Market function

Increased market fragility

We expect the fixed income market to be subject to increased bouts of illiquidity and disruption, due to increased complexity, constraints on intermediaries and investors, and a rapidly growing market.

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We expect important parts of the fixed income market to suffer from increased fragility over the next several years. This is really the continuation of a trend, evidenced by two high-profile recent disruptions: the 2019 repo market volatility and the COVID-induced 'dash for cash'. In fact, the nature of shocks has been worsening since 2016, with both more frequent and more severe disruptions in Treasury and funding markets.

One source of this fragility is the increasingly complex set of regulations that govern investing and intermediation. These rules interact, affecting markets in unexpected ways (at least *ex ante*). We illustrate this phenomenon with the bank SLR and IHC rules. Bank capital is constrained by the SLR but IHC rules segregate it by jurisdiction. Capital is trapped and banks are unable to 'flex' up their balance sheets to meet a sudden increase in liquidity demand, resulting in increased local volatility, and increased local contagion, forcing more regulatory intervention.

Another source of fragility is the rapidly growing size of the Treasury market, as has been highlighted in other chapters of this report. We roughly expect demand for intermediation to scale with the size of the market, and thus the large deficits are only going to raise the bar for regulators.

The natural response to market fragility will continue to be new rules, restrictions, and requirements. For example, central clearing is a response to the increased volatility that we link to post-crisis reforms. While this will release some constraints, notably those linked to balance sheet capacity, it will introduce new costs and constraints associated with (potentially pro-cyclical) margins and significant additional complexity. The result is an increasingly baroque array of interactions across rules that are only exposed *ex post*, after a market dislocation.

We argue that investors and regulators are faced with a trilemma: it is impossible to simultaneously have stable markets and intermediaries and no moral hazard**.** Pre-crisis, extreme market liquidity came at the cost of highly levered banks and significant systemic risk. The post-crisis efforts to stabilize banks and other intermediaries have improved the situation overall, but reduced the stability of markets. Further, pre-crisis intervention to stabilize banks has been transformed into post-crisis official interventions to support market functioning, introducing a new form of moral hazard. The natural response is to layer new regulations, but

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we suspect there is no 'silver bullet' combination of rules and structures that will solve this trilemma.

This not to argue that the new framework is poorly designed or mistaken. Instead, regulators are fighting an uphill battle: a framework that is effective in a $20 trillion market may not be adequate for a $40 trillion market. In fact, the real source of the trilemma may be a reduced tolerance -- from investors, intermediaries, and, most importantly, central banks -- for market instability. This intolerance is not from a lack of nerves: liquid and well-functioning Treasury and funding markets are essential for the efficacy of the post-crisis reforms. If we are correct, the cycle of disruption, intervention, and regulatory innovation will continue for the foreseeable future.

A more fragile fixed income market

We expect increased fragility in the fixed income market over time, with more frequent bouts of illiquidity, poor functioning, and heightened volatility. Of course, this is only the continuation of a trend, rather than a new phenomenon. Several episodes, such as the September 2019 dislocation in the US repo market and the COVID-induced "dash for cash" highlight that these risks already exist.

That said, several ingredients are in place that we believe will exacerbate these risks. First and foremost, the supply of Treasuries, as discussed in several earlier pieces, will increase the demand for intermediation, which should scale roughly with the size of the market. Second, increasing, and increasingly complex, constraints on intermediaries will limit their flexibility, particularly in times of stress, leading to more frequent and more severe dislocations.

Of course, the constraints on intermediaries are not without purpose; they are designed to increase the stability of the intermediaries themselves, such as through tighter capital requirements, or to relieve other constraints that hinder market functioning, such as the requirement to centrally clear transactions in Treasuries. However, each new restriction and requirement adds to the complexity of the market, and reduces its flexibility. We do not believe a "silver bullet" combination of regulations and facilities exists that will shoehorn the rapidly growing Treasury market into the existing market infrastructure, at least over the medium term. Instead, we believe the increasingly complex rules interact, often in unexpected ways that are only exposed *ex post*, after a market dislocation, and which then begets a new round of innovation and regulation. The substantial supply of Treasuries means that regulators and investors are fighting an uphill battle; a market structure that works for a $20 trillion market may not work for a $40 trillion market, and the flaws won't be obvious until they are exposed by market events.

We illustrate with a case study on how two rules changes interacted to increase the fragility of the international repo markets. But there are other examples in which regulations interact with each other to create market fragilities. And as we discuss below, we suspect new regulations designed to address the shortfalls in existing rules are likely to create or exacerbate other fragilities.

The supplemental leverage ratio (SLR) and the requirement that foreign banks organize their US activities under separately capitalized and governed holding companies known as Intermediate holding companies (IHCs) are two aspects of the post-crisis regulatory regime that each address specific vulnerabilities in the banking system. The SLR addressed the risks posed by excessive balance sheet leverage exposed by the financial crisis, and the IHC (and subsequent similar regulations adopted in Europe) address the difficulty resolving failed subsidiaries when loss-absorbing capital is not available locally. At the same time, each imposes constraints on dealer

balance sheets, such as repo and reverse repo transactions, which are balance sheet intensive but low risk-weight. The SLR took effect earlier (2014); it directly limits the ability of banks to flex upwards repo balances. The IHC constraint is indirect: it limits banks' ability to move capital across jurisdictions, particularly in response to market dislocations.

These rules interact, and their combined effect is much stronger than either is individually. For example, capital mobility is unnecessary absent the SLR; banks would have no need to shift capital between jurisdictions if balance sheets were unconstrained. Similarly, absent capital segregation, banks could access their global pool of capital during dislocations, mitigating the effect of the SLR on repo markets. Further, when the US passed its IHC rules, it did not know that Europe would adopt similar rules, further limiting the flexibility of intermediaries. Our analysis shows that the combination of the two rules results in more frequent, more severe, and more persistent dislocations to both US and European repo markets, which cause greater (local) spillovers to other markets.

The resulting instability in funding and Treasury markets then sparked a mandate for central clearing, efforts to increase regulation of principal trading firms (PTFs) as well as higher capital requirements associated with Treasury trading as part of Basel III. Of course, each of these comes with its own complexity and imposes new constraints; for example, the central clearing mandate relieves the constraint on balance sheet capacity but replaces it with higher intermediation costs and added complexity for non-members of the clearing platform. But this is only one example. As rules become increasingly complex to correct for the side-effects of earlier regulation, intermediation costs rise and flexibility declines. Participants instead solve a Rubik's cube of global rules and requirements that not only reduces their ability to make markets, but also slows their response to dislocations. The consequences only become fully apparent with the right (or wrong) combination of events.

In short, we expect the frequency of market dislocations to increase, and the trends we document in repo and Treasury markets will worsen over time especially as debt outstanding grows. Policy makers will need to intervene to support market stability more frequently, which can worsen moral hazard by expanding the 'alphabet soup' of facilities and programs designed to support markets over time, as new vulnerabilities are exposed and subsequently addressed. Importantly, our analysis does not imply that the post-crisis regulations are mistaken. While there are surely aspects of the new rules that can be fine-tuned or improved, the financial crisis exposed a fundamental flaw in our financial system: the pre-crisis easy liquidity and stable functioning was achieved at the cost of excessively risky banks. These risks would only be higher today. Instead, we believe that regulators are seeking the right balance between market functioning, moral hazard, and the degree and distribution of systemic risk. This may in fact be its own form of 'trilemma', in that we cannot have a well-functioning system that also lacks both moral hazard and systemic risk.

