

AERIAL VIEW

ACCESS A BROADER MARKET PERSPECTIVE



FUTURE-PROOFING THE U.S. TREASURY MARKET

BY KATY BURNE

BY THE NUMBERS

\$22.1 TR

size of U.S. Treasury market¹

\$4.2 TR

the amount the Treasury market grew between March 31, 2020 and March 31, 2021²

\$4.2 TR

amount of government securities centrally cleared each day by FICC³

\$615 BN

the average daily trading volume in U.S. Treasuries, year-to-date⁴

\$500 BN

the daily cap on the U.S. Standing Repo Facility, across all counterparties⁵

\$300 BN

the amount of U.S. Treasuries sold by foreign central banks⁶

\$192 BN

the peak day for settlement fails in the pandemic⁷

\$120 BN

the monthly amount of Fed asset purchases (Treasuries and mortgage bonds)⁸

75%

the percentage of Treasury cash trades that are uncleared⁹

63%

the percentage of uncleared Treasury repos, excluding uncleared bilateral trades¹⁰

SOURCES:

1. SIFMA
2. U.S. Treasury Department
3. DTCC
4. SIFMA, as of Oct.19, 2021
5. Federal Reserve
6. U.S. Treasury, March 2020
7. BNY Mellon, March 12, 2020
8. Federal Reserve
9. Futures Industry Association
10. Office of Financial Research, U.S. Repo Markets Data Release, as of September 10, 2021

THE PANDEMIC THREW THE SPOTLIGHT BACK ON PERCEIVED GAPS IN THE STRUCTURE OF THE U.S. TREASURY MARKET. SOME SAY THE MARKET'S INFRASTRUCTURE, AND THE FED'S ROLE IN IT, NEEDS TO CHANGE—AS PERHAPS DO BANKING REGULATIONS—TO FOSTER RESILIENCY.

BY KATY BURNE

Recent stresses in U.S. Treasury trading have been incongruous with a market that holds itself out as the deepest and most liquid in the world. For those trading in March 2020, it was surprising how the pandemic-induced panic threatened the integrity of even safe-haven government securities and how challenging it was to sell them.

That was just the latest episode exposing fault lines in the \$22 trillion Treasury market. Over the years, cracks have emerged as sophisticated technology platforms and high-frequency traders have contributed to faster flows. The size of the market has expanded, overwhelming the capacity of broker dealers to facilitate Treasury trading. And the Federal Reserve has increased its footprint by buying trillions of dollars of Treasuries and shoring up the market for repurchase agreements or “repos” backed by Treasury securities.

The prevailing view of academics, regulators and others tasked with

understanding the latest liquidity shortages is that the Treasury market's infrastructure, and the Federal Reserve's role in it, needs to be reevaluated—as do regulations affecting the market. One idea is to broaden access to a new Fed backstop beyond primary dealers and banks. Another is to boost membership of an industry clearinghouse and increase the Fed's oversight of that utility. A third idea is to revisit leverage rules targeting banks to try to prevent them from gumming up markets and a fourth is to increase transparency.

Some consensus is emerging. The functions underpinning day-to-day Treasury settlements are not a cause for concern. But liquidity is increasingly liable to disappear during periods of stress, which is a worry at a time when the U.S. deficit is growing and when interest rates are expected to rise. Should investors lose faith in their ability to convert Treasuries to cash at reasonable prices, or get the securities they need for hedging, it could have

worrisome knock-on effects on securities prices worldwide and potentially the U.S. dollar as a reserve currency.

The industry needs to connect the risks of past events with proposed structural changes that could make the Treasury market more resilient in the future. As an institution that played a pivotal role in the first instance of U.S. government borrowing 200 years ago—and remains one of the principal infrastructure providers in the Treasury market today—BNY Mellon hopes to foster greater stability and better prepare the Treasury market for decades to come.

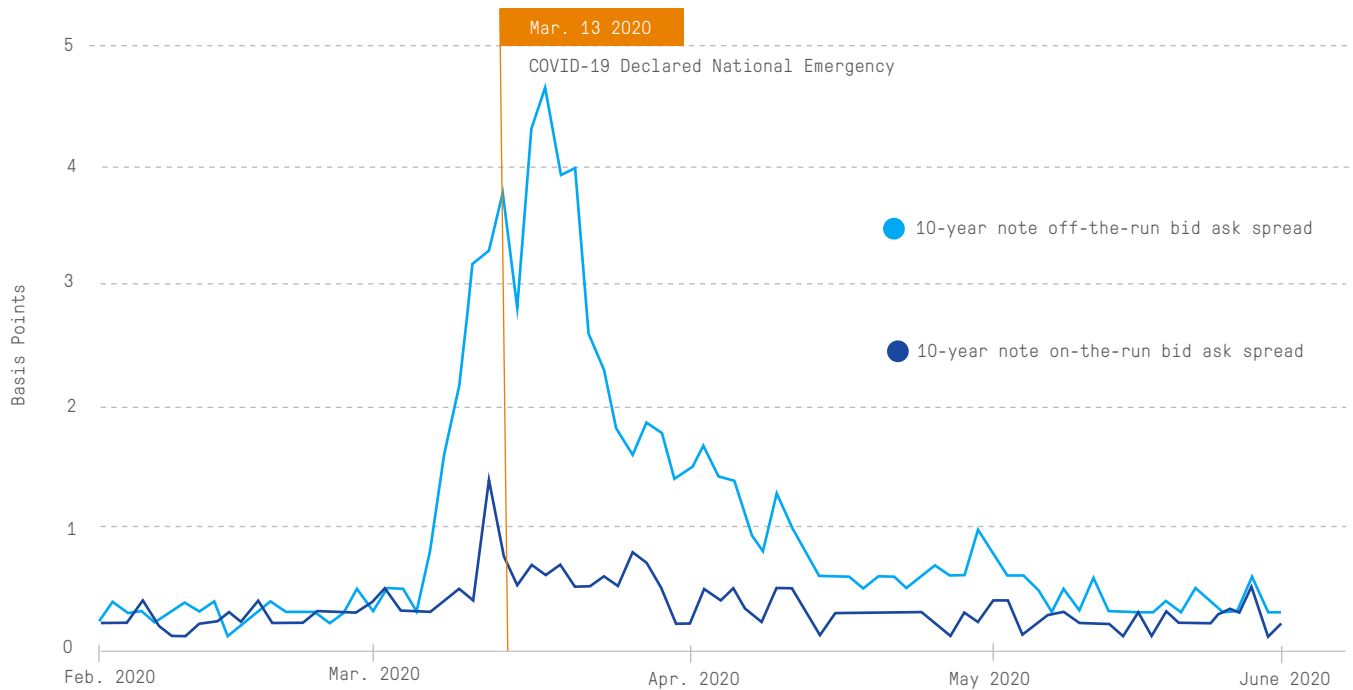
AN ABERRATION

If market practitioners needed fuel to reignite the long-running debate over issues with the U.S. Treasury market, they found plenty of kindling in March 2020. At the onset of the COVID-19 pandemic, traders sold whatever they could to raise cash.

