off episodes when they would normally attract safe haven flows.*
- *Evidence in the US Treasury market points to forced selling of treasury securities by investors who had attempted to exploit small yield differences through the use of leverage.*
- *Even though government bonds are safe assets, large holdings by leveraged investors may detract from orderly market functioning and may necessitate interventions by the central bank.*

Government bonds play a crucial role in the financial system, serving as safe assets as well as a benchmark for a wide array of other assets. They also provide a market hedge for stock market investors in that government bond prices often rise when stock prices fall (Clarida (2019)). However, government bond markets experienced a period of unusual turbulence and impaired market functioning in mid-March as the Covid-19 crisis escalated. Market dislocations spilled over to other markets and adversely impacted funding conditions in secured and unsecured money markets.

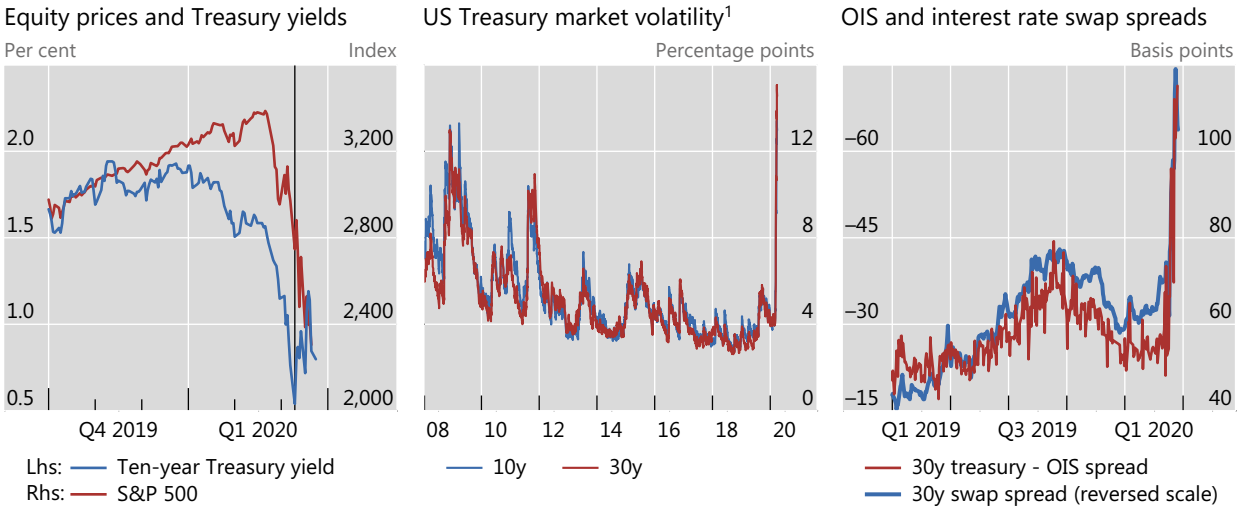
Orderly markets rest on buyers who are attracted by low prices to enter the market, so that price declines in the absence of fundamental news are cushioned by purchases. However, from time to time, the demand response can become perverse, where price declines may beget more sales. One example is when an investor has borrowed money to purchase assets. When the asset price falls and threatens the investor's solvency, the lender will call in the loan, forcing the investor to sell. In this way, a price decline can lead to further sales, not purchases. Without dealers who can absorb sales and stabilise prices, a feedback loop may develop where price declines beget more sales, leading to further price declines.

The US Treasury market may have experienced precisely such an episode of forced sales and feedback loops during the Covid-19 crisis. We review the evidence and draw broader lessons for market resilience when leveraged investors constitute a substantial portion of the investor base. We conclude with reflections on the role of the central bank as a "dealer of last resort" in such circumstances.

Dislocations in the US Treasury market. The US Treasury market suffered one of its most severe bouts of volatility in March. The initial phase of investor de-risking through early March saw orderly flight-to-safety into treasuries. The 10-year yield fell to historical lows, sparking discussions of whether it could go negative. However, from 9 March, the market experienced a snapback in yields and extreme turbulence (Graph 1, left-hand panel), especially for long-dated treasuries (Graph 1, centre panel).