Case study: SLR and the establishment of the IHCs

We demonstrate the potential for tension between stability and safety of large financial institutions and market functioning using two specific pieces of the post-crisis financial reforms, both of which were designed to address key fragilities that were exposed by the crisis. Of course, these are only two of many changes that have been enacted as part of the ongoing process of financial regulatory reform that was catalyzed by the GFC. We choose these to demonstrate two points. First, we will show how regulations with completely different motivations, scope, and timing, can interact to cause a combined effect that creates its own meaningful risks, which are difficult to foresee in advance. Second, we will demonstrate how the realization of these risks results in the next step of the process, which involves creating new

rules, regulations, and facilities to address the emerging risks generated by the first round of reform.

SLR

Pre-crisis, the dominant capital ratio governing banks was based on the risk-weighted average. The crisis exposed the flaw in this uni-dimensional approach: it allowed banks to apply extreme levels of leverage against assets deemed to be low risk. Of course, some of the assets considered low risk proved to be very risky indeed, and losses from those positions exacerbated the consequences associated with the general dearth of capital in the banking system (RWA based capital requirements were also increased post-crisis).

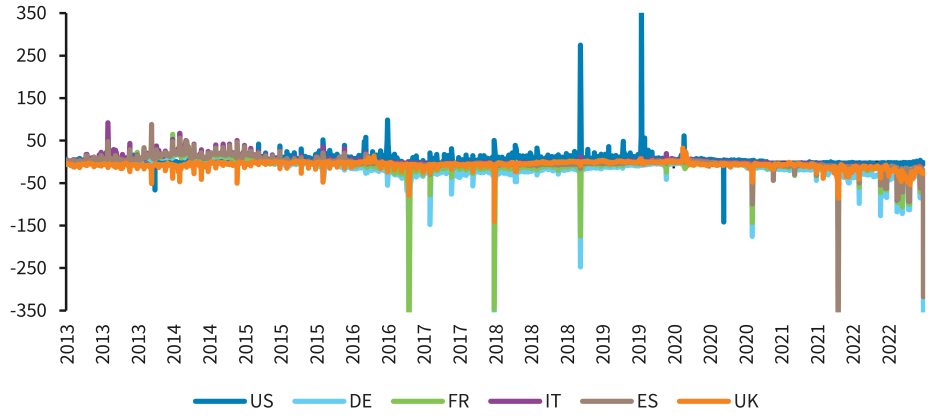
The financial crisis revealed banks' inadequate capital and their over-reliance on risk-weighted measures of leverage that understated balance sheet risk. US regulators adopted additional leverage-based capital requirements that are based on total rather than risk-adjusted assets. The supplemental leverage ratio (SLR), sets a minimum ratio of capital to assets of 5%. Importantly, the asset base is all-inclusive; for example, reserves, Treasuries, and overnight repurchase transactions collateralized by Treasuries all count in the denominator. In addition, regulators have shifted their focus from purely on-balance sheet entries to total exposures which include off-balance sheet derivatives. These exposures are included in other capital metrics such as those based on the annual systemic risk surcharge (GSIB score).

An important consequence of the SLR is that the total capacity for matched book repo is capped. In a matched book, the bank acts as an intermediary between investors and borrowers of cash in the repo market. Typically, this activity is balanced - that is, the bank is not directionally long or short repo. But accounting rules require that to net off long and short positions, the counterparty to the trades must be the same, with the same maturity date and collateral type. As a result, intermediating between say, money funds and hedge funds, while largely balanced still consumes a significant amount of regulatory capital because the counterparties are different. Thus, a bank that was operating at its target leverage ratio (i.e., the SLR minimum plus whatever buffer the bank utilizes) would need to raise new equity if it wanted to increase its repo market making. But the margins from running a low risk activity such as a Treasury matched book operation are slim and insufficient to cover the cost of new equity. As a result, the SLR is effectively a system-wide limit on the balance sheet capacity for low RWA assets.

However, banks can, in principle, substitute between low RWA assets based on market opportunities. For example, if repo rates spike, banks can sell Treasuries or reserves and use the capacity to engage in more repo. These are close to true substitutes as they all count towards the various liquidity requirements, such as those mandating a minimum amount of high quality liquid assets (HQLA), although the spike in repo rates in September 2019 revealed a soft preference for reserves over other forms of HQLA. This preference was likely strengthened after the collapse of SIVB when banks discovered that outside of Federal Reserve liquidity programs, monetizing Treasuries is neither immediate nor capital neutral.

That said, there is nothing about the SLR that prohibits banks from substituting across currencies. In fact, we find evidence that banks shifted their repo balances across currencies in response to market opportunities, using data on US and European repo rates and the dollar-euro cross-currency swaps from January 2013 to July 2016 (this is after the US adopted the SLR). One piece of evidence is that US and European repo markets were highly interrelated: shocks tended to overlap, and day-to-day variations in repo spreads were highly correlated (Figure 1).

FIGURE 1. **Repo spreads (bp)**



Note: Repo spread rates reflect general government collateral.
Source: TCC GCF Repo Index, Bloomberg, Fed, ECB, BoE

This 'global contagion' might seem bad; events in Europe were telegraphed to US markets and vice-versa. But it is actually a sign of a well-functioning financial system. The contagion is driven by banks reallocating capacity across markets in response to events, in an effort to equalize rates of return and distribute shocks across a global pool of capital. As we will see below, it also served to limit the frequency and severity of shocks, which is exactly what we expect when banks can reallocate capacity in response to dislocations. In other words, while the SLR capped the total repo capacity of the banking system, it retained important flexibility across currencies, that allowed banks to allocate their capacity in the markets with the greatest demand.

IHCs and financial segregation

The second regulation we examine is the requirement that foreign-owned banks organize their US activities under a separately capitalized and governed entity known as an Intermediate Holding Company (IHC). Each IHC has its own management team, Board of Directors, and is subject to the capital and liquidity rules established by the US Federal Reserve, and to the annual stress test (CCAR) process.

As with the SLR, this rule was based on a lesson learned during the GFC. In this case, the lesson was that large and complex global financial institutions expose the various jurisdictions they operate in to systemic resolution risk for a variety of legal and interconnection issues. In addition, the subsidiaries tended to be more thinly capitalized than their parents as well as their local (domestic) competitors. The Dodd-Frank Act (2010) instructed the Federal Reserve to address this gap by establishing and enforcing standards for foreign-owned banks operating in the US; it did so via Regulation YY, which (in part) mandated the establishment of IHCs by July 2016.

Regulation YY severely curtails the ability of foreign-owned banks to shift capital between jurisdictions. To move capital out of the US entity and back to the parent requires the recommendation of the US management team, approval of the US Board (until 2019, it also required explicit approval from the US Federal Reserve as well). These recommendations and approvals cannot be made on a whim; management must give due consideration to the most recent stress tests, forecasts of local revenues and costs, etc. It could take months or longer to secure the required approvals, severely limiting the ability to extract capital from the US entity in response to market events. Of course, knowing that capital is difficult to extract from the US is itself a deterrent to injecting capital into the entity, particularly in response to a market

disruption, which might present only a short-term opportunity, after which the entity would be overcapitalized.