Before the Fed restored calm, it became unusually costly to sell aging

SPREAD OUT

Off-the-run Treasuries were harder to sell in the market meltdown than recently issued debt.



Notes: On-the-run Treasury securities are those most recently auctioned. Off-the-runs were auctioned prior. A basis point is equal to 1/100th of the percent or 0.01 percent.

SOURCE: GAO ANALYSIS OF BLOOMBERG DATA

FIGURE 1

“off-the-run” Treasuries in any meaningful size. Between February 26 and March 9, the benchmark 10-year Treasury yield fell 80 basis points to 0.55%, or 0.317% intraday, and then rose to 1.20% by March 18—a stark turnaround by historical standards (see Figure 1). Further out on the curve, the difference between where buyers were willing to buy 30-year Treasuries, and sellers sell them, was six times recent norms.

At times, some traders said it was easier to sell low-grade corporate debt than illiquid Treasuries. “We anticipated that risk assets like credit would see volatility amid a global health and economic crisis,” said Brandon Rasmussen, head of fixed-income trading at Russell Investments, which had \$330 billion in assets under management as of June 30, 2021. “It was unusual that the risk-free market experienced a similar period of dislocation.”

Dealers, who often buy and hold bonds on a temporary basis to facilitate client

orders, were hamstrung in their ability to make markets because they became sensitive to the size of their balance sheets. Some principal trading firms shut off their automated price-quoting systems, preferring to price transactions manually—a sign that they preferred human intuition to algorithms during such extreme market moves.

The upheaval relaunched a debate about the Treasury market that began seven years ago, on October 15, 2014, when yields on the 10-year note traded in an abnormally wide range in a window of just 12 minutes. The 2015 joint staff report by U.S. government regulators that followed was the biggest review the Treasury market had seen since 1992. It covered many of the market’s shortcomings, but few changes were made in the immediate aftermath.

The market for overnight repos has not been immune. In September 2019, rates on those trades spiked to more than 9% from previously prevailing levels around

2.3%, prompting a fresh debate about how to foster stability in Treasuries and reduce overreliance on the Fed.

What the market needs now is a package of measures that encourages broker dealers to facilitate secondary market trading using less of their own balance sheets while giving the Fed an option to bypass those middlemen, if needed, and still deliver cash or securities for funding—when and where they are needed. There are complexities to these measures, and some work has already started. But it will take more industry and inter-agency coordination, and time, to achieve meaningful impact.

Calls to address structural problems in the government bond market are coming at a critical juncture. Inflation is taking off just as the Fed is in discussions to reduce the pace of its monthly asset purchases and the effects of the COVID-19 pandemic are far from over. There is ample room for repeat liquidity crises in Treasuries, with the potential

“Eventually it will cost a lot more to finance the U.S. deficit. It would be better to restructure the current market.”

— DARRELL DUFFIE, STANFORD UNIVERSITY

to dent market confidence.

“We are better prepared than we used to be, but we haven’t dealt with the underlying problem,” said Gennadiy Goldberg, senior U.S. rates strategist at TD Securities USA LLC. “Anything can happen tomorrow that’s a Black Swan.”

Treasuries are still bought and sold in over-the-counter markets, which are prone to freezing up. As the market has expanded, growing by more than \$4 trillion between March 2020 and March 2021 alone, average daily trading has not grown with it (see Figure 3). Investors are also still transacting with other investors through broker dealers, not in “all-to-all” trading venues that are capable of matching anyone with anyone.

“As the crisis in 2020 showed us, access to liquidity needs to be at the top of the market’s agenda,” said Nichola Hunter, head of rates for MarketAxess, a trading platform operator that is planning to extend its existing all-to-all marketplace for credit to Treasuries in the first half of 2022.

For now, the market is helped by high demand for anything perceived to be a high-quality liquid asset and the government is not seen to be at imminent risk of defaulting. But Treasuries cannot continue to be a safe harbor if a large swath of liquidity providers step away when markets get too rocky.

“Eventually it will cost a lot more to finance the U.S. deficit. It would be better to restructure the current market,”

said Darrell Duffie, a Stanford University finance professor. A July paper by the Group of Thirty (G30) think tank was an initial blueprint of that plan, he added.

STANDING REPO AND STIGMA

This year the Fed made permanent two of the backstops it used to quell the disturbance in early 2020, delivering on one of the pieces of architecture that commentators said was needed in a future stress event. Although that tool is now live, there is still room for enhancement.

The Fed’s “Standing Repo Facility” (SRF) is designed to provide loans at fixed times each day so that firms don’t have to conduct fire sales of Treasuries when they need cash. One of them is a backstop purely for foreign entities, which sold nearly \$300 billion of Treasuries in March 2020.

The domestic SRF lends cash to U.S. primary dealers and state or federally chartered commercial banks, with a minimum of \$30 billion in assets or \$5 billion in securities. It settles through a part of the market called “triparty,” leveraging BNY Mellon’s platform (see Figure 2). The loans are available every day at 1.30-1.45p.m.—although some have said the facility should be available on demand—leaving the discount window as the backstop for any late-afternoon funding emergencies.

BNY Mellon has had conversations

with 30 prospective banks regarding access to the SRF, said Brian Ruane, CEO of the bank’s Government Securities Services Corp. and Clearance and Collateral Management business. All are early-stage discussions, and it is unclear how many firms will use it even though they meet the access criteria.