Covid-19 market rout and dislocations in the US Treasury market

Graph 1



The vertical line in the left-hand panel indicates 9 March 2020.

[1] Exponentially weighted moving average volatility over a one-year window (decay factor = 0.96).

Source: Bloomberg.

The positive gap between treasury yields and the corresponding interest rate swap rate is an indicator of investor balance sheet cost, as holding treasuries entails using up balance sheet, while swaps are a zero money-down (off-balance sheet) position. Periods of heightened volatility tend to go hand-in-hand with limited balance sheet capacity of dealers due to tighter risk constraints. As yields snapped back, the spread between treasury yields and swap rates widened dramatically in mid-March (Graph 1, right-hand panel). Similarly, the market experienced severe mispricing along the yield curve (yield curve fitting errors) and between benchmark bonds and other similar securities (Graph 2, left-hand panel), indicating a breakdown in arbitrage linking various corners of fixed income markets.

Unwinding of hedge funds' relative value strategies. Hedge funds that employ so-called relative value strategies fund large positions in treasury securities using leverage through repos, while, at the same time, selling the corresponding futures contract.[1] Hedge funds employing such strategies profit from small differences in the yield between cash treasuries and the corresponding futures. Moreover, since the futures yield and cash yield move together closely, the hedge fund can pocket the small yield difference regardless of which way the market moves. This is an example of a "long-short strategy", as made famous by Long Term Capital Management (LTCM), a hedge fund that failed in 1998, where a long position in one asset is hedged by a short position in a closely related asset (Shin (2010, Chapter 3)).

Relative value investors can achieve high levels of leverage because the collateral value of Treasury securities is normally high. For instance, if an investor can borrow $99 by pledging $100 worth of treasuries, the investor need have only $1 of own funds to hold treasuries worth $100, achieving 100-fold leverage. In this way, even a small yield difference can be magnified by leverage. Before the Covid-19 crisis, the cash futures relative value strategy delivered a steady stream of returns. One indication of the popularity of such trades was the growing short positions in futures by leveraged funds (Graph 2, centre panel).

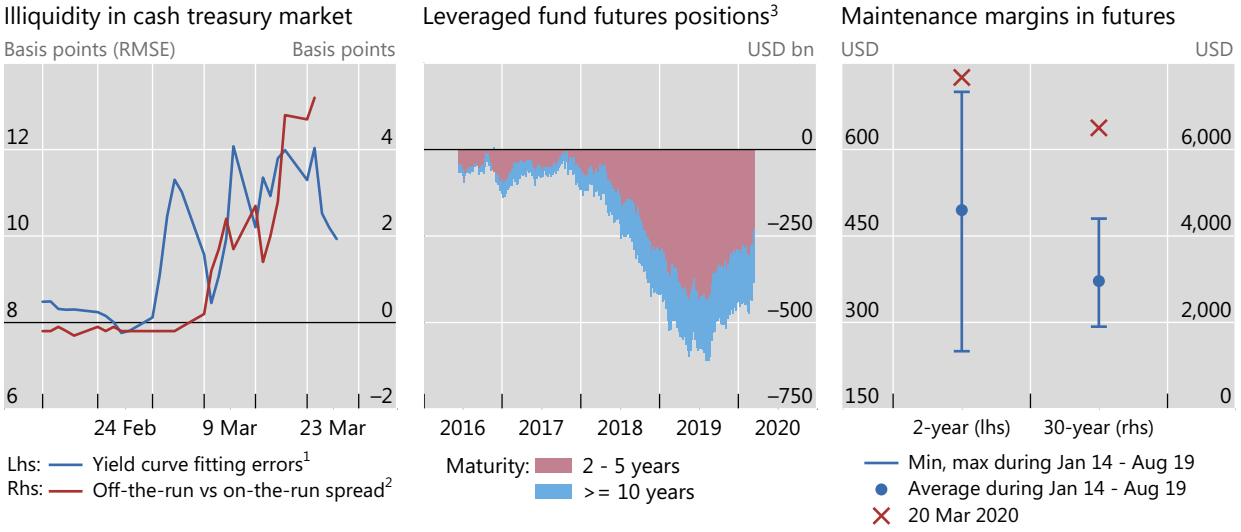
However, as volatility picked up and margins surged, particularly at the long-end (Graph 2, right-hand panel), liquidity in futures markets deteriorated sharply (Graph 3, left-hand panel). Futures-implied yields