In addition, European regulators adopted an analogous set of rules in 2019. These require non-member banks operating in Europe to organize their activities under an Intermediate Parent Undertaking (IPU), which is subject to (roughly) the the same governance and supervisory requirements as a US IHC. This response was perhaps unsurprising; the US had effectively ring-fenced the capital allocated to US subsidiaries, which meant capital could flow into but not out of the US in response to a crisis. Europe re-established symmetry with the IPU requirement.

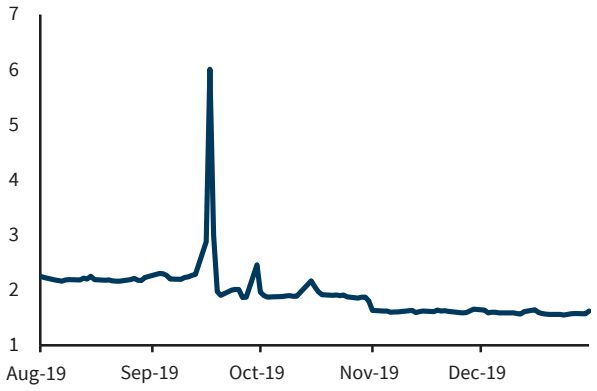
As a result, globally active US banks now face similar constraints regarding the capital of their European subsidiaries as non-US banks face with their US subsidiaries. Bank capital is segregated by jurisdiction and unavailable for use by other subsidiaries; allocating it across jurisdictions is costly and time consuming, requiring a mix of internal governance and regulatory approval. In short, bank capital is trapped.

Market stability and liquidity declined as a result

Together, these two rules changed the nature of shocks. Along with other regulatory changes governing liquidity requirements and the rapid expansion in debt, the Treasury market has experienced more frequent and more severe bouts of illiquidity since 2014. Given the size of the Treasury market and its reputation as the most global and liquid market, these periodic bouts have attracted a considerable amount of attention from regulators, academics and participants.

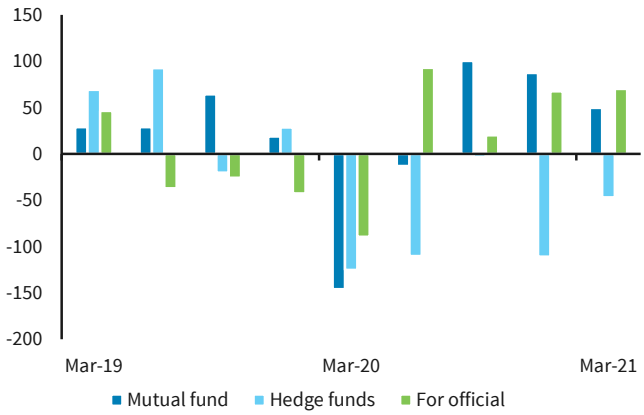
The two most recent - and severe - shocks occurred in September 2019 and March 2020. In the first, crowded positioning, tight dealer balance sheets and unanticipated bank reserve scarcity pushed overnight repo rates dramatically higher (Figure 2). Less than six month later, COVID triggered a 'dash-for-cash' in which a wide variety of Treasury investors unloaded their holdings to boost their precautionary cash balances. In Q1 20, mutual funds and foreign official institutions were heavy sellers. Hedge funds also reduced their holdings that quarter and continued selling for another year (Figure 3). Unsurprisingly given this selling wave, the bid-ask spread on some off-the-run Treasuries widened to nearly 30x their normal levels. This required the Fed to step in to support market liquidity with massive purchases - of $1.6trn in Treasuries and $700bn in MBS between March and June 2020 - and to temporarily exclude Treasuries from the SLR calculation, in an effort to relieve constraints on bank balance sheets.

FIGURE 2. **GCF repo (bp)**



Source: DTCC, Barclays Research

FIGURE 3. **Treasury selling ($bn)**



Source: Federal Reserve, SEC, Barclays Research

Many commentators relate these bouts of instability to financial reform, particularly to the SLR, including Liang and Parkinson (2020)[1] and Duffie (2023).[2] Duffie notes that the ratio of primary dealer assets to GDP fell by 18.5% between 2010-22. At the same time, outstanding public sector debt increased 170%. Duffie et al show that when balance sheet capacity utilization at dealers increases from 40% to 80%, their compound measure of Treasury market illiquidity increases by 3 standard deviations from the average predicted based on yield volatility alone. They note that more than 80% of the measured illiquidity in the Treasury market comes from yield volatility. As a result, narrow balance sheet capacity creates an illiquidity loop. Banks react to the increase in yield volatility by rationing their balance sheet and stepping back from market intermediation. This increases illiquidity and they step back further from intermediating.

Favara et al compare Treasury cash and repo trading at banks and non-banks during and after the SLR exemption period.[3] During this period, the Fed temporarily allowed banks to exclude their Treasury and reserve holdings from the calculation of the SLR. The credit line drawdowns that occurred in early 2020 as bank borrowers ramped up their precautionary liquidity buffers were sudden and unexpected balance sheet expansions for banks. The authors find that these expansions reduced bank intermediation in the Treasury cash and repo markets, and this effect is larger for banks with lower SLRs and after the exemption period expired.

However, taking a global perspective highlights how the changes are linked to more than just the SLR, and why the challenges with market functioning have risen. The capital segregation discussed above worsened with the passage of the European IPU rules, such that the fragilities it causes have grown. As evidence of the importance of segregation, we first examine how the overlap between US and European repo markets changed with the introduction of the IHCs in July 2016 (Figures 4 and 5). We see that every measure of overlap fell; once capital mobility became more difficult, markets became more segregated.

[1] See, for example, "Enhancing Liquidity of the US Treasury Market Under Stress", N. Liang and P. Parkinson, Brookings Institute Working paper 72, 2020.

[2] See, "Dealer Capacity and U.S. Treasury Market Functionality", D. Duffie, Duffie, M. Fleming, F. Keane, C. Nelson, O. Shachar, and P. Van Tassel, Federal Reserve Bank of New York, October 2023.

[3] See, "Leverage Regulations and Treasury Market Participation: Evidence from Credit Line Drawdowns", G. Favara, S. Infante, and M. Rezende, Federal Reserve Board, December 2022.

FIGURE 4. **Shocks overlap (US)**

Shock in:		Overlap with shock in:	Pre 2016	Post 2016	Change
US	&	Core	22.1%	16.2%	-26.7%
US	&	UK	32.4%	18.6%	-42.6%
US	&	At least one	62.2%	27.9%	-55.1%
US	&	Severe	18.9%	5.6%	-70.4%

Note: Overlap refers to the percentage of US shocks that coincide with a shock in Core, At least one, Severe or UK measures. Shocks are defined as dates when the absolute value of repo spreads is above the 95th percentile.
Source: DTCC GCF Repo Index, Bloomberg, Barclays Research