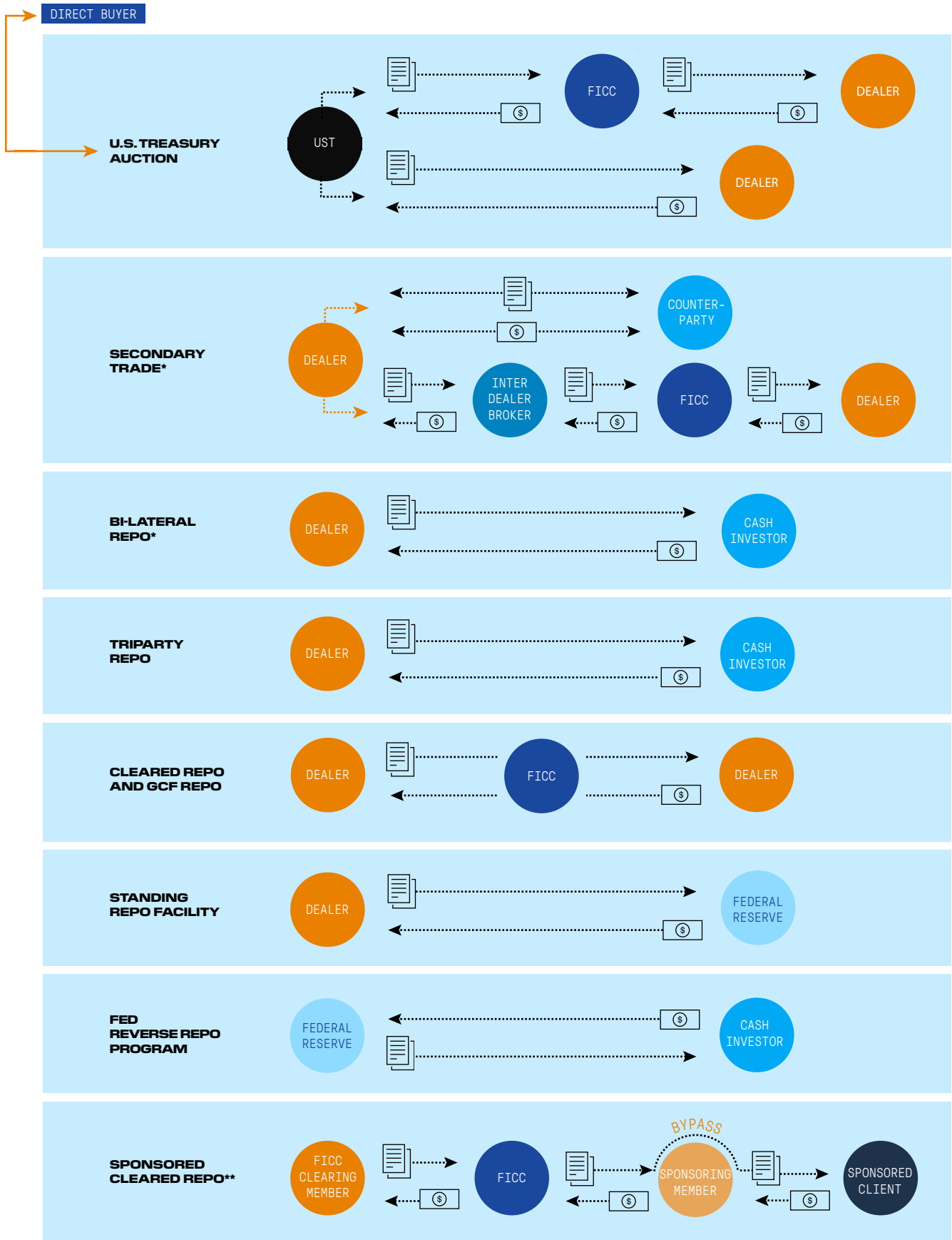
Separately, some media outlets have reported that SRF access may not be embedded as part of their liquidity assumptions for recovery and resolution planning and stress testing, in which case there could be a stigma attached to using the facility and demand may be muted. The Fed has said it expects to adjust the access criteria for the SRF to allow for a broader set of depository institutions to be counterparties, but no further guidance has been provided.

Since there can be negative connotations with borrowing from the discount window when the loans are made public, the SRF will use auctions instead—and even this may not be enough to negate the stigma. Auctions mean firms can compete for cash and they don’t have to use the facility for last-resort funding emergencies. The daily cap on the facility is set at \$500 billion, very close to the maximum amount of Fed support provided in March 2020.

“Some people want to limit the footprint of the Fed, so what this cap is doing is saying it’s only there for a stress event,” said David Andolfatto,

U.S. TREASURY MARKET ECOSYSTEM

Below are the workflows for BNY Mellon's settlement platform for cash Treasury and repo trades.



*CUSTODY AGNOSTIC **FICC's legacy Sponsored Member Program for Treasuries settles bilaterally via BDC. A new general collateral (GC) program settles in AccessEdge.

“Our conversations with the PTF community continue, and we are engaging with them to see if there are additional tweaks we can make to clearing to better suit their business model.”

— LAURA KLIMPEL, DTCC

senior vice president at the St. Louis Fed. “If such a facility had been made available in the spring of 2020, it would have gone a long way towards quelling the disruption.”

There are calls to see SRF expanded beyond banks and primary dealers, to hedge funds, for example, since it currently falls short of recommendations by the G30 paper. The broader the facility’s access, the less likely the next stress event ricochets around financial markets with dangerous aftershocks. Former New York Fed President William C. Dudley said in a September interview with BNY Mellon, “I think it would be better if it was broader—not just opened up to regulated institutions.”

But access to the Fed’s liquidity is only likely to be granted to regulated firms in good standing. Some have warned that expanding usage too far could be problematic if the facility is used too loosely. To prevent it being used in a business-as-usual scenario, the minimum bid rate of 25 basis points is well above standard overnight repo rates. Still, there is a risk that even that rate becomes attractive to lower-tier participants on a regular basis.

Another way for the Fed to broaden its reach with the facility would be having SRF transactions be centrally cleared. This would require the Fed and leveraged investors like hedge funds to get access to the main clearinghouse for Treasuries, which is Fixed

Income Clearing Corp. (FICC), a unit of Depository Trust & Clearing Corp.

To add the Fed as a clearinghouse member, FICC would need to find a way to allow the Fed to participate as an exempt member, but “without requiring the Fed to share in potential losses from defaults by FICC members,” said Patrick Parkinson, a special advisor to the Bank Policy Institute and former director of bank supervision at the Fed.

