

White Paper on Clearing and Settlement in
the Market for U.S. Treasury Secured
Financing Transactions

TMPG Consultative Paper

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[Clearing and Settlement in the Secured Financing Market – Trade Flow Mapping](#)

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Executive Summary

The structure of the U.S. Treasury securities ("Treasury securities") market has significantly changed since 2000 with the increased use of advanced technology, innovations in execution venues, and increases in new central clearing services offered. These structural changes have implications for the clearing and settlement processes in the Treasury market, and there is concern that market participants may not have maintained a common understanding of the changes and risks inherent to these post-trade processes. Indeed, these typically benign processes could be disrupted by contingent events, creating unexpected credit exposures and adding stress in the market. A stark reminder that stress events do occur within the Treasury markets is the significant disruptions to Treasury market functioning in late March 2020 and the subsequent official sector intervention. Furthermore, given the Treasury market's global importance, any significant disruption has the potential to create systemic risk.

Given these concerns, the Treasury Market Practices Group (TMPG) completed a study of clearing and settlement practices for U.S. Treasury securities in July of 2019, issuing a comprehensive [White Paper on Clearing and Settlement in the Secondary Market for U.S. Treasury Securities](#). The July 2019 white paper describes the current state of clearing and settlement processes in the secondary market for Treasury securities, as well as identifies potential risk and resiliency issues.

Based on the findings of the 2019 paper and subsequent public feedback, the TMPG strengthened its [Best Practices for Treasury, Agency Debt, and Agency Mortgage-Backed Securities Markets](#) to address identified risks, calling market participants in the Treasury, agency debt, and agency MBS markets to apply rigorous risk management to clearing and settlement practices for all products, including instruments with high credit quality or a short settlement cycle. The updated TMPG best practice guidelines included specific recommendations related to counterparty risks in the clearing and settlement process and clearing- and settlement-related operational resiliency, planning, and processes.¹

The present effort complements the group's prior work and focuses on the current clearing and settlement practices for U.S. Treasury secured financing transactions (SFTs), which include both repurchase agreements and securities lending agreements. A working group², composed of TMPG members and subject matter specialists from TMPG member and non-member firms, was tasked with:

- mapping the current structure of SFT clearing and settlement,
- identifying potential risk and resiliency issues, and
- facilitating a public discussion of clearing and settlement processes and practices.

This paper provides a detailed description of the various clearing and settlement arrangements for SFTs involving Treasury securities in an effort to help improve market participants' understanding of these processes and the risks they may face.

The TMPG encourages all market participants to incorporate best practices into their operations in order to promote market integrity and efficiency and to conduct due diligence to evaluate the robustness of current practices, including whether their risk mitigation tools are sufficient for their level of market

¹ See [Best Practice Guidance on Clearing and Settlement](#).

² See Appendix for a list of working group members.

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engagement. The best practice recommendations particularly relevant to risk and resiliency issues in SFT clearing and settlement are noted in the [Best Practice Guidance on Clearing and Settlement](#). The TMPG recognizes that the best practice document is a “living document” and will update the best practices as needed in light of the findings of this paper.

The TMPG also recognizes that certain clearing and settlement issues are outside the remit of the group’s best practices. Although the TMPG does not have a common position on certain issues, including the potential role of expanded central clearing, the group recognizes that public- and private-sector stakeholders are continuing to explore options to address these issues.^{3 4}

Current structure of clearing and settlement

There are two large segments of the Treasury SFT market (see Section I): dealer-to-customer and dealer-to-dealer trading. Most dealer-to-customer trades are cleared and settled in two ways. The first is on a bilateral basis when each party to the trade uses their respective and bespoke clearing and settlement processes. The second leverages the tri-party repo settlement platform offered by a clearing bank. Under this agent-cleared approach, both parties to the trade use the clearing and settlement processes offered by a clearing bank.

Although still a small part of total dealer-to-customer activity, a third clearing option for dealer-to-customer trades is to utilize the Sponsored Service provided by the central counterparty (CCP) in the Treasury market. Trades that are centrally cleared through the Sponsored Service are either settled on the tri-party repo settlement platform or on a bilateral basis, depending on the nature of the trade.

In contrast to the dealer-to-customer segment, most dealer-to-dealer trades are cleared through the CCP using either its General Collateral Finance (GCF[®]) Repo Service⁵ or Delivery-Versus-Payment (DVP) Service. Trades cleared using the GCF Repo Service are settled on the tri-party repo settlement platform. For trades cleared using the DVP Service, each market participant uses their respective settlement processes.

Potential risks and resiliency issues

The TMPG identified the following potential risk and resiliency issues for consideration. The application of TMPG best practices can help to mitigate many of these risk. Absent such due diligence by market participants, firm-specific risk events could cause stress in overall market function to the detriment of all market stakeholders.

³ The Securities and Exchange Commission (SEC) recently proposed changes, [17 CFR Part 240](#), to the standards applicable to covered clearing agencies for U.S. Treasury securities that would require such covered clearing agencies to have written policies and procedures reasonably designed to require that every direct participant of the covered clearing agency submit for clearance and settlement all eligible secondary market transactions in U.S. Treasury securities to which it is a counterparty.