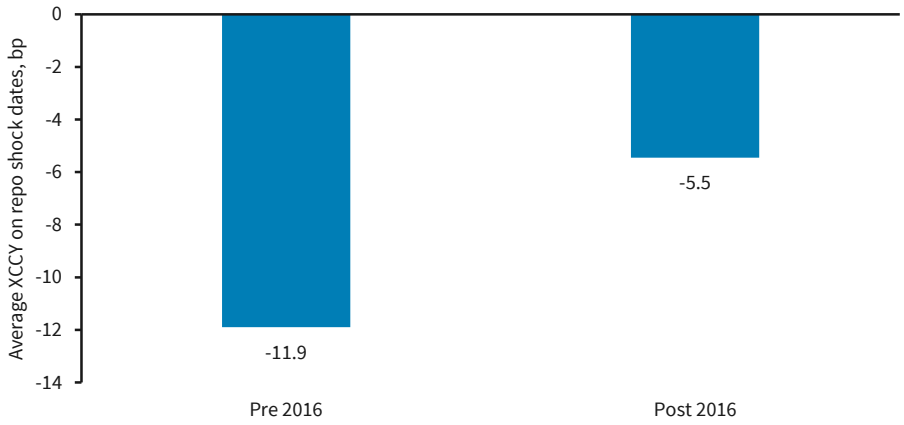
FIGURE 5. **Shocks overlap (Europe)**

Shock in:		Overlap with shock in:	Pre 2016	Post 2016	Change
Core	&	US	24.6%	14.6%	-40.7%
UK	&	US	33.3%	19.3%	-42.0%
At least one	&	US	20.2%	16.2%	-19.8%
Severe	&	US	21.2%	14.2%	-33.0%

Note: Overlap refers to the percentage of Core, At least one, Severe or UK shocks that coincide with a shock in the US. Shocks are defined as dates when the absolute value of repo spreads is above the 95th percentile.
Source: DTCC GCF Repo Index, Bloomberg, Barclays Research

We can also see evidence for the segregation of capital in the cross-currency market. Before 2016 and the advent of the IHCs, it reacted in the expected way to shocks in international repo markets. When there was an opportunity to shift balances from dollars to euros, the basis swap became more negative (meaning more expensive to swap euros to dollars) and vice-versa (Figure 6). However, the evidence of money moving across markets in response to opportunities declines by over half after 2016; absent capital mobility, banks were no longer able to reallocate balances based on market events.

FIGURE 6. **Sensitivity of the 3m EURUSD xccy basis to repo shocks declined after 2016**



Note: sensitivities are estimated in a formal regression model, controlling for macro variables (the size of the TGA, primary dealers' Treasury inventory and the 10-year implied rates volatility) and including quarter-end fixed effects.
Source: Bloomberg, Barclays Research

While reduced global contagion might sound good, it comes at a significant cost: shocks are more frequent and more severe. As stated above, banks can no longer distribute shocks across the global system, so when disruptions occur, there is no way to mitigate their effect with capital inflows. Figure 7 shows that shocks in the repo market became more than 25% more frequent in both the US and Europe. The severity of shocks increased by 31% in the US, and by over 300% in Europe.

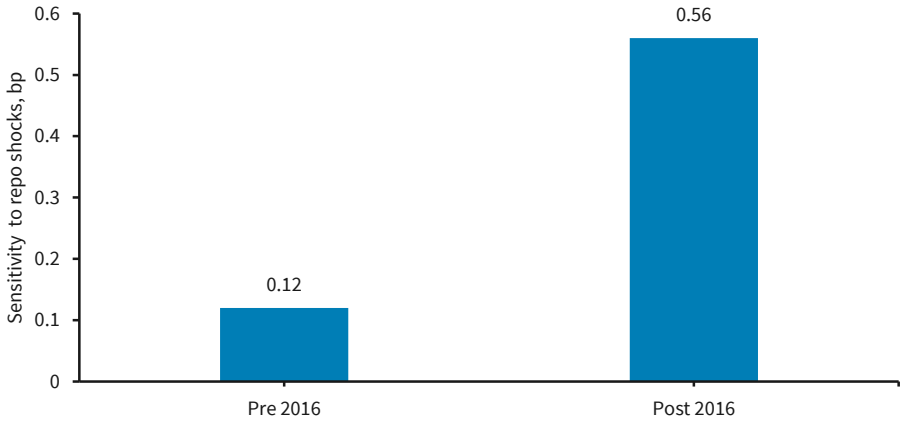
FIGURE 7. **The nature of repo shocks has changed**

Repo shock series	Severity			Frequency			Persistence		
	Pre 2016	Post 2016	Change	Pre 2016	Post 2016	Change	Pre 2016	Post 2016	Change
US	15.4bp	20.2bp	31.2%	4.2%	5.3%	26.2%	18.9%	40.7%	115.3%
Core	10.8bp	44.8bp	314.8%	4.1%	5.2%	27%	43.9%	55.8%	27.1%
UK	14.6bp	15.1bp	3.4%	4.3%	5.3%	23.3%	19.4%	49.4%	154.6%
At least one	N/A	N/A	N/A	9.7%	12.9%	33.0%	52.6%	60.3%	14.6%
Severe	N/A	N/A	N/A	1.2%	3.7%	208.3%	30.3%	42.9%	41.6%

Note: Severity is measured as the absolute value of repo spreads on shock dates (in bp); frequency is measured as the percentage of dates with a repo shock; persistence is measured as the probability of a shock today, given a shock the prior day.
Source: DTCC GCF Repo Index, Bloomberg, Barclays Research

Finally, disruptions to repo markets cause more local spillovers as well. We illustrate using the sensitivity of the futures cash basis (for the 2y Treasury) to repo market disruptions. This basis has attracted significant regulatory attention, based on concerns on the size of the positions taken by hedge funds and other levered investors. After the introduction of the IHC, the sensitivity of the basis to repo disruptions increased by more than a factor of four (Figure 8). With no outlet for the shock, it spread instead to other (local) markets, causing greater disruptions.

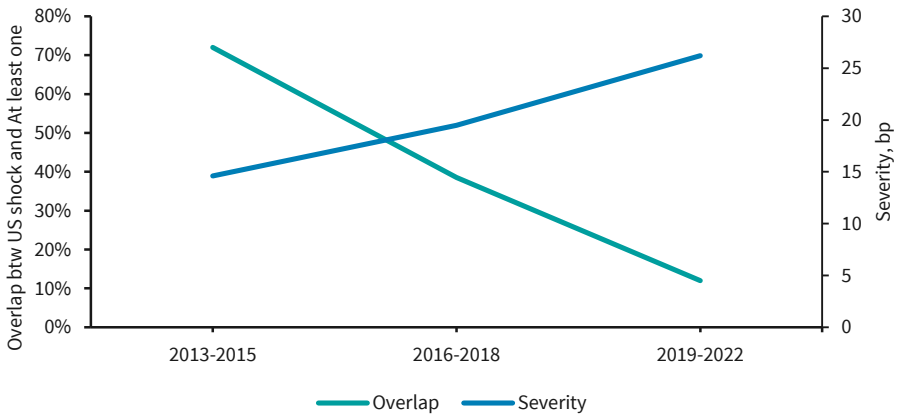
FIGURE 8. **The effect on the swap basis**



Note: Sensitivities are estimated in a formal regression model, controlling for macro variables (the size of the TGA, primary dealers Treasury inventory and the 10-year implied rates volatility) and including quarter-end fixed effects.
Source: Bloomberg, Barclays Research

As discussed above, the creation of the IHCs was the start of a trend towards greater capital segregation, which continued with the European rules enacted in 2019. In fact, the results above blend two periods: one with more limited segregation imposed by the US, and one after 2019 with more severe segregation, imposed by both the US and Europe. When we examine the severity of repo shocks, we find that they increased further with the passage of the European rules (Figure 9). Together, these results show the negative side of segregation: when banks can no longer distribute shocks across the global system, the local effects are much worse.