The Fed already leverages BNY Mellon’s triparty and clearing settlement platforms for its open market and monetary policy operations. It also maintains an account at FICC for settling transactions related to U.S. Treasury auctions when the debt is first issued.

In times, the Fed may expand its current borrower requirements for SRF, but currently the central bank has not provided any guidance that it is seeking to become a clearinghouse member or expand its repo facility to leveraged investors.

CLEARING IS NO PANACEA

Many commentators say that the market would be safer, and more efficient, if more trades were routed to FICC, although central clearing alone could not resolve problems on days when sellers are selling into a one-way market with insufficient buyers.

A potential clearing mandate would not have to involve all market

participants to be beneficial. It could, for example, cover trades through interdealer broker (IDBs), where there is a broker dealer on one side who is clearing, and a principal trading firm on the other who is not.

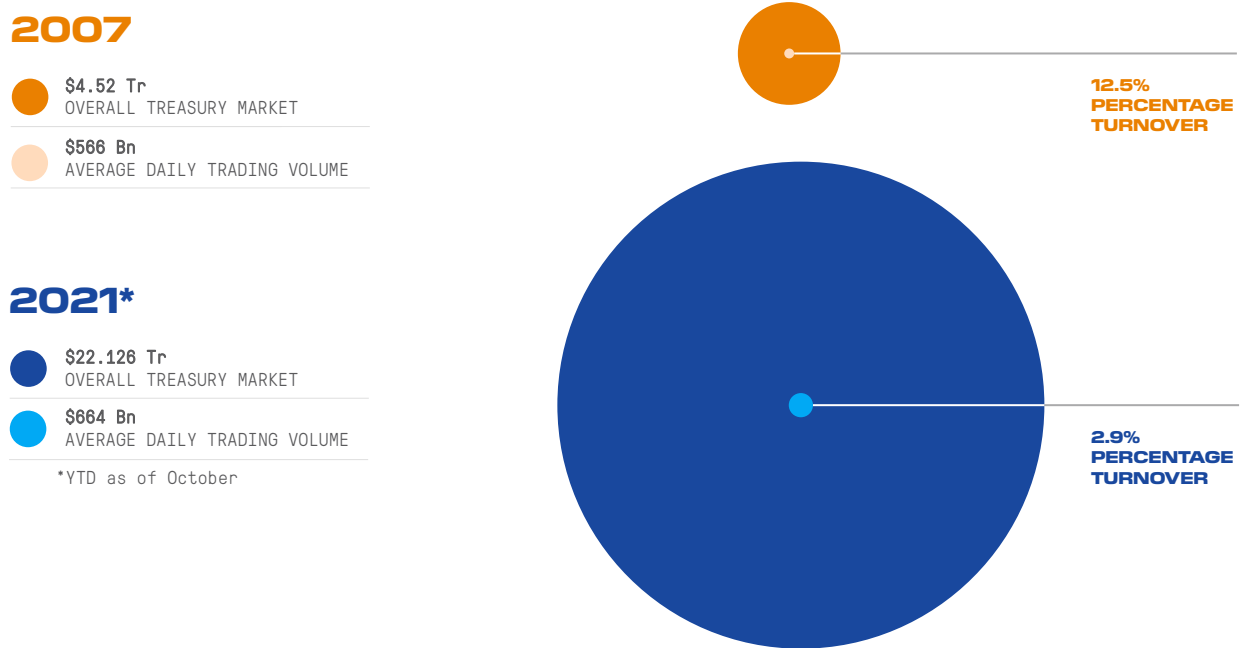
Currently, most buyers and sellers use a one-to-one process known as “bilateral” settlement, which inserts an agent like BNY Mellon to exchange securities and cash simultaneously on demand. Central clearing is different: one, because the clearinghouse stands in between all participants to buffer their credit risks to one another, manage a potential default and reduce settlement fails; and two, because settlement times are more rigid.

Very few cash Treasury transactions are centrally cleared today, whereas in the derivatives market, roughly 76% of interest-rate swaps are cleared following regulations promulgated by the Dodd Frank financial law. Specifically, more than 75% of cash Treasury trades are uncleared, according to the Treasury Market Practices Group (TMPG), and 63% of Treasury repos were uncleared as of Sept. 10, according to the U.S. Office of Financial Research.

Using FICC for clearing offers important benefits but is costly. One is that two opposing trades can be offset and collapsed into a single risk position in a process called “netting”. There are some reasons cash Treasury trades are conducted outside of the

DECLINING TURNOVER

Average daily trading volumes in the U.S. Treasury market have fallen as the market has grown.



SOURCE: SECURITIES INDUSTRY AND FINANCIAL MARKETS ASSOCIATION (SIFMA)

FIGURE 3

clearinghouse. But often the balance sheet relief they can get through netting at FICC allows them to facilitate more Treasury trading. Central clearing of cash Treasuries would have lowered dealers' gross settlement obligations by 60% in early 2020, according to a New York Fed paper.

One clearinghouse for Treasuries might produce the most netting benefits. Clearing through a single entity also potentially allows the Fed, and FICC, better oversight over a larger swath of the Treasury market.

Netting at FICC is limited today, however, in part because not everyone is a full-service member of the clearinghouse. There are cross-margining arrangements between Treasury futures trades cleared at the CME Group and cash Treasury trades cleared at FICC, but the companies are proposing to enhance those to improve the model itself and who can benefit from the arrangement—a move that is

subject to regulatory approval.

Some researchers have suggested shining a light on the responsibilities of FICC itself. In a July paper by the Futures Industry Association (FIA), principal trading firms said there are obstacles to FICC membership and that its margining practices are less than completely transparent.

"Our conversations with the PTF community continue, and we are engaging with them to see if there are additional tweaks we can make to clearing to better suit their business model, including considerations around cross-margining and high frequency trading," said Laura Klimpel, general manager of FICC.