⁴ Central clearing offers certain benefits, including transfer of counterparty credit risk to the CCP through novation, multilateral netting of exposures, transparency and other risk mitigation features, such as margining, that also serve to reduce liquidity risks and risks to broader market functioning. Additional considerations for central clearing include the cost of clearing, the ability to access a CCP, and the concentration of activity in a central counterparty for the activity that is centrally cleared.

⁵ GCF is a registered service mark of the Fixed Income Clearing Corporation (FICC) and is a particular type of repo in which trades are executed anonymously, with FICC acting as a CCP and guaranteeing settlement.

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1. Overall, clearing and settlement for SFTs is fragmented. As demonstrated by the number of maps included in this white paper, there are a multitude of clearing and settlement options available to participants. For a given option, risks to a smooth post-trade process for Treasury SFTs can manifest in several ways, including counterparty credit concerns and operational issues. The large number of clearing and settlement options, then, places a significant burden on market participants to fully recognize the inherent risks of each option, and to put into place the appropriate risk mitigants.

In normal times, when a counterparty's risk of default is idiosyncratic and Treasury market liquidity is deep, the differences in clearing and settlement processes have only small implications for risk. In times of stress, however, when defaults are more common and overall Treasury market liquidity can decrease, these differences could have important risk implications.

2. For non-centrally cleared bilateral SFTs, clearing and settlement is bespoke and opaque. Individualized clearing and settlement arrangements may work well during the ordinary course of business. However, the bespoke nature of these arrangements combined with the short period of time between trade execution and trade settlement can make resolving post-trade disputes a challenging task. In times of stress, disputes arise more frequently and may be more difficult to resolve in a timely manner, increasing the risk of a disruption to settlement, which is an outcome that could create unexpected credit exposures.

Given that the clearing and settlement risks associated with Treasury SFTs are fairly benign during the normal course of business, some participants may not fully use the array of risk management tools to mitigate these risks. The opaqueness of these processes obscures a participant's ability to assess the counterparty credit risk a participant incurs indirectly through the clearing chain. Where transparency is impaired, market participants may not be able to accurately identify, measure, and manage their counterparty risk exposure. This opaqueness could then create an undesirable level of aggregate risk in the Treasury SFT market.

3. For non-centrally cleared bilateral SFTs and agent-cleared tri-party repo, positions carry counterparty and liquidity risks, with potential systemic implications. If one of the parties to an SFT defaults, the other party to the trade must take steps to make itself whole again. These steps usually require the party to purchase or sell Treasuries, and so entail liquidity risk, which has two components. The first is the risk that the market price of Treasuries moves against the party trying to make itself whole, and the second is that this recovery process takes longer than expected. In normal times these liquidity risks are low, but in times of stress, when Treasury market liquidity could decline, these risks can rapidly escalate.

Furthermore, the counterparty and liquidity risk associated with the default of a large SFT position can have systemic implications. If the party lending cash into the SFT is forced to quickly liquidate a large amount of securities, a fire sale could result, further stressing the Treasury market.

Although counterparty and liquidity risks exist for centrally cleared repos, these risks are mitigated with the CCP's required risk management standards and transparent and orderly process to handle defaults.

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4. For all SFTs, third-party credit extension arrangements may not be fully understood.

Fundamental to most clearing relationships is the process by which many clearing entities facilitate the settlement process by extending credit or liquidity support intraday to customers in anticipation of settlement. Although progress has been made on the tri-party repo settlement platform to only provide credit on a committed and limited basis, settlement off this platform usually relies on a variety of arrangements that are often opaque. If market participants misunderstand the depth, breadth, or durability of these credit and liquidity extension arrangements, they cannot adequately manage their risk.

5. The opaqueness of the SFT market may obscure some participants' ability to accurately identify and manage clearing and settlement risks. Reflecting the over-the-counter nature of the SFT marketplace, there is substantial opaqueness in the pricing of the SFTs as well as the quantity traded, although recent advances have been made regarding transparency to the tri-party market. This opaqueness means that some participants and regulators lack a comprehensive view of the SFT marketplace, and this is especially true for the non-centrally cleared bilateral SFT segment.⁶ This lack of transparency makes it difficult for some participants and regulators to determine Treasury SFT market functioning, especially on a real-time basis. Furthermore, some participants are often unable to determine the amount of leverage or level of concentration risk that exists for a given security type. As a result, the opaqueness of the SFT market makes it difficult for some participants to accurately identify and manage clearing and settlement risks.

The five risks highlighted above exist and are managed under normal market conditions. Adherence to existing best practices, particularly around internal controls and risk management, could further mitigate these risks across a range of events. That said, participants should examine whether these risks are managed well enough to endure contingent market events, when defaults could be more common and Treasury market liquidity could decrease. Further, defaults by a large or otherwise crucial market participant could have a contagion effect by disrupting Treasury market functioning and creating unexpectedly large credit exposures for other interconnected market participants.

Given the Treasury market's global importance and benchmark status, any disruption has the potential to create systemic risk that may be transmitted to other domestic and international capital markets. Although the likelihood of such a disruption in the Treasury market is remote, the TMPG believes a discussion of the clearing and settlement processes and practices now is prudent and could help improve the Treasury market's resiliency to stress events.

⁶ The Office of Financial Research adopted a rule in February 2019 to establish a data collection covering centrally cleared funding transactions in the U.S. repurchase agreement (repo) market. See [Centrally Cleared Repo Data Collection | Office of Financial Research](#).