FIGURE 9. Repo market overlap declined as severity of shocks increased



Note: Severity is measured as the absolute value of repo spreads on shock dates
Source: DTCC GCF Repo Index, Bloomberg, Barclays Research

It is important to recognize how the two regulations we discuss interact. Neither is individually likely to result in such a dramatic shift in the nature of market disruptions. For example, the SLR was in effect before 2016, but yet shocks were relatively rare. Why? Because banks had the ability to flex capacity within an individual market by accessing their global pool of capital. This reduced the effect of the limitation on balance sheet imposed by the SLR, because the capacity within any given jurisdiction was not capped. Similarly, absent the SLR, the IHC and IPU rules would be irrelevant (at least for low risk-weighted assets), because there would be no need to move capital between jurisdictions to support increased balance sheet. Only with a binding SLR is such mobility necessary.

In short, the SLR has increased the need for capital mobility, by capping balance sheet capacity as a function of local capital. But the IHC/IPU structures eliminated the ability to migrate capital across jurisdictions. Only together do they impact funding markets.

Changing the SLR

If the SLR contributes to the illiquidity in the Treasury market, why not change the requirement to exempt Treasuries? After all, Treasuries are low risk assets that satisfy bank liquidity requirements. And, the Fed has experience with exempting Treasuries from the calculation, so it has a 'live' experiment for comparison (Favara, 2022).

However, Fed officials seem reluctant to take up this issue. Instead, the Fed appears to be moving in the *opposite* direction as official commentary since the SIVB collapse and the Basel III endgame proposal suggests. Regulators are seeking to expand capital, liquidity and stress testing rules to smaller banks (Category III and IV) while simultaneously raising capital requirements tied to trading activity.

Beyond the issue of the Fed's intentions, we are skeptical about the effectiveness of permanently excluding Treasuries from the SLR calculation. A temporary, and importantly, unexpected, exclusion allows banks to flex their balance sheets in a crisis. But a permanent one is similar to a corporate travel budget - travellers use it all or risk getting budgeted less next year. Banks are unlikely to leave unclaimed balance sheet capacity "in reserve" ready to be deployed when intermediation demand unexpectedly increases. Instead, they are likely to fully use any SLR capacity released. This is significant because the liquidity shocks in 2019 and 2020 appear to reflect inflexibility rather than a lack of outright balance sheet capacity.

That is, there is sufficient balance sheet capacity under normal market conditions, but that capacity is not resilient in periods of stress; it evaporates quickly. In both episodes the evaporation took two different forms depending on the provider. Large banks intermediaries widened their bid-ask spreads sharply - hoping not to get hit - while non-bank dealers such as PTFs, simply stepped out of the market entirely, 'going dark'. As we observe above, some of the inflexibility is caused by factors outside the SLR.

Loosening the SLR poses two questions. First, will the extra capacity released be enough to accommodate intermediation demand in a future crisis, especially as Treasury debt outstanding is growing faster the bank capital? Second, since capital is a scarce resource, would banks dedicate this extra capacity to Treasury intermediation or some other activity with higher returns? This is, of course limited by RWA-based capital requirements (which have gone up since the crisis and are set to rise further if the Basel III Endgame is adopted as written). Our sense is that were the Fed to consider modifying the SLR, it would not be free. Instead, the loosening would be accompanied by other changes to capital rules to ensure that overall capital levels do not decline.

Although Fed Chair Powell suggested that the proposed Basel III Endgame rule was likely to be revised before finalized and that this could "take some time", we think it is unlikely to include a permanent SLR exemption for Treasuries.[4]

Round two regulation: Bypass banks

The increased market fragility, highlighted by the 2019 and 2020 episodes, concentrated regulatory attention on expanding intermediation capacity. If market illiquidity is caused by the adverse interplay between bank regulation and the demand for intermediation, what is the solution? Rather than reducing bank capital requirements and reversing the progress toward safer banks since the GFC, regulators seek to change the Treasury market by reducing the importance of bank-provided market making. Enter round 2 regulation.

Bypass banks: Central clearing

The chief and most widely discussed reform is the SEC's central clearing mandate. Central clearing reduces constraints on balance sheet capacity imposed by the SLR. It allows platform members to net down their long and short positions because each transaction faces the same counterparty (the central clearing platform, or CCP). Multilateral netting through clearing significantly expands banks' intermediation capacity. Fleming and Keane estimate that central clearing would have reduced gross settlement volume by roughly 70% in March 2020.[5] Central clearing has other benefits as well. It reduces counterparty credit risk as this is assumed by the Fixed Income Clearing Corporation (FICC), which is the counterparty to all trades. In return, the FICC monitors and charges its members risk-based haircuts.

In addition to expanding bank balance sheet capacity, central clearing could pave the way to all-to-all trading in the Treasury market. After all, if the binding constraint on liquidity is dealer balance sheet capacity, wouldn't a market in which all buyers and sellers meet to transact without the need for an intermediary remove this constraint?

Higher costs...

However, the gains from central clearing do not come for free. There are two sets of associated costs - direct ones such as margin and liquidity support obligations, as well as indirect ones that reflect complexity and new concentration risks. We expect these to increase transaction costs,

[4] See Semiannual Monetary Policy Report to Congress, Fed Chair J. Powell, March 6, 2024.

[5] See, "The Netting Efficiencies of Marketwide Central Clearing", M. Fleming and F. Keane, Federal Reserve Bank of New York, April 2021.

albeit unevenly. Intuitively, it makes sense that higher costs could decrease market intermediation capacity. Of course, *if* the market evolves away from intermediated liquidity to an all-to-all framework, then this fragility might disappear entirely. In fact, SEC Chair Gensler argues that central clearing together with all-to-all trading will increase competition while removing frictions in liquidity. However, our sense is that while all-to-all clearing works in some markets, it may be less effective in others where counterparty risk is an important factor such as repo.

The direct costs associated from clearing will go up. A significant portion (~75%) of the roughly $2trn in uncleared repo activity has zero margins. To be sure, the dealer may be charging a haircut based on the overall portfolio that includes repo (longs and shorts) as well as cash and futures positions. Hempel et al. note that about 70% of unhaircutted, uncleared bilateral repo trades are in portfolios with simultaneous repos and reverses that net under current accounting rules.[6] That said, because this activity is not cleared and occurs off the FICC platform, it is not subject to their VaR margining described below.

FICC members are charged margin on their cleared transactions. This is accumulated in the FICC's clearing fund, which is scaled to cover the projected losses associated with a member's default. Each member's margin contribution is calculated and collected twice a day, although in periods of financial market stress this frequency is increased.

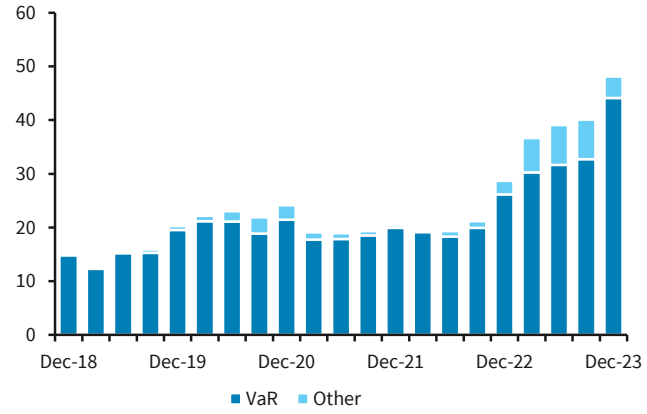
FICC estimates the member's margin using VaR methodology. It runs simulations to model the potential returns from its member's portfolio of trading positions. The simulations are sensitized to several risk factors including: key rates, convexity, implied inflation, volatility and time. These results are sorted with the margin amount set to cover 99% of the potential losses from the portfolio over a 3d liquidation period. The FICC assumes that it will take 3d after a member's default to liquidate its portfolio. The simulation period uses historical returns dating back 10y as well as an additional 1.5y period from 2008-09 to deepen the calibration for "extreme but plausible" events.