Lou Crandall, chief economist at Wrightson ICAP, said the costs of clearing could be lowered if FICC was able to access funding at the SRF because the availability of a backstop might "reduce the cost of bringing a broader range of trades into

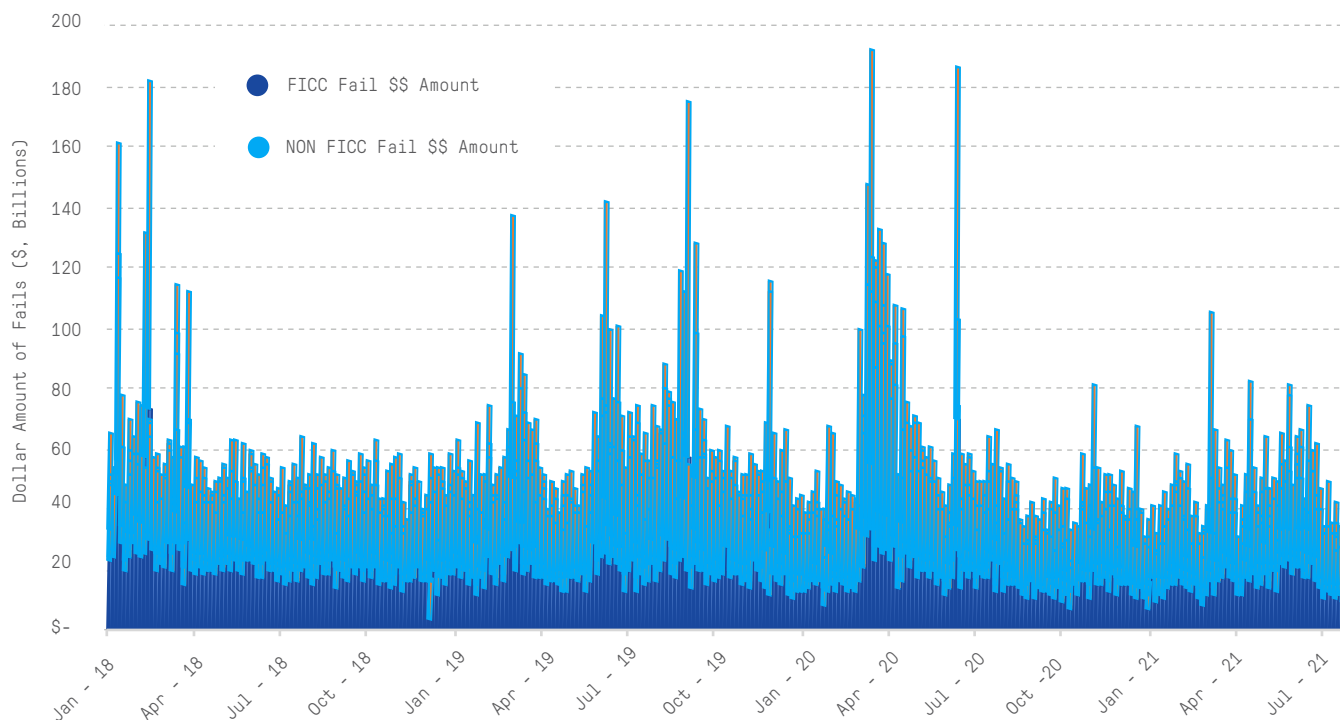
central clearing."

FICC's most recent efforts have encouraged more overnight repo clearing. The lynchpin of this effort is an arrangement allowing non-members to be sponsored in by FICC members. The counterparties agree their trade details, settle via an agent, and then instruct the agent to pass their trades over to FICC, before the agent steps out of the trade. As of October, there were 30 sponsoring members of FICC cleared repo and almost 2,000 sponsored entities, according to FICC.

Such sponsored repo arrangements actually date back to 2005 but are growing because they are helping dealers to continue brokering repos without using their balance sheets while allowing leveraged investors to sidestep the onerous responsibilities of FICC membership. The question is what can be done to encourage more dealers to sponsor Treasury repos into clearing, rather than conducting them

FIXING FAILS

Settlement fails peaked at \$192 bn in early 2020, with FICC cleared trades seeing fewer fails.



SOURCE: BNY MELLON

FIGURE 4

bilaterally, as well as how to boost clearing of cash trades.

Another question is one of inter-agency oversight, given that more activity through FICC is likely. Its main regulator is the Securities and Exchange Commission but since it is designated as a systemically important financial market utility (SIFMU), it is also overseen by the Fed and the Financial Stability Oversight Council. Under Title VIII of Dodd Frank, financial market utility supervision was split between various agencies, so the SEC is the supervisory agency for FICC, but the Fed also has certain supervisory authority.

Sharing information between regulators should be easy but information-sharing agreements can take a long time. Parkinson said that cooperative oversight involving multiple agencies is a complex process that unavoidably slows the regulatory response to changing circumstances. “Market

participants can become frustrated because it’s not clear to them how the interagency decision-making process works,” he said.

An Interagency Working Group for Treasury market surveillance issued a joint report on November 8 saying it was examining recent volatility episodes and potential reforms, including the benefits of expanded central clearing and transparency.

RECALIBRATING RULES

The most efficient way to fix liquidity in the Treasury market with the biggest payoff may also need to contemplate updates to current banking regulations. The G30, other think tanks and certain public sector officials say those rules are hampering banks’ ability to facilitate trading.

Banks say it is the Supplementary Leverage Ratio (SLR) that is impeding their ability to act as middlemen because that rule counts cash and U.S.