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Public Dialogue

The TMPG seeks public feedback on the following aspects of Treasury SFT Clearing and Settlement:

- the accuracy and completeness of various clearing and settlement arrangements described,
- risk and resiliency issues identified and potential mitigants, and
- any other feedback and suggestions.

As always, the TMPG welcomes feedback on its ongoing work or suggestions for improved market practice.

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This paper proceeds as follows: In Section I, we provide an overview of SFTs, specifically repurchase agreements and securities lending. Section II provides a detailed discussion of the clearing and settlement of SFTs and references a companion packet of exhibits, “Trade Flow Mapping,” that include stylized maps of these processes. Section III summarizes the risks and resiliency issues associated with current clearing and settlement practices.

Section I: Secured Financing Transactions Market Overview

SFTs – including repurchase agreements (repos) and securities lending – are part of the collateralized U.S.-dollar-denominated money markets. Repos are financial transactions in which a party sells U.S. Treasuries to another party with a promise to repurchase the asset at a pre-specified later date. Securities lending is the short-term loan of U.S. Treasuries in exchange for cash or other collateral. Securities lending against cash and repo agreements are economically similar, and investors and firms use repo and securities lending to secure funding for their activities, make markets, and facilitate the implementation of various investment, risk management, and collateral management strategies. SFTs also play an essential role in the functioning and efficiency of the financial system, enhancing price discovery and secondary market liquidity by facilitating arbitrage in the Treasury markets and by enabling shorting of Treasuries in securities lending.

Repo transactions can be categorized into two main groups: Trades between a broker-dealer and its customer (dealer-to-customer) and trades between two broker-dealers (dealer-to-dealer). Securities lending transactions are both negotiated between customers and dealers as well as facilitated by agent lenders. In addition, some asset managers have internal securities lending activity.

For repo transactions, dealers are significant market makers in the dealer-to-customer segment, using a variety of trading venues, including voice and proprietary trading platforms, to enter into repos with their customers. In the dealer-to-dealer segment, the dealers trade with one another (and certain other market participants) primarily through interdealer brokers (IDBs). The IDBs offer the participating firms proprietary electronic screens or trading platforms that post the best bid and offer prices of the participants, along with the associated quantities bid or offered. For trades executed on an IDB, the IDB stands in the middle as the principal to each of the participants to preserve the anonymity of each party and prevent unfair advantages among traders or disclosures of trading positions and strategies. For securities lending transactions, dealers play a large role by borrowing securities on behalf of clients or themselves. Lenders of securities are generally financial institutions that own the assets outright, such as pension plans, mutual funds, and insurance companies. Although some lenders directly negotiate securities lending agreements, many lenders use agents, such as custodial banks, to conduct these activities.⁷

The life cycle of an SFT consists of three major components: execution, clearing, and settlement. Execution occurs when two parties agree to a trade, an event that can occur across a range of venues, from voice to electronic platforms. Clearing occurs post-execution and refers to the steps involved with preparing executed trades for settlement and the submission of settlement instructions. For those trades that are cleared through a CCP, clearing includes a guarantee of settlement and novation, and

⁷ See, Federal Reserve Bank of New York, Staff Report, *Repo and Securities Lending*, December 2011, revised February 2013.

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usually the netting of obligations for settlement. Settlement of an SFT involves two steps. In the first step, the on-leg (aka the start-leg) of the trade is settled and involves one party (Seller) delivering securities against cash to the other party (Buyer). In the second step, the off-leg (aka the end-leg) of the trade is settled, and this involves the Buyer returning the securities against cash to the Seller. Usually, the on-leg settlement occurs on the same day as execution. The difference in time between the off-leg and on-leg determines the maturity of the trade, where the most common maturity of Treasury SFTs is overnight.

There are a number of ways that an SFT can be cleared and/or settled. Turning first to repos, in the dealer-to-customer segment, repos are most commonly cleared and/or settled in three ways:

- **Bilateral non-centrally cleared:** when each party to the trade uses their respective and bespoke clearing and settlement processes (see the top panel in the figure “Trades in Treasury SFT Markets” below). Settlement typically occurs on a DVP basis and the parties (or their custodians) must have back-office capabilities to receive, track, value, and account for the securities.
- **Non-centrally cleared tri-party settlement platform:** when each party uses a settlement platform offered by a clearing bank (see the second panel in the figure below). Under this agent-cleared approach, both parties to the trade use the clearing and settlement processes offered by a clearing bank. The clearing bank provides a variety of services, including collateral valuation, margining, collateral management services, as well as back-office support to both parties by settling transactions on its books and confirming that the terms of the repo are met. Additionally, the clearing bank acts as custodian for the securities held as collateral and allocates collateral to trades at the close of the business day. These services provided by the clearing bank enable less-sophisticated market participants, who do not have their own collateral management back-office capabilities, to engage in cash lending in repo.
- **Sponsored Service:** when a dealer, who is a CCP member, sponsors a Sponsored Member customer such that their trade can clear through a CCP.⁸ These centrally cleared trades are either settled on the tri-party settlement platform or on a bilateral basis, depending on which Sponsored Service is used.