[1] This trading strategy is commonly referred to as treasury futures arbitrage and forms part of the broader set of balance sheet-consuming trades that consist of a cash Treasury leg that is used as collateral and funded in the repo market, coupled with a derivatives transaction.

dropped more rapidly than bond yields, imposing mark-to-market losses on relative value investors who had sold futures and bought cash bonds. One facet of the ensuing price dislocations between bonds and futures was the fact that the implied repo rates of the cheapest-to-deliver bonds in the futures contracts rose markedly above market term repo rates (Graph 3, centre panel). In frictionless markets, the implied repo rate that an investor would earn by buying the cash bond and delivering it in fulfilment of the futures contract should theoretically be equal to the actual term repo rate. The breakdown of the relationship suggests severe strains at the time in relative value trades. Once the funds were no longer able to meet variation margins, their positions were unwound by dealers/futures exchanges, pushing prices lower. This in turn gave rise to a classic "margin spiral" (à la Brunnermeier and Pedersen (2009)), whereby the cycle of illiquidity, price dislocations and tighter margin requirements fed on itself.[2]

Illiquidity in cash Treasury markets and leverage in futures

Graph 2



[1] Deviations from a fitted yield curve based on Nelson-Siegel methodology; RMSE = root-mean-square error. [2] 30-year bond maturing on 15 Nov 2049 vs on 15 Feb 2050. [3] Net futures positions.

Sources: CBT; CFTC; CME; Bloomberg.

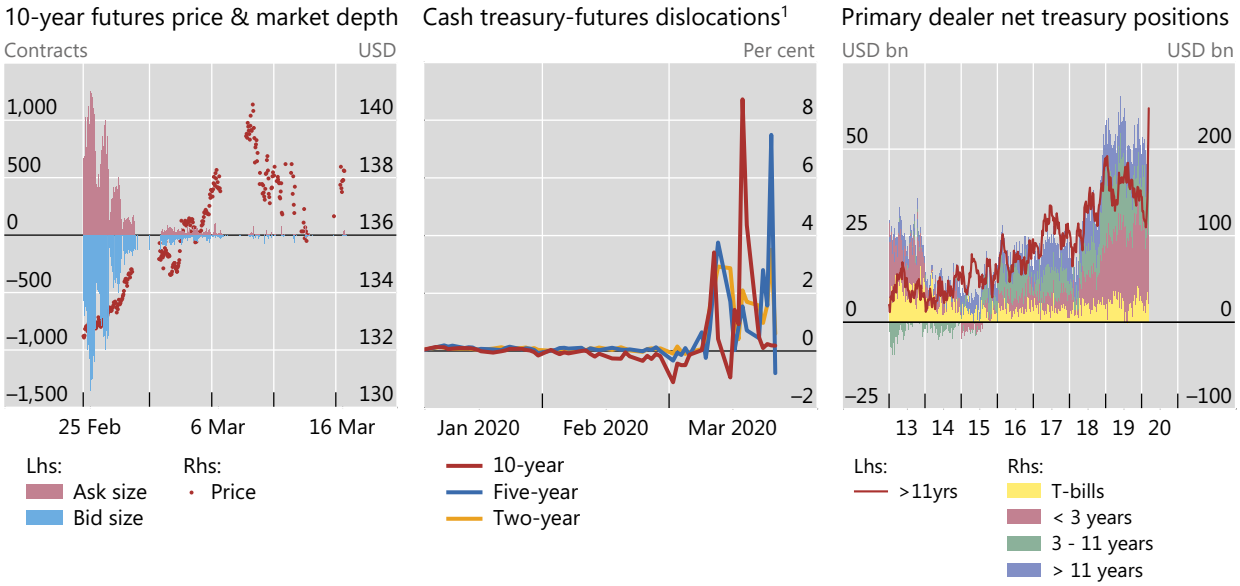
Dealer balance sheets under pressure. Under normal circumstances, dealers would be able to alleviate market stresses by absorbing sales and building up an inventory of securities. But, dealers' treasury inventories had already been stretched, especially from 2018 onwards, as they needed to absorb a large amount of issuance (Graph 3, right-hand panel). Far from there being a shortage of safe assets, there was a glut in the run-up to Covid-19. In addition, the steep rise in the volume of the cleared repo market segment (where dealers can economise on capital through netting) indicates that hedge funds have increased their leveraged positions (Graph 4, left-hand panel). With inventories already bloated, dealers faced severe difficulties of further absorbing the unwinding of investor positions in March 2020, particularly at the long end.