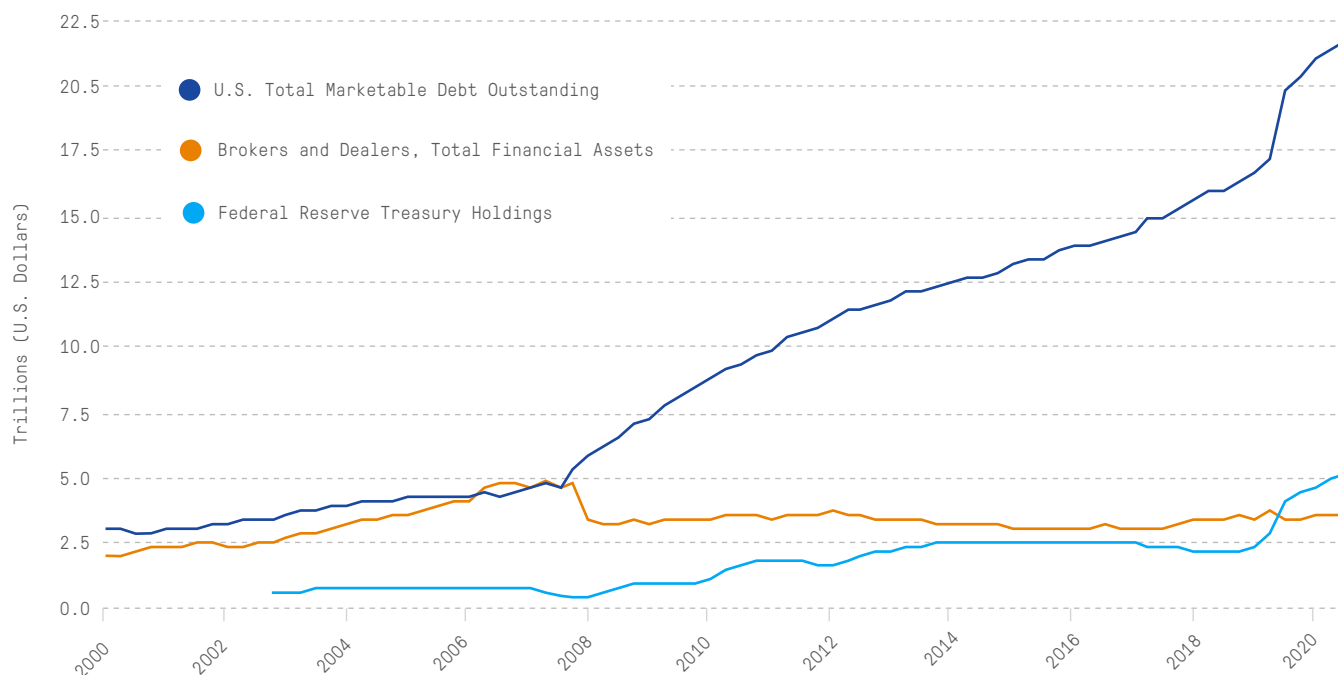
Treasuries as just as risky as commercial loans. The New York Fed research team has written in the past that, “Regulation may also constrain dealer intermediation activity,” although some banks are no longer SLR constrained.

The Fed, the Office of the Comptroller of the Currency and the Federal Deposit Insurance Corp. briefly changed the SLR in early 2020 to ease strains in the market, allowing Treasuries to be exempt from the SLR denominator calculations in the hope it would improve the ability of big dealers to make markets in government bonds. But that relief has since expired.

In March, the Fed said it would invite public comment on “several potential SLR modifications.” Meanwhile, academics and policymakers have debated a permanent fix to the leverage ratios, for example by excluding reserves from leverage ratio calculations, and possibly Treasuries, Treasury repos and other borrowings from the Standing

GROWING MISMATCH

The size of the Treasury market has far outpaced broker dealers' capacity to facilitate the trades.



SOURCE: BNY MELLON, FEDERAL RESERVE, U.S. TREASURY

FIGURE 5

Repo Facility under leverage ratio capital calculations.

As written, leverage ratios can be a “binding” capital constraint, meaning that banks must hold the same amount of additional capital whether they are holding super-safe central bank deposits, Treasuries or riskier debt. Former Fed official and current Under Secretary of the Treasury for Domestic Finance, Nellie Liang, and Parkinson wrote in a report for the Brookings Institution that reserves at the central bank should be “permanently excluded” from the SLR “because they are riskless” but not Treasuries or Treasury repos because they “have interest rate risk.”

Other jurisdictions and regulators have adopted their own recalibrations. The U.K. just made the recommendation to raise its SLR from 3% to 3.25% while excluding claims on central banks from the leverage ratio.

Fixing leverage ratios is not likely

any time soon in part because of the intersection with other banking regulations, the politics of doing so, and the changeover in bank regulators and Fed governors. A fix would also require all three agencies to effect a change at the bank level: the Fed, the OCC and the FDIC.

In a November press conference, Fed Chair Jerome Powell said the central bank was looking at “ways we can address liquidity issues through that channel” of SLR regulation. No public quantitative impact assessment has been conducted so far, however, and regulators may need to ensure that together, changes to capital rules are capital neutral in the aggregate.

“Fixing the leverage requirement is probably the biggest thing that can be done” along with the psychological benefit of having the SRF to increase confidence in the market, said Bill Nelson, chief economist at the Bank Policy Institute.

DEARTH OF DATA

The fourth pillar in future-proofing the Treasury market may involve more price transparency. Today, government regulators are collecting data on secondary market cash Treasury trades from broker dealers and reporting it to the Trade Reporting and Compliance Engine of the Financial Industry Regulatory Authority (FINRA), more commonly known as “TRACE.”

None of that cash Treasury trading information is publicly disseminated in real time, so a comprehensive data set is still not available without a delay. It is released weekly as aggregated volume data, for the prior week, going back to January 2019. There is also an incomplete data set on the repo market, because uncleared bilateral trades are still not reported. “There is a thicket of regulations and exemptions that needs to be cleared up,” Duffie notes.

Having a more appropriate level of transparency may be an item on the

“BNY Mellon stands ready to support the U.S. Treasury market and our clients—and to help convene further discussions around this important topic... Better liquidity is the route to stability.”

— BRIAN RUANE, BNY MELLON

agenda of the SEC’s new chairman, Gary Gensler. In 2015, then-SEC chair Mary Jo White questioned whether more data should be collected from Treasury trading venues after the October 2014 “flash rally” episode.

In January this year, the Fed invited public comment on a proposal to require certain depository institutions to report their Treasury and agency mortgage-backed securities trading. There is a delicate balance, however, between introducing sufficient market transparency to meet the expectations of regulators and carving into the already-thin spreads that make facilitating Treasury trading an attractive business. Publicly reported data could incur a small lag so that it supports the overall mission of transparency in being close to real time, but not so instantaneous that it hurts liquidity providers.

Resolving the current blind spot in Treasury data could help the market to assess whether more clearing would make sense. More data around principal trading firms and their algos would also be helpful as trading further migrates from the telephone to the screen; as volatile episodes become more frequent; and as settlement fails become an increasing focus for participants.

Volumes on FICC almost doubled between March and May 2020, while

settlement fails peaked at \$192 billion on March 12, 2020 (see Figure 4). BNY Mellon has teamed up with Google Cloud to forecast settlement fails hours ahead of the market closing time—and is now exploring a separate “round robin” pair-off service by itself to reduce fails further.