In the dealer-to-dealer segment, the IDBs and most dealers entering into repos are members of the CCP and so repos are usually centrally cleared. If a participant is not a CCP member, then the dealer-to-dealer trade is likely to be cleared and settled on a bilateral basis. For dealer-to-dealer SFTs, the CCP provides two clearing services:

- **FICC DVP Service:** when both parties to the trade submit trade details to the CCP, including which specific securities will be delivered at settlement (see the third panel in the figure below). Participants often use IDBs to help with trade execution and price transparency. The CCP guarantees settlement once it successfully confirms trade details submitted by all parties and each party to the trade uses their own settlement processes to satisfy their (netted) obligations.

⁸ Currently, there is a single CCP that offers this service to its members.

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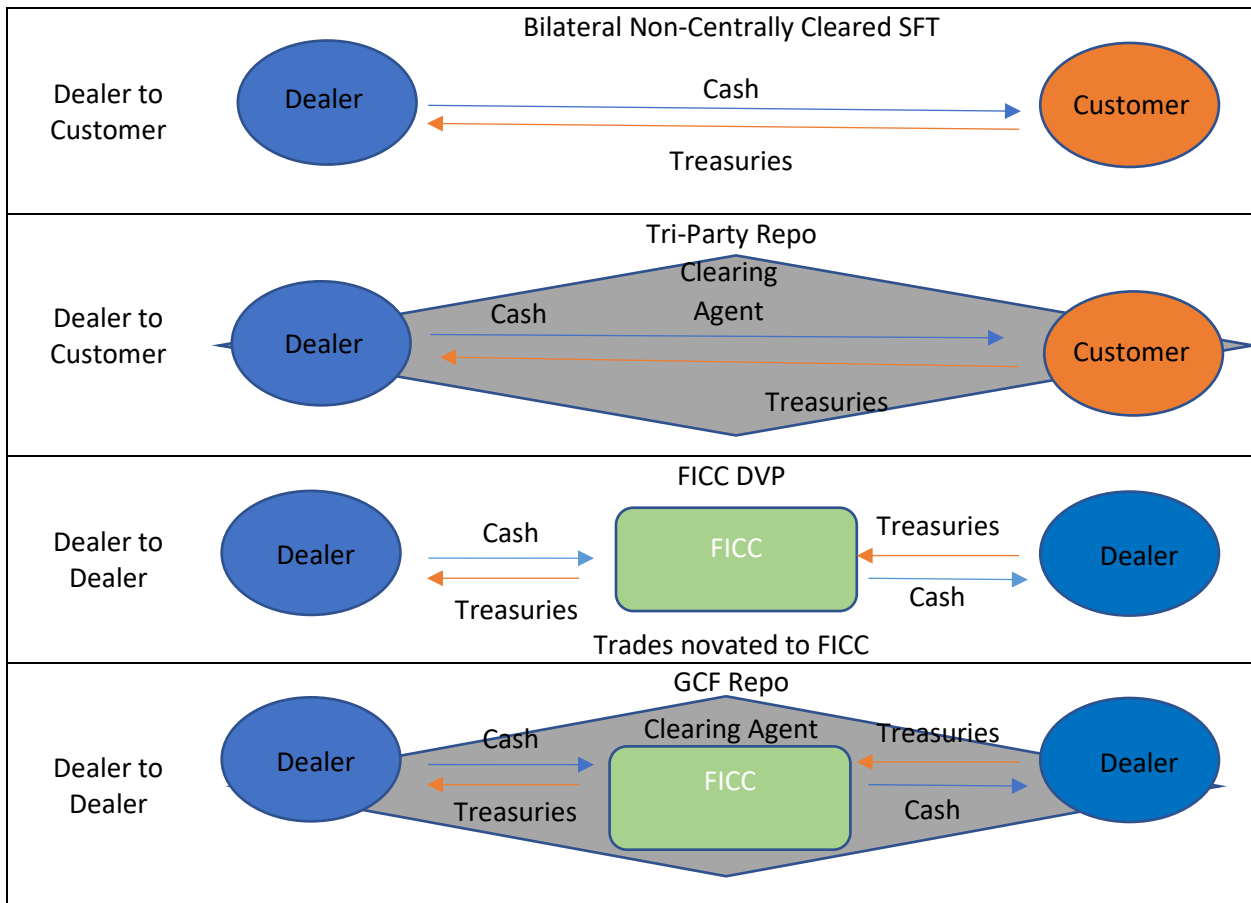
- **GCF Repo Service:** when both parties use an IDB that ensures anonymity to both the buyer and the seller to execute a general collateral repo (see the bottom panel in the figure below). The IDB then submits these details to the CCP, which upon receipt novates and guarantees settlement. The parties to the trade clear and settle their net obligations on the tri-party settlement platform.

Turning next to securities lending transactions, there are two main ways these transactions are cleared and settled. The first is when each party to the trade uses their respective and bespoke clearing and settlement processes, similar to the bilateral non-centrally cleared case mentioned above for repo. The second is when both parties clear and settle the trade on the tri-party settlement platform. A salient difference between securities lending and repo is that where repos are almost always settled on a delivery-versus-cash basis, it is not uncommon for securities lending transactions to settle on a free-of-payment (FOP) basis.⁹

⁹ Free-of-payment is a settlement method for a securities transaction in which the delivery or receipt of the securities occurs without the simultaneous exchange of the associated cash payment.