Knock-on effects on systematic funds. The treasury-futures relative value trades were likely to have been just the tip of the iceberg, as a number of other relative value trades (those using total return swaps, for example) were also susceptible. Furthermore, while the locus of initial market turbulence largely involved relative value investors, de-risking quickly spread to systematic funds. Such funds follow a rules-based investment strategy with limited, if any, scope for discretionary or tactical adjustment.

[2] A factor that likely exacerbated the situation was the activation of business continuity planning and work-from-home arrangements on a hitherto unprecedented scale. According to market sources, not only did this make it harder to deal with back office tasks due to margin calls, but it also led to a further overall decline in internal risk limits.

Futures market illiquidity and US Treasuries on dealers' balance sheets

Graph 3



[1] Implied repo rates of cheapest-to-deliver bonds in Treasury futures minus the one-month General Collateral market repo rates.

Sources: Refinitiv; JPMorgan Chase; Bloomberg; BIS calculations.

While systematic strategies are not new, they have expanded rapidly in recent years and their market impact is likely to have increased. Market estimates suggest that about $1–1.4 trillion of $9 trillion in hedge fund assets could be managed by systematic funds, including so-called **CTA/momentum funds** that take both long and short positions, primarily in futures markets, and **volatility control funds** that adjust their portfolios dynamically by allocating to safer assets, such as fixed income or cash, when volatility rises.[3] These lever up the equity part of the portfolio and de-risk when volatility limits are reached.

Another group of systematic funds are so-called **risk parity funds** that use leverage to enhance the return contribution of safer assets, eg government bonds, in their overall portfolio. They tend to have longer look-back periods and are less responsive to short-lived episodes of financial market volatility.[4] However, during the Covid-19 crisis, the dislocation in the treasury market meant that bonds no longer performed as a hedge or delivered desired exposure in either type of strategy. As the funds scaled down leverage, this led to a dash for cash, exacerbating declines in *both* equity and bond prices. As the equity market sell-off accelerated and treasury volatility also rose, the assets and number of risk parity funds began to fall (Graph 4, centre panel), indicating that the de-risking by systematic funds was widespread.

Policy considerations. Events in the last few weeks underscore the importance of market surveillance that takes account of so-called negative convexity positions. The term "convexity" originates from option pricing, and refers to the property whereby the holder of an option benefits from an increase in volatility. "Negative convexity" refers to the reverse property, where an investor incurs losses when volatility rises, eg because the investor has sold options. Investors with negative convexity positions can hedge dynamically by trading the underlying security, but such trading strategies invariably entail procyclical