RESTORING CONFIDENCE

Whatever the outcome of discussions about perceived flaws in the Treasury market, the recent round of papers suggests there is a need to enhance the market’s liquidity—and some momentum to do so. As it stands, one of the reasons the Treasury market stays healthy in normal times is because Fed operations are so central to its daily function. In extremely abnormal times, the market is not holding up all that well, even with those processes in place (see Figure 5).

Changing the model with more central clearing likely would have had a small positive impact on the stresses of March 2020, but not avoided them. The newly expanded Standing Repo Facility would likely have helped, too. But as each individual measure has a limited impact in isolation, there is a genuine question among some practitioners as to how to move forward—even with the G30 paper as a blueprint.

Some changes, like expanded central clearing, may need to be mandated by

regulators. Finding a way for the Fed to interact with the market through FICC, on the other hand, may be the simplest and the most effective immediate change. The challenge will be the coordination efforts of implementing such changes and the time this may take. It remains unclear whether the right sort of package will materialize in time for the next liquidity crisis—especially if there is insufficient regulatory or political will.

With calls for market improvements and no silver bullet, a package of well-thought-out solutions has a higher chance of having a material impact in the next stress event. “BNY Mellon stands ready to support the U.S. Treasury market and our clients—and to help convene further discussions around this important topic,” says Ruane. “Better liquidity is the route to stability.” ●

Katy Burne is Editor-in-Chief of Aerial View Magazine in New York.

Questions or Comments?

Write to Kevin.Reinert@bnymellon.com in Clearance and Collateral Management; Kieran.Lynch@bnymellon.com for BNY Mellon Markets; or reach out to your usual relationship manager.

BNY Mellon is the corporate brand of The Bank of New York Mellon Corporation and may be used to reference the corporation as a whole and/or its various subsidiaries generally. This material and any products and services may be issued or provided under various brand names of BNY Mellon in various countries by duly authorized and regulated subsidiaries, affiliates, and joint ventures of BNY Mellon, which may include any of those listed below:

The Bank of New York Mellon, a banking corporation organized pursuant to the laws of the State of New York, whose registered office is at 240 Greenwich St, NY, NY 10286, USA. The Bank of New York Mellon is supervised and regulated by the New York State Department of Financial Services and the US Federal Reserve and is authorized by the Prudential Regulation Authority (PRA) (Firm Reference Number: 122467).

In the U.K., a number of services associated with BNY Mellon Wealth Management's Family Office Services - International are provided through The Bank of New York Mellon, London Branch. The Bank of New York Mellon also operates in the UK through its London branch (UK companies house numbers FC005522 and BR000818) at One Canada Square, London E14 5AL and is subject to regulation by the Financial Conduct Authority (FCA) at 12 Endeavour Square, London, E20 1JN, UK and limited regulation by the PRA at Bank of England, Threadneedle St, London, EC2R 8AH, UK. Details about the extent of our regulation by the PRA are available from us on request.

Investment management services are offered through BNY Mellon Investment Management EMEA Limited, BNY Mellon Centre, One Canada Square, London E14 5AL, which is registered in England No. 1118580 and is authorised and regulated by the Financial Conduct Authority. Offshore trust and administration services are through BNY Mellon Trust Company (Cayman) Ltd.

BNY Mellon Fund Services (Ireland) Limited is regulated by the Central Bank of Ireland.

The Bank of New York Mellon SA/NV, a Belgian public limited liability company, with company number 0806.743.159, whose registered office is at 46 Rue Montoyerstraat, B-1000 Brussels, Belgium, authorised and regulated as a significant credit institution by the European Central Bank (ECB), under the prudential supervision of the National Bank of Belgium (NBB) and under the supervision of the Belgian Financial Services and Markets Authority (FSMA) for conduct of business rules, a subsidiary of The Bank of New York Mellon.

The Bank of New York Mellon SA/NV operates in Ireland through its Dublin branch at Riverside II, Sir John Rogerson's Quay Grand Canal Dock, Dublin 2, D02KV60, Ireland and is registered with the Companies Registration Office in Ireland No. 907126 & with VAT No. IE 9578054E. The Bank of New York Mellon SA/NV, Dublin Branch is subject to limited additional regulation by the Central Bank of Ireland at New Wapping Street, North Wall Quay, Dublin 1, D01 F7X3, Ireland for conduct of business rules and registered with the Companies Registration Office in Ireland No. 907126 & with VAT No. IE 9578054E.

The Bank of New York Mellon SA/NV operates in Germany as The Bank of New York Mellon SA/NV, Asset Servicing, Niederlassung Frankfurt am Main, and has its registered office at MesseTurm, Friedrich-Ebert-Anlage 49, 60327 Frankfurt am Main, Germany. It is subject to limited additional regulation by the Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, Marie-Curie-Str. 24-28, 60439 Frankfurt, Germany) under registration number 122721.

The Bank of New York Mellon SA/NV operates in the Netherlands through its Amsterdam branch at Strawinskylaan 337, WTC Building, Amsterdam, 1077 XX, the Netherlands. The Bank of New York Mellon SA/NV, Amsterdam Branch is subject to limited additional supervision by the Dutch Central Bank ("De Nederlandsche Bank" or "DNB") on integrity issues only (registration number 34363596). DNB holds office at Westeinde 1, 1017 ZN Amsterdam, the Netherlands.

The Bank of New York Mellon SA/NV operates in Luxembourg through its Luxembourg branch at 2-4 rue Eugene Ruppert, Vertigo Building - Polaris, L-2453, Luxembourg. The Bank of New York Mellon SA/NV, Luxembourg Branch is subject to limited additional regulation by the Commission de Surveillance du Secteur

Financier at 283, route d'Arlon, L-1150 Luxembourg for conduct of business rules, and in its role as UCITS/AIF depositary and central administration agent.

The Bank of New York Mellon SA/NV operates in France through its Paris branch at 7 Rue Scribe, Paris, Paris 75009, France. The Bank of New York Mellon SA/NV, Paris Branch is subject to limited additional regulation by Secréariat Général de l'Autorité de Contrôle Prudentiel et Prémière Direction du Contrôle de Banques (DCB I), Service 2, 61, Rue Taitbout, 75436 Paris Cedex 09, France (registration number (SIREN) Nr. 538 228 420 RCS Paris - CIB 13733).