However, since 2020, higher price volatility together with a decline in price correlations across maturities has reduced the adequacy of the FICC's current VaR methodology. Its achieved (margin) coverage ratio has fallen below its 99% target. As a result, the FICC has proposed a methodology designed to better account for sharp swings in prices. This is expected to increase aggregate average daily VaR by about $3bn/day. Currently, the daily total is about $48bn/day (Figure 10).

We estimated the cost of clearing an estimated $2trn in repo by building a hypothetical matched book of repo longs and shorts across different portfolios and pushing them through the FICC VaR simulator. This cost was likely on the order of $50-60bn higher than what FICC members currently pay. Our estimate may be too large as it did not take into account the potential for netting FICC VaR across client accounts as well as the potential for future cross product netting with CME futures. That said, there does seem to be a rough correlation between margin costs and trading volumes (Figure 11).

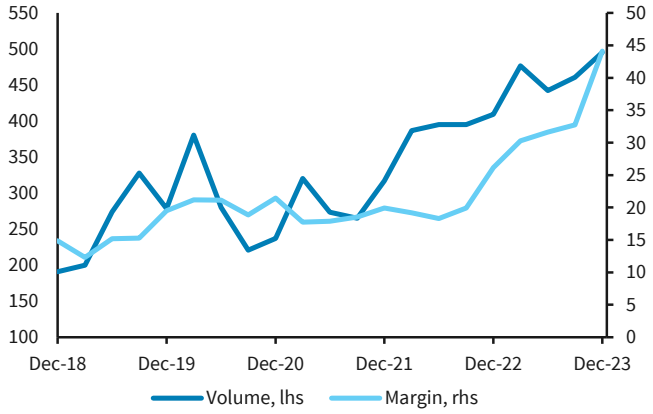
[6] See, "Why Is So Much Repo Not Centrally Cleared?", S. Hempel, J. Kahn, R. Mann, and M. Paddrik, Office of Financial Research, US Treasury, 2023.

FIGURE 10. **Required VaR ($bn)**



Note: Other changes account for backtesting and margin deficiencies.
Source: DTCC, Barclays Research

FIGURE 11. **Required margin and average volume ($bn)**



Note: Required margin and average monthly cleared repo activity.
Source: DTCC, Barclays Research

But even if our estimate of the direct cost is too high, as we describe below, there is the additional, difficult-to-determine complexity burden that requires working through the array of potential interactions between the direct FICC member and its non-member clients.

VaR is not the only direct cost. Because the FICC does not have access to liquidity from the Fed's discount window, it must rely on private sector resources: the defaulting member's margin, the cash and securities held in the FICC's clearing fund, and its capped contingent liquidity facility (CCLF).

As the name implies, the CCLF is a pre-committed liquidity program in which the FICC's members promise to contribute a pre-determined amount of liquidity to support ongoing clearing operations as the FICC unwinds the insolvent member's transactions. The CCLF is only triggered after the other liquidity resources have been exhausted. Direct members legally attest that they will provide the FICC liquidity up to their cap once the FICC "declares a CCLF event." Because the CCLF is a legally binding obligation, bank FICC members must incorporate it into their liquidity plans, stress testing, and other regulatory requirements, such as the LCR.

...and more complexity

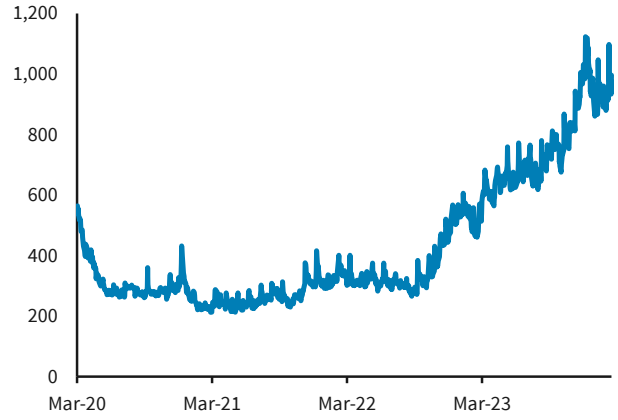
Centrally clearing trades also introduces greater complexity. Complexity can contribute to fragility by creating a set of near-equivalent transactions. In normal times, intermediaries and investors will optimize their positions across these different options, but substituting between them can then become difficult or constrained, which can exacerbate shocks.

The SEC's clearing requirement does not specify how various counterparties are meant to clear their trades - that is, as direct members of the FICC or as non-members who work through an direct member intermediary. Direct members are responsible for meeting capital requirements and contributing to the FICC's liquidity support in a crisis through the CCLF. In return, they are able to clear trades without going through an intermediary, which means that have more access to secondary market liquidity in periods of stress. However, they also face potential loss mutualization in the event of a member's default.

Indirect access includes two similar approaches: sponsored and agented access (ACM). Through sponsored access, non-FICC members can clear their trades through a direct (sponsoring) member (Figure 12). Their sponsor guarantees the client's performance on the platform. The FICC charges the sponsoring member margin on its client trades and this activity is included in the calculation of its other FICC obligation such as the CCLF. The sponsor can do the other side

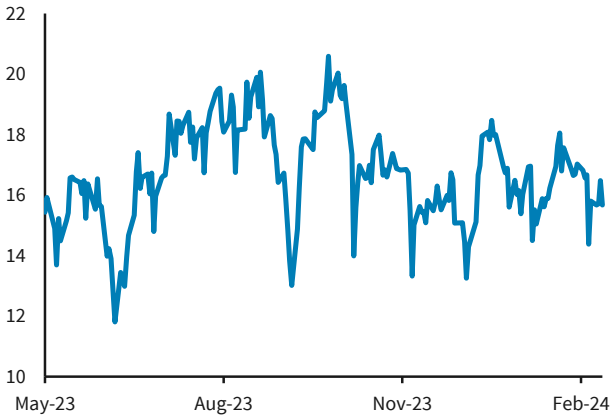
of the trade or it can be done "away" with a different FICC member. Trades can be settled on a CUSIP by CUSIP basis or as tri-party GC (Figure 13). Sponsored access has become very popular - particularly as a tool for expanding netting capacity in periods of balance sheet scarcity such as quarter-ends or when the demand for funding is especially strong.

FIGURE 12. Sponsored repo volume ($bn)



Source: DTCC, Federal Reserve

FIGURE 13. Sponsored tri-party (% total)



Source: DTCC, Federal Reserve

ACM is similar - direct members submit trades for clearing on behalf of their non-member clients. But unlike sponsored repo, the FICC has no legal relationship with the member's client - the direct member is simply passing its client's activity through to the clearing platform.