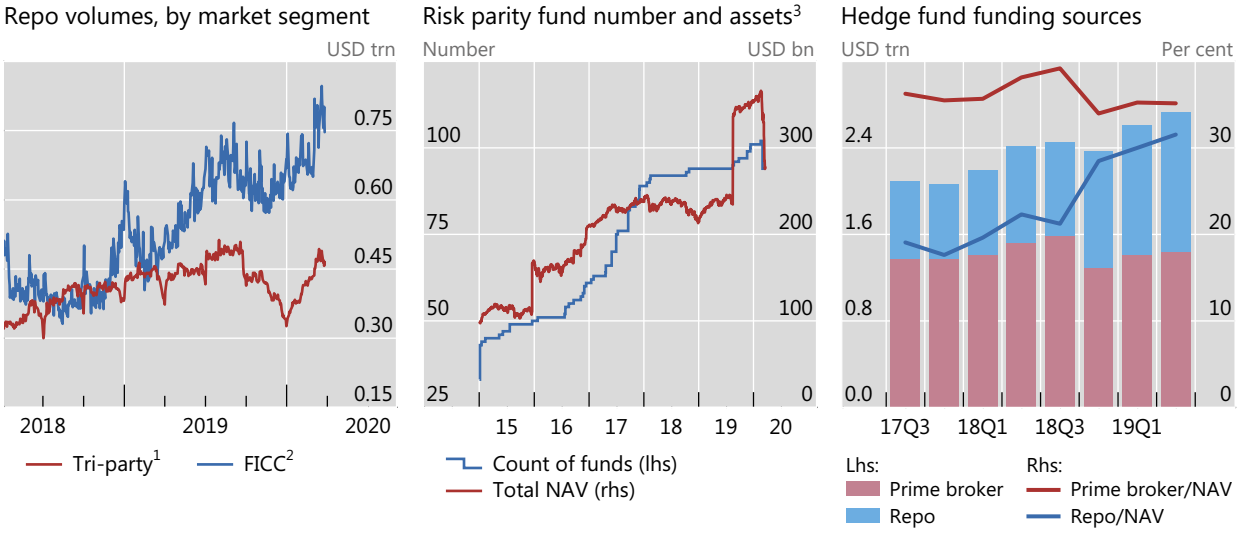
[3] According to market sources, assets under management of CTA/momentum funds are about $300 billion, and of volatility control funds another $300 billion (tailored mainly for insurance companies offering variable annuity products); assets under management of risk parity funds are estimated to be in the range of about $400 billion. In addition, factor investing/smart beta ETFs account for another $400 billion.

[4] For example, market contacts report that risk parity funds did not join the burst of broad-based selling back in December 2018.

trading strategies of selling when the price falls, and buying when the price rises (Shin (2010, Chapter 4)). Portfolio insurance strategies behind the 1987 stock market crash are a good example.[5]

Hedge fund funding sources and indicators of activity by risk parity funds

Graph 4



[1] Tri-party = Tri-Party General Collateral market. [2] FICC = Fixed Income Clearing Corporation. [3] Includes multiple funds belonging to the same fund family.

Sources: Federal Reserve Bank of New York; US Securities and Exchange Commission; Bloomberg; BIS calculations.

The recent episode in treasury markets illustrates yet again that high leverage through cheap funding of securities positions can lead to the accumulation of negative convexity positions. This directly raises the risk of an endogenous feedback loop, when such positions unwind rapidly and in a non-linear way as volatility picks up. As such, market monitoring should look beyond current conditions and ask the "what-if" questions that are relevant for potential market stresses. To be effective, such fully fledged stress tests must assess the potential scope for forced selling and feedback loops, especially in tranquil periods when leverage is building up.

More generally, there are important lessons on the importance of the composition of the investor base, and the related policy issue of the provision of liquidity by central banks. Given the importance of the government bond market as a benchmark financial market price, any dysfunction has far-reaching detrimental effects that ripple through the rest of the financial system and the real economy.

In this context, the reaction function of the central bank is an important background factor. The ample provision of funding by the central bank may be an enabling factor for cheap leverage via repos to fuel short-convexity exposures. Hedge funds rely on two main sources of funding: repo and prime brokers, and the importance of repo funding has been growing gradually (Graph 4, right-hand panel). In retrospect, the repo market ructions of September 2019 appears to have been a canary in the coal mine for the recent turmoil. Back then too, repo demand from hedge funds to maintain arbitrage trades between cash bonds and derivatives contributed to the funding squeeze in dollar repo markets.[6]

Recent events also illustrate how the authorities may need to absorb sales directly rather than doing so indirectly by lending to dealers, especially when funding is not the relevant constraint. This may also explain why, on this occasion, the Fed's rapid purchases of securities out of dealers' inventories (to the

[5] Another example is the convexity hedging by MBS investors or by liability-driven institutional investors, such as life insurers.

[6] See eg Avalos et al (2019).

tune of about $670 billion) appeared more effective in stabilising the market than the provision of liquidity via repo operations, where take-up was relatively subdued.

More broadly still, the shift in the investor base should be a matter of policy discussion. The recent shifts in the investor base of treasury securities from official sector investors (eg foreign central banks) and long-term investors towards leveraged traders and other negative convexity investors give pause for thought regarding potential future volatility from endogenous feedback loops.

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