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Trades in Treasury SFT Markets



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Section II: Detailed Clearing and Settlement Cases

In this section we lay out the details of clearing and settlement for four general scenarios: (i) repos that are non-centrally cleared and settled on a bilateral basis, (ii) repos that are non-centrally cleared and settled on the tri-party settlement platform, (iii) repos that are centrally cleared, and (iv) securities lending transactions. For each general scenario there is a set of exhibits that include stylized maps and accompanying detailed notes (See, “Trade Flow Mapping”).

The maps have a common structure to facilitate comparison across the different scenarios, with some distinctions between the set of non-centrally cleared SFTs and those depicting centrally cleared SFTs, which we note below. The maps break down the trade life cycle of SFTs into four steps: (i) execution (including trade booking), (ii) affirmation and confirmation (including trade matching), (iii) clearing and settlement of the on-leg and (iv) clearing and settlement of the off-leg. In addition to illustrating the clearing and settlement processes, the maps also highlight the participants in the settlement chain and identify which of them have counterparty credit risk and credit extension risk throughout the clearing and settlement process.¹⁰

The most common form of SFTs is a same-day overnight trade where steps (i) through (iii) occur on the same business day (T+0) and step (iv) occurs on the following business day (T+1). As such, the clearing and settlement processes for the same-day overnight trade are detailed for all the cases below. In some cases, the clearing and settlement processes for other types of trades are also shown, including same-day term trades, where step (iv) occurs at a future business date (T+N) as well as forward-starting SFTs where steps (i) and (ii) occur on T+0, step (iii) occurs on a future business date (T+N), followed later by step (iv).

Some of the common features across the clearing and settlement maps are:

- Entity type: included as individual rows in the process, for instance, a clearing bank, a custody bank, CCP, etc. (Note that the number of entity types and hence rows differ across the various maps.)
 - For the bilateral and tri-party repo cases, the securities provider of an SFT is designated as Seller and the cash-provider is designated as Buyer.
 - For the centrally cleared cases, the securities provider of an SFT is designated as CCP Member (Repo) and the cash-provider is designated as CCP Member (Reverse).¹¹
- Timeline:
 - For the non-centrally cleared cases, steps (i) through (iii) are displayed on one map and step (iv) is displayed on a separate map.
 - For the centrally cleared cases, all steps are displayed on the same map.
- Information flows and movements of cash or securities designations:

¹⁰ Market risk (the risk that the value of the securities exchanged in the SFT changes between the time the trade is executed and the settlement of the off-leg) is an important determinant of the amount of counterparty credit risk associated with an SFT.

¹¹ Reverse references reverse repo, which is the party of an SFT who has agreed to receive securities and deliver cash.

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- Information flows (gray dashed arrows): Two-way information flows include trade messaging, confirmation, and matching processes. One-way information flows include delivering and receiving instructions and settlement confirmations.
- Movements of securities (solid black arrows): This includes movements across Fedwire Securities Service or as a transfer on the books of a bank.¹²
- Movements of cash (solid black lines with squares)
- Identification of credit risks:
 - Counterparty credit risk (solid red outline): Risk of counterparty non-performance and the associated risks from liquidating or covering positions, which has two components. The first is the risk that the market price of Treasuries moves against the party trying to make itself whole, and the second is that this recovery process takes longer than expected.
 - Centrally cleared credit risk (solid green outline): Risk the CCP assumes in becoming principal to a trade. This is the risk of a CCP member not performing on its obligations to the CCP and the associated risks the CCP faces in liquidating or covering that position.
 - CCP counterparty risk (dashed green outline): Risk of CCP non-performance and the associated risks the CCP members face from liquidating or covering positions.
 - Credit extension risk (solid orange outline): Risk assumed by parties advancing cash upon receipt of securities on behalf of the underlying Buyer secured by such securities. In the event of the Buyer's default, the party providing the cash advance may liquidate the Treasuries and absorb credit and market risk.
- Other features of the maps include:
 - A pie chart in the top right corner, summarizing the evolution of credit risk over the SFT life cycle. The numbered quadrants of the pie chart denote the specific trade life-cycle stage and which entities have a credit risk exposure during that stage. The numbering of the quadrants aligns with the numbering across the top row of the relevant map.
 - For the bilateral and tri-party repo cases, a summary chart at the bottom of each map indicating which entity holds credit risk at various points in the clearing and settlement process.

A number of different entities may play a role in the clearing and settlement of SFTs, depending on the parties to the trade. A list of different entities highlighted in the stylized clearing and settlement maps are:

- Buyers (cash providers) / Sellers (securities lenders)
 - Buy-side Firms: Clear and settle SFTs using a non-centrally cleared bilateral process and, if eligible, using the tri-party settlement platform. In addition, if the Buy-side firm is a sponsored member of the CCP, its trades with a sponsoring member of the CCP could be centrally cleared using the Sponsored Service.
 - Dealers (CCP non-members, typically not registered broker dealers): Clear and settle SFTs on a non-centrally cleared bilateral process and, if they are eligible, on the tri-party

¹² Fedwire Services include the Fedwire Funds and the Fedwire Securities Service, which banks, businesses, and government agencies rely on for critical same-day funds and securities transfers. "Fedwire" is a registered service mark of the Federal Reserve Banks. A complete list of marks owned by the Federal Reserve Banks is available at [FRBservices.org](https://www.frb.org/services).