The complexity lies in the choice of indirect access model and the decisions that the direct member and its customer will need to make. While this is fairly arcane, these decisions create significantly different obligations for the direct member and its client. The source of these depend on whether the client is contributing to the FICC margin cost resulting from its trades and whether this margin is held in segregated customer accounts. These decisions determine the rate on the transaction, how much margin the client pays, and ultimately, whether the client will be able to take advantage of cross product margining opportunities once introduced between CME and FICC.[7] Because counterparties may prioritize different aspects, clearing outcomes may change over time. For example, we think direct members may prefer ACM and the ability to net FICC margin across customers more ahead of reporting dates.

Our intention is less to highlight the mechanics of centrally clearing Treasuries but rather to point out that in an attempt to expand the intermediation capacity of banks, the market is becoming more complicated and costly. First, there is no single clearing model - direct and indirect members have different access channels and within the latter, the choice of model depends on a complicated interplay between charging margin and its segregation.

Second, although all trades will go through the same clearing platform, they will not have the same price. Instead, members and their clients will now negotiate across rate, access fees and margin contributions. Moreover, this will vary by counterparty and what aspects of clearing the counterparties value most. As a result, all cleared trades are not identical substitutes. This invites comparison shopping but it also means that in periods of stress it may not be easy to shift between clearing models. Finally, clearing is not free - direct costs go up as a function of VaR and volume.

[7] These were introduced for direct FICC members in January. It may take 2 or more years to extend access to their customers.

Concentration risk

Central clearing may introduce other risks. There is only one Treasury market clearing platform. As a result, its ability to survive a variety of operational threats as a well as the traditional one from a member's default will be even more critical when an additional $2trn in transactions moves through the platform. Not only does this require careful monitoring (and margining) of its direct member's activity, but the FICC also needs to keep track of indirect member activity over two different access models (sponsored and ACM) each with different margin obligations. In addition, the FICC is moving to expand cross-product margining to client activity. This raises an additional threat - contagion risk spreading from another CCP. We think these risks and their complexity will require significant - and continued - industry infrastructure investment.

But concentration risk is not limited to the FICC. Some of the recently proposed rule changes likely favor institutions with deeper pockets and broader capital resources. For example, the recently approved dealer registration rule will require some current liquidity providers such as principal trading firms (PTFs) to hold more capital or leave the business. Similarly, we think accommodating more indirect access to central clearing will be costly. This could mean that activity favors economies of scale with larger institutions able to sponsor more clients at lower costs.

The SEC does not agree that market intermediation will become more concentrated. It argues that any spread widening resulting from higher clearing costs will be enough to bring in new participants and increase the activity of existing ones. In addition, it argues that registration and central clearing could improve the quality and durability of the liquidity provided by intermediaries. Higher capital requirements reduce risk-taking and leverage, so the risk of market stress events is lower.

Margin procyclicality

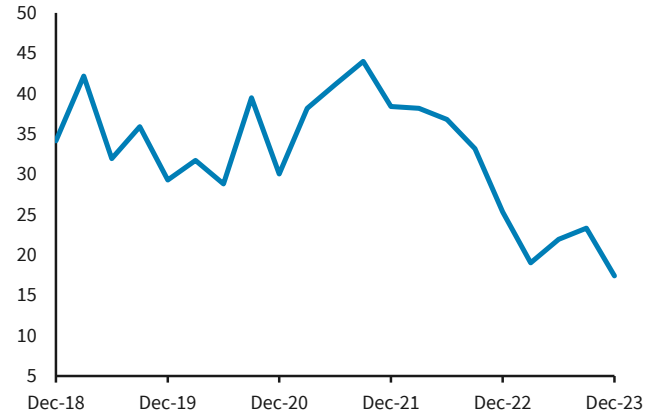
The 'dash for cash' has increased scrutiny on the margin practices of central clearing platforms. As trading volumes increase or market volatility rises, central clearing platforms demand more margin from their members. As most members use cash to satisfy their requirements, this increases their demand for liquidity.[8] They can either borrow more cash to meet their requirements or reduce their positions. Schrimpf et al. argue the March 2020 Treasury market turmoil was exacerbated by a margin spiral that forced leveraged investors to unwind their positions in order to meet their margin requirements.[9] As market volatility rises, margin requirements increase, causing investors to deleverage quickly through asset fire sales that increase market volatility and start the cycle anew. At the same time, these assets become harder to finance; repo margin requirements often increase as collateral values decline and counterparty risk increases. With less access to financing, investors are forced to sell assets which in turn, increases the market dislocation, re-triggering the asset price and funding loops. Of course, direct members typically keep extra balances on hand as a buffer to unexpected margin increases. These balances have gotten thinner recently (Figure 14).

In addition, the location in which central clearing platforms keep their margin cash can exacerbate the liquidity crunch caused by the increase in margin. CCPs are able to keep their cash at the Federal Reserve in IORB-earning accounts (Figure 15). In periods of stress, if this cash shifts to the safety of the Fed's balance sheet as opposed to being recycled back into repo (or bank deposits), the effects of procyclical margin shocks could be amplified.

[8] We focus on initial margin; variation margin redistributes cash across members.

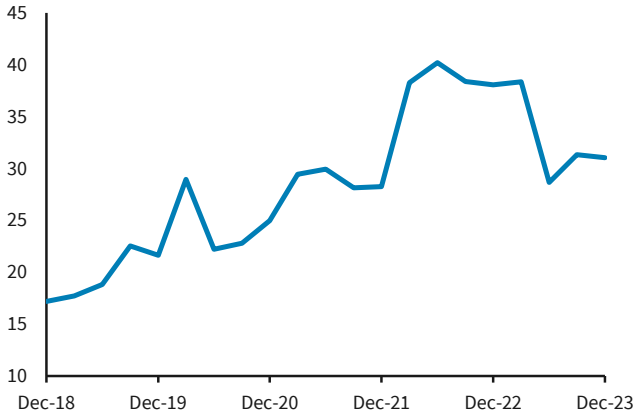
[9] See, "Leverage and Margin Spirals in Fixed Income Markets During the COVID-19 Crisis", A. Schrimpf, H. Shin, V. Sushko, Bank for International Settlements Bulletin, April 2, 2020.

FIGURE 14. **DTCC excess margin (% required)**



Source: DTCC, Barclays Research

FIGURE 15. **DTCC cash margin at Fed (% total)**



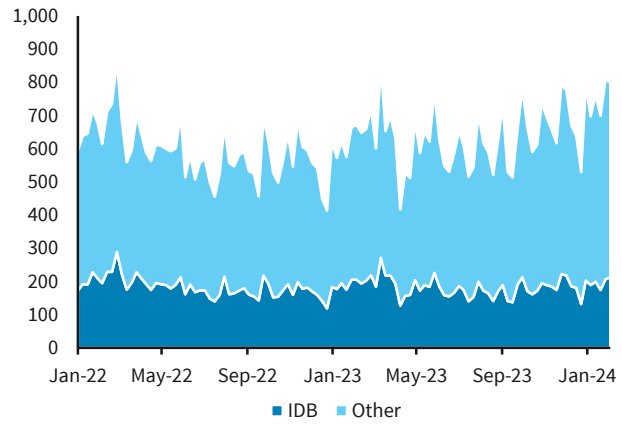
Source: DTCC, Barclays Research

Bypass banks: Non-bank intermediation

GSIB banks are not the only liquidity providers in markets. So, the intermediation bottleneck created on their balance sheets may have less influence on market liquidity if non-bank market makers step in. But regulators expect these other liquidity providers to meet 'safety standards' similar to banks.