The Bank of New York Mellon SA/NV operates in Italy through its Milan branch at Via Mike Bongiorno no. 13, Diamantino building, 5th floor, Milan, 20124, Italy. The Bank of New York Mellon SA/NV, Milan Branch is subject to limited additional regulation by Banca d'Italia - Sede di Milano at Divisione Supervisione Banche, Via Cordusio no. 5, 20123 Milano, Italy (registration number 03351).

The Bank of New York Mellon SA/NV operates in Denmark as The Bank of New York Mellon SA/NV, Copenhagen Branch, filial of The Bank of New York Mellon SA/NV, Belgium, and has its registered office at Strandvejen 60/5, 2900 Hellerup, Denmark. It is subject to limited additional regulation by the Danish Financial Supervisory Authority (Finanstilsynet, Århusgade 110, 2100 København Ø).

The Bank of New York Mellon SA/NV operates in Spain through its Madrid branch with registered office at Calle José Abascal 45, Planta 4ª, 28003, Madrid, and enrolled on the Reg. Mercantil de Madrid, Tomo 41019, folio 185 (M-727448). The Bank of New York Mellon, Sucursal en España is registered with Banco de España (registration number 1573).

The Bank of New York Mellon SA/NV operates in England through its London branch at 160 Queen Victoria Street, London EC4V 4LA, UK, registered in England and Wales with numbers FC029379 and BR014361. The Bank of New York Mellon SA/NV, London branch is authorized by the ECB (address above) and is deemed authorised by the Prudential Regulation Authority. Subject to regulation by the Financial Conduct Authority and limited regulation by the Prudential Regulation Authority. Details of the Temporary Permissions Regime, which allows EEA-based firms to operate in the UK for a limited period while seeking full authorisation, are available on the Financial Conduct Authority's website.

The Bank of New York Mellon (International) Limited is registered in England & Wales with Company No. 03236121 with its Registered Office at One Canada Square, London E14 5AL. The Bank of New York Mellon (International) Limited is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority.

Regulatory information in relation to the above BNY Mellon entities operating out of Europe can be accessed at the following website: <https://www.bnymellon.com/RID>.

The Bank of New York Mellon, Singapore Branch, is subject to regulation by the Monetary Authority of Singapore. For recipients of this information located in Singapore: This material has not been reviewed by the Monetary Authority of Singapore. The Bank of New York Mellon, Hong Kong Branch (a branch of a banking corporation organized and existing under the laws of the State of New York with limited liability), is subject to regulation by the Hong Kong Monetary Authority and the Securities & Futures Commission of Hong Kong.

The Bank of New York Mellon is regulated by the Australian Prudential Regulation Authority and also holds an Australian Financial Services Licence No. 527917 issued by the Australian Securities and Investments Commission to provide financial services to wholesale clients in Australia.

The Bank of New York Mellon has various other branches in the Asia-Pacific Region which are subject to regulation by the relevant local regulator in that jurisdiction.

The Bank of New York Mellon Securities Company Japan Ltd, as intermediary for The Bank of New York Mellon.

The Bank of New York Mellon, DIFC Branch, regulated by the Dubai Financial Services Authority (DFSA) and located at DIFC, The Exchange Building 5 North, Level 6, Room 601, P.O. Box 506723, Dubai, UAE, on behalf of The Bank

of New York Mellon, which is a wholly-owned subsidiary of The Bank of New York Mellon Corporation.

Pershing is the umbrella name for Pershing LLC (member FINRA, SIPC and NYSE), Pershing Advisor Solutions (member FINRA and SIPC), Pershing Limited (UK), Pershing Securities Limited (UK), Pershing Securities International Limited (Ireland), Pershing (Channel Islands) Limited, Pershing Securities Canada Limited, Pershing Securities Singapore Private Limited, and Pershing India Operational Services Pvt Ltd. Pershing business also includes Albridge Solutions, Inc. and Lockwood Advisors, Inc., an investment adviser registered in the United States under the Investment Advisers Act of 1940. Pershing LLC is a member of SIPC, which protects securities customers of its members up to \$500,000 (including \$250,000 for claims for cash). Explanatory brochure available upon request or at sipc.org. SIPC does not protect against loss due to market fluctuation. SIPC protection is not the same as, and should not be confused with, FDIC insurance.

Past performance is not a guide to future performance of any instrument, transaction or financial structure and a loss of original capital may occur. Calls and communications with BNY Mellon may be recorded, for regulatory and other reasons.

Disclosures in relation to certain other BNY Mellon group entities can be accessed at the following website: <http://disclaimer.bnymellon.com/eu.htm>.

This material is intended for wholesale/professional clients (or the equivalent only), is not intended for use by retail clients and no other person should act upon it. Persons who do not have professional experience in matters relating to investments should not rely on this material. BNY Mellon will only provide the relevant investment services to investment professionals.

Not all products and services are offered in all countries.

If distributed in the UK, this material is a financial promotion. If distributed in the EU, this material is a marketing communication.

This material, which may be considered advertising, is for general information purposes only and is not intended to provide legal, tax, accounting, investment, financial or other professional advice on any matter. This material does not constitute a recommendation or advice by BNY Mellon of any kind. Use of our products and services is subject to various regulations and regulatory oversight. You should discuss this material with appropriate advisors in the context of your circumstances before acting in any manner on this material or agreeing to use any of the referenced products or services and make your own independent assessment (based on such advice) as to whether the referenced products or services are appropriate or suitable for you. This material may not be comprehensive or up to date and there is no undertaking as to the accuracy, timeliness, completeness or fitness for a particular purpose of information given. BNY Mellon will not be responsible for updating any information contained within this material and opinions and information contained herein are subject to change without notice. BNY Mellon assumes no direct or consequential liability for any errors in or reliance upon this material.

This material may not be distributed or used for the purpose of providing any referenced products or services or making any offers or solicitations in any jurisdiction or in any circumstances in which such products, services, offers or solicitations are unlawful or not authorized, or where there would be, by virtue of such distribution, new or additional registration requirements.

BNY Mellon Wealth Management conducts business through various operating subsidiaries of The Bank of New York Mellon Corporation.

Any references to dollars are to US dollars unless specified otherwise.

This material may not be reproduced or disseminated in any form without the prior written permission of BNY Mellon. Trademarks, logos and other intellectual property marks belong to their respective owners.

The Bank of New York Mellon, member of the Federal Deposit Insurance Corporation (FDIC).

© 2021 The Bank of New York Mellon. All rights reserved.