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settlement platform. In addition, if the dealer is a sponsored member, its trades with a sponsoring member of the CCP can be centrally cleared using the Sponsored Service.

- Dealers (CCP members): Clear and settle SFTs using a non-centrally cleared bilateral process and, if eligible, the tri-party settlement platform. If the counterparty to the SFT is also a CCP member, then one of the centrally cleared processes is used. Finally, if the counterparty is a sponsored member, the CCP member could act as a sponsoring member, if eligible, and centrally clear the trade using the Sponsored Service.
- Clearing / Custody Banks: Clear and settle on behalf of clients in all clearing and settlement processes. Further, the clearing bank operates the tri-party settlement platform that supports the settlement of tri-party repo, GCF Repo trades, Sponsored GC trades, and securities lending trades.
- Central Counterparty (CCP): Financial utility that centrally clears repos for its members.
- Interdealer brokers (IDB): Dealers that operate electronic and voice platforms that, among other services, enable participants to trade anonymously.

1. Repos that are non-centrally cleared and settled on a bilateral basis

We start with the least complex clearing and settlement case: a repo transaction that is cleared and settled on a bilateral basis. A typical example of this type of trade is a dealer-to-customer transaction in which the dealer could be providing securities or lending cash on the initial settlement leg. Dealer-to-dealer transactions are also settled in this space, if at least one of the dealers is not a member of the CCP.

The clearing and settlement process is illustrated using two maps: The first map incorporates the trade life-cycle steps of execution, clearing, and the settlement of the on-leg and the second map incorporates clearing and the settlement of the off-leg. For the on-leg, two variations are presented.

The first variation, the map in Exhibit 1a, is a same-day repo, in which the on-leg settlement occurs on the same day as execution. As illustrated in the top row of that map (reading it left-to-right), execution typically occurs between 6:00 am and 8:00 am quickly followed by trade booking and matching. Between 8:30 am and 3:30 pm (the operating hours of Fedwire Securities), clearing continues as both the Buyer and Seller send instructions to their settlement agents (denoted as a Clearing Bank and Custody Bank in the map) regarding the trade. The on-leg settlement occurs before 3:30pm, followed by end-of-day reporting from the settlement agents on transactions and end-of-day positions.

The second variation, the map in Exhibit 1b, is a forward-starting repo, in which the on-leg settlement occurs on a day after trade-execution (usually the following business day, as depicted in the map). As illustrated in the top row, trade booking and matching occur on the same day as execution. The Buyer and Seller then send settlement instructions on the day in which the on-leg settles. Additional details about the clearing and settlement processes are provided in the notes accompanying in Exhibits 1a and 1b (see “Trade Flow Mapping,” pages 5-7).

The processes for the off-leg settlement, depicted in Exhibit 1c, are the same regardless of whether the trade is a same-day repo or a forward-starting one. The map details how both parties send settlement instructions (usually before 8:00 am), with settlement of the off-leg occurring between 8:30 am and 3:30 pm, followed by end-of-day reporting by the settlement agents. Additional details on the off-leg processes depicted in map 1c are provided in the accompanying notes.

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Credit risks

After trade execution, counterparty credit risk arises between the Buyer and Seller, illustrated by the red-border ellipses around the Buyer and Seller in maps 1a and 1b. After trade execution, counterparty credit risk arises between the Buyer and Seller, illustrated in the maps by the red-border ellipses around the Buyer and Seller in Exhibits 1a and 1b. This risk reflects the fact that if one of the parties to the trade does not fulfill its obligations and so causes the on-leg settlement process to fail, then the other party may face a cost in replicating the trade with another party. This replacement cost risk naturally encompasses the market risk of the security in question.

Once the on-leg has settled, counterparty credit risk remains between Buyer and Seller (note the red-border ellipse in the map in Exhibit 1c) but is changed. This risk now reflects what happens if the off-leg does not settle. If the Buyer fails to return securities, then the Seller can use the cash it received with the on-leg settlement to make itself whole, by purchasing securities in the Treasury cash market. If the Seller defaults, then the Buyer can use the securities it received with the on-leg settlement to make itself whole, for example by selling them in the Treasury cash market.

In addition to this counterparty credit risk, the settlement process of both the on-leg and off-leg entail a different type of credit risk: credit extension risk. Because securities are transferred on a delivery-versus-payment basis and firms other than the Buyer and Seller are involved in settlement, some parties advance cash upon receipt of securities on behalf of the Buyer, when the cash is secured by those securities. In the case of a Buyer's default, these parties may face costs recovering their cash, for example, in liquidating the securities. In the maps of Exhibits 1a and 1b, the Custody Bank faces credit extension risk to the Buyer when it delivers cash to the Clearing Bank upon receipt of the securities. This risk is extinguished once the Buyer fully funds its obligations. In the map of Exhibit 1c, the Clearing Bank faces credit extension risk to the Seller, when it delivers cash to the Custody Bank upon receipt of the securities. This risk is extinguished once the Seller fully funds its obligations.¹³

2. Repos that are non-centrally cleared and settled on the tri-party repo platform

We now turn to the case of repo trades that are cleared and settled on the tri-party settlement platform, a service offered by a clearing bank. A typical example of a tri-party repo is a general collateral repo when a large securities dealer is sourcing cash from an investor, such as a money market mutual fund, in exchange for collateral. The Federal Reserve also operates its Reverse Repurchase Agreement Facility and Standing Repo Facility on this settlement platform.