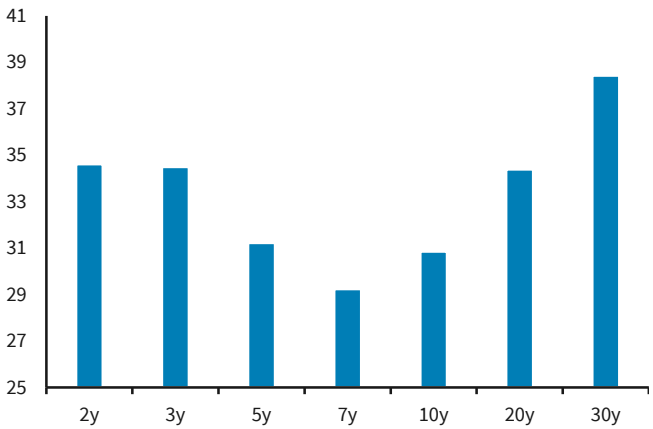
Principal trading firms (PTFs) are significant (high volume) liquidity providers. But the liquidity they supply is very narrow.[10] PTFs trade Treasuries on their own account and have no customers. They frequently trade high volumes and face other PTFs or dealers. The PTF business model relies on minimizing capital consumption by ending the day flat. While their trading volumes are high, they are meant to be 'in and out'. Their objective is to capture small relative value movements rather than taking multi-day positions or warehousing securities. As a result, their activity tends to be concentrated in relative value strategies, often involving futures and on-the-run Treasuries. And much of it is electronic and executed through interdealer brokers (IDBs). Daily average IDB volume exceeds $200bn/day (Figure 16). And IDBs account for roughly a third of the trading in on-the-run securities (Figure 17). Using TRACE data, the Fed and SEC estimate that approximately 60% of daily IDB Treasury volume involves PTFs.

FIGURE 16. **IDB volume ($bn)**



Source: Federal Reserve, Barclays Research

FIGURE 17. **IDB share (% on-the-run Treasuries)**



Source: Federal Reserve, Barclays Research

[10] See, "Principal Trading Firm Activity in Treasury Cash Markets", J. Harkrader and M. Puglia, Federal Reserve Board, August 4, 2020.

This means that PTFs are 'fair weather' liquidity providers whose focus is very concentrated (on-the-runs). Not only is this a different type of liquidity from that provided by banks, it is far less resilient in a crisis. As PTFs do not hold positions overnight, their liquidity is less durable than a bank's which has some capacity to wait out market movements. In periods of stress, dealers and PTFs behave differently. Dealers will widen their bid-ask spreads to prevent getting hit at unattractive levels. By contrast, PTFs pull away completely, removing all their bid-asks and going dark. This occurred during COVID but they remained in the market after last March's deposit run.

As a result, the SEC views the quality of their liquidity provision somewhat differently than that provided by banks. Recently, it finalized rules that would require more PTFs to register with the SEC. All things equal, the capital requirements tied to registration will raise intermediation costs for unregistered PTFs and *could* reduce their willingness to make markets. The SEC acknowledges that the registration rule is likely to create some "small negative effects on market liquidity and efficiency". But the largest PTFs are already registered so these effects are uncertain even though our rough sense is that it could concentrate more activity in the hands of the larger PTFs. The SEC disputes this, arguing that any widening in spreads caused by market concentration is likely to attract new entrants. Moreover, the IDB market is less concentrated than the dealer-to-customer market, which is dominated by banks and broker-dealers.

A trilemma?

The GFC exposed a critical flaw in the global financial architecture. The combination of thinly capitalized banks and a poorly designed resolution framework resulted in significant systemic risk, which was ultimately backstopped by governments. Banks benefited from implicit support, and the resulting moral hazard only increased their incentives to exploit the lax capital rules to the fullest extent. Policy makers and regulators spent years addressing the underlying sources of instability, by raising regulatory capital requirements, introducing new ratios measuring both capital and liquidity as well as a stress-testing regime to measure stability, and modernizing the resolution framework. The goal was to both reduce the probability of failure of a large and systemically important institution, and to create the tools needed to manage such a failure without causing the system to collapse. While there remains a debate about the need for further reforms, there is no doubt that the current system is dramatically safer, and that the resolution framework is (at least theoretically) sound.

But what was once a two dimensional issue – improving the stability of banks while avoiding moral hazard - has evolved into a three dimensional problem. As we outline above, efforts to make banks safer have strained market functioning. Market making and liquidity in the largest, most liquid debt market has become less resilient leading to price shocks and increased volatility. But we wonder if the trilemma of banks stability and systemic risk, moral hazard, and market functioning is solvable. Or is this the equivalent of a single equation with three unknowns?

Regulators have taken a piecemeal approach toward addressing this trilemma. They have modified rules on an *ad hoc*, temporary basis such as the temporary SLR exemptions. At the same time, they have tried to address the cause of strained market functioning by changing market structure through clearing. But both approaches have unintended consequences that, in turn, require additional interventions. While *ad hoc* adjustments like the BTFP may solve an immediate market function problem they also increase moral hazard.[11] This is reinforced by the Fed's tendency to re-use its emergency tools. Liquidity programs introduced in 2008-09

[11] The BTFP allowed banks to pledge their underwater Treasuries to the Fed in return for 1y cash at OIS+10bp. Importantly, the Fed accepted the collatearal at par.

reappeared in 2020. And while the BTFP expired last month, we expect it will return during the next crisis.

Efforts to address the issues created by too heavy reliance on bank intermediation created new risks and vulnerabilities. As we discussed, the second-round steps to address the new fragilities solve some issues well but introduce new constraints and risks, some of which we likely do not fully understand ex-ante. We wonder if risk is like energy: it can neither be created nor destroyed, it can only be transformed or transferred from one form to another. Clearly the *ancien régime* of high systemic risk, high moral hazard but strong liquidity and market functioning was not ideal. But does this mean that the new era of safer banks requires market participants to accept some slippage in market functioning together with more frequent government interventions?

In fact, the real source of the trilemma may be a reduced tolerance -- from investors, intermediaries, and, most importantly, central banks -- for market instability. There was a time when disruptions in the Treasury and funding markets did not beget panic and intervention. In past work, we show that based on fundamentals such as macroeconomic uncertainty, realized volatility, and balance sheet scarcity, liquidity is not unusually poor. And, indeed, liquidity conditions appear benign relative to the pre-GFC era. For example, these markets were dislocated for months during the LTCM crisis in 1998, which was precipitated by Russia's default on old USSR debt. Today, such conditions would almost surely engender an emergency response involving some combination of asset purchases, emergency facilities, and relaxed regulatory constraints.

The fear of disruption is, at least in part, justified. The linkages between intermediaries and investors have become more complex over the past several decades, meaning that stress can propagate in unexpected ways through the system, as demonstrated by the events leading up to the financial crisis. Further, the size and importance of the Treasury and funding markets has grown, and Treasuries and other high quality assets play a more prominent role in the regulatory framework. Both factors have increased the consequences of disruptions. For example, the efficacy of ratios such as the LCR is wholly dependent on liquidity in those instruments. A dysfunctional Treasury market would pose a challenge to the entire post-crisis approach to liquidity regulation. However, as we highlight above, the downside of a bubble-wrapped market is moral hazard, where intervention suppresses the consequences of liquidity and financing risk, or even (based on recent events) interest rate risk, and where investors and intermediaries position accordingly, raising the frequency of disruptions.

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