The clearing and settlement process is illustrated using two maps (see "Trade Flow Mapping," pages 10-14), where the first map incorporates the trade life-cycle steps of execution, clearing, and the settlement of the on-leg and the second map incorporates clearing and the settlement of the off-leg.

The first map, in Exhibit 2a, details the clearing and settlement processes for a same-day repo, where trade execution and the on-leg settlement occur on the same day (T+0). As illustrated in the top row, execution typically happens between 7:00 am and 9:00 am, quickly followed by trade booking. Note that trade execution happens between the two parties, away from the tri-party settlement platform. Between 10:00 am and 3:30 pm is typically when both parties of the trade affirm the details of the trade with the clearing bank, confirming, for example, that the trade can be cleared and settled on the tri-party settlement platform. Before 3:30 pm, both parties need to deliver cash or securities to their

¹³ This credit extension risk is not present if the Buyer or Seller pre-funds its obligations.

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accounts on the tri-party settlement platform in preparation of the settlement of the on-leg. Settlement begins at 3:30 pm, with the tri-party clearing agent checking to make sure that each party has met its obligations. After this check, the on-leg of the repo is settled on the books of the clearing bank and end-of-day collateral reports are transmitted to the Buyer and Seller. Detailed notes of these processes are provided in the accompanying notes of Exhibit 2a.

The second map, in Exhibit 2b, details the off-leg settlement processes. The business day begins with the tri-party clearing agent marking-to-market the securities posted as collateral. If securities have fallen in value overnight, the Seller could be required to post additional collateral into its tri-party repo trades, an obligation that is usually fulfilled with cash. Up until 3:00 pm, the Seller can also substitute out securities that it would like to use outside of the tri-party settlement platform, although the majority of substitutions happen before noon. As illustrated in the map and detailed in the accompanying notes, this securities-for-securities swap process is completed in two steps. The first step involves the Seller posting cash to the tri-party clearing agent and receiving the securities it would like to use elsewhere. The second step then involves the Seller delivering eligible securities to the tri-party clearing agent and receiving back the cash it had just posted.

Shortly after noon, the tri-party clearing agent receives an intraday price feed for Treasuries, and performs another mark-to-market exercise, re-evaluating the value of securities held as collateral in tri-party repo trades. As in the early morning, if securities have declined in value, the Seller is required to post additional collateral into its trades. Starting at 3:30 pm, the settlement of the off leg begins. The tri-party clearing agent checks to make sure that the Seller has enough cash to meet its obligations, and once that is verified the trade is unwound.

Credit risks

Upon trade execution, the Buyer and Seller hold counterparty credit risk to one another, as evidenced by the red-bordered ellipses in the map in Exhibit 2a. This counterparty credit risk remains until the settlement of the off-leg of the transaction and is the same as that described in Section II.1, for repos that are non-centrally cleared and settled on a bilateral basis. In particular, the tri-party settlement platform does not mitigate or transform this risk for the Buyer and Seller, because the clearing bank acts solely as an agent in providing clearing and settlement services.

In contrast to non-centrally cleared bilateral repos, the tri-party settlement platform minimizes the amount of intraday credit extensions that are required to facilitate settlement. Indeed, the tri-party clearing agent settles both the on-leg and the off-leg of the repo without any intraday credit extensions. That said, the sole tri-party clearing agent providing services in this market may offer the Seller capped and committed intraday credit to facilitate clearing and settlement.¹⁴ Uses of such credit are marked by the orange-bordered ellipses in Exhibit 2b, illustrating how the Seller can use intraday credit to facilitate (i) a securities-for-securities substitution for a given repo and (ii) the off-leg settlement of a maturing repo trade combined with the on-leg settlement of a new repo.

¹⁴ For details on tri-party repo reform, see the Federal Reserve Bank of New York's May 2010 white paper "[Tri-Party Repo Infrastructure Reform](https://www.newyorkfed.org/banking/tpr_infr_reform.html)," as well as the information posted at https://www.newyorkfed.org/banking/tpr_infr_reform.html.

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3. Repos that are centrally cleared

We now turn to centrally cleared repos. The CCP offers four main services to its members: GCF Repo[®], FICC DVP Repo, Sponsored DVP Repo, and Sponsored General Collateral (GC) Repo. Each service's clearing and settlement arrangements are discussed in turn, each with their own set of stylized maps and accompanying notes (see "Trade Flow Mapping," pages 15-78).

a. GCF Repo

The GCF Repo Service enables eligible members of the CCP to centrally clear general-collateral repo trades. GCF Repo participants settle their net positions on the tri-party settlement platform. Although there is a range of participant types that are members of the CCP, a typical GCF Repo trade is between two registered broker dealers.

The clearing and settlement process is illustrated in one map, from trade execution to the settlement of the start-leg and the end-leg (aka the on-leg and off-leg, respectively). There are two maps in this section, where the first one (in Exhibit 3a.i) considers same-day overnight trades and the second one (in Exhibit 3a.ii) illustrates same-day term trades.

Starting with same-day, overnight GCF Repo, we first note there are five different entities involved with clearing and settling: the two CCP members facing each other on the trade, an IDB which helps with trade execution, the CCP, and the tri-party clearing agent. As illustrated in the map in Exhibit 3a.i, trade execution involves three parties: Two CCP members who execute a trade through an IDB. The CCP member promising to deliver cash against securities is labeled "Reverse" and the other CCP member promising to deliver securities against cash is labeled "Repo". The IDB stands between the two CCP members as a counterparty to each dealer (and so ensures the anonymity of the counterparties to one another). After execution, both CCP members book the trade in their systems, and the IDB submits the trade details to the CCP on behalf of all parties to the trade. CCP members are required to affirm GCF Repo trades submitted on their behalf by the IDB.

Upon receipt of the trade from the IDB, the CCP novates the trade and so becomes the counterparty to both of the original parties to the trade. The CCP stops accepting trade details at 3:00 pm, and shortly thereafter the CCP computes each participant's net position for each general collateral trade type. This results in the IDB's securities position netting down to zero because the IDB is on both sides of the transaction that are novated to the CCP. This netting process includes only GCF Repo trades, and for a given date includes same-day overnight GCF Repo trades, overnight GCF Repo forward-starting trades scheduled to start on this given date, and all GCF Repo term trades that have not yet matured.

After receiving information on their net settlement positions from the CCP, each CCP member then settles these obligations on the tri-party settlement platform. In the map in Exhibit 3a.i, the settlement process is illustrated for the case in which the Reverse CCP member has an end-of-day ("net") obligation to deliver cash against securities and the Repo CCP member has an end-of-day ("net") obligation to deliver securities against cash. To satisfy these obligations, the Repo CCP member moves securities into its account on the tri-party settlement platform and similarly, the Reverse CCP member moves cash into its account. The tri-party clearing agent, after verifying that both securities and cash are in place, first moves the securities from the Repo CCP member's account to the CCP's account and then onto the Reverse CCP member's account, where all three accounts are on the tri-party settlement platform. Simultaneously, the cash is moved in the opposite direction, from the Reverse CCP member to the CCP

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to the Repo CCP member. With this settlement of the start-leg, the tri-party clearing agent sends end-of-day reports to all participants (as is done with non-centrally cleared tri-party repo trades).

On the following business day, the Repo CCP member has the option to substitute out securities from its trades, using the two-step process described in Section 2 (non-centrally cleared tri-party repo trades). These substitution processes are available until 3:30 pm, after which the settlement of the end-leg begins. This process mirrors the start-leg process, albeit in reverse. After verifying that the Repo CCP member's account has the required amount of cash and the Reverse CCP member's account has the securities, the tri-party clearing agent moves the securities from the Reverse CCP member's account to the CCP's account and then onto the Repo CCP member's account. As before, cash is moved simultaneously in the opposite direction. With these transfers, the end-leg of the GCF Repo trade is settled. Details on both the start and end legs are provided in the notes accompanying Exhibit 3a.i (pages 18-19 in "Trade Flow Mapping").

The next stylized clearing and settlement map, in Exhibit 3a.ii illustrates those processes for same-day GCF Repo trades that have maturities greater than overnight (aka term trades). Most of the processes for clearing and settlement are the same as those described for overnight GCF Repo trades, where the key difference is the number of days between the settlement of the start-leg and end-leg. Further details are provided in the notes accompanying Exhibit 3a.ii (pages 21-24 in "Trade Flow Mapping").

Credit Risks

Upon trade execution, both CCP members and the IDB hold counterparty credit risk to one another, as highlighted by the red-bordered ellipses in the maps of Exhibits 3a.i and 3a.ii. The IDB usually submits trade details to the CCP in near-real time, and so this counterparty credit risk is quickly transformed. Upon receipt of the trade from the IDB, the CCP novates the trade, and as a result the Reverse and Repo CCP members' counterparty risk is netted and transferred to the CCP (as illustrated by the green-bordered ellipses).

The CCP manages its counterparty credit risk to its members using various tools, including but not limited to: the collection of Clearing Fund¹⁵ margin and mark-to-market adjustments. The Clearing Fund margin is composed of two calculated components – value-at-risk and repo rate volatility – and is usually collected twice daily using intraday and end-of-day cycles.¹⁶ The tri-party clearing agent marks-to-market the securities delivered by the Repo CCP member consistent with the processes described in Section 2 (above). Mark-to-market pass-through adjustments on the repo rate are collected or paid once daily by the CCP. Note that a key difference between overnight and term GCF Repo trades is that the CCP needs to manage its counterparty credit risk for a longer length of time.

As mentioned in Section 2's credit risk description, the tri-party clearing agent settles positions without any intraday credit extensions. Further, the sole tri-party clearing agent providing services in this market offers GCF Repo participants capped and committed intraday credit to facilitate clearing and settlement. This credit could be used for collateral substitutions, for example, or to facilitate the end-leg settlement of a maturing repo combined with the start-leg settlement of a new repo.

¹⁵ Clearing fund margin is margin posted to a default fund that covers any losses resulting from liquidation of the defaulting Member's open guaranteed obligations.

¹⁶ Although the CCP has two standard margin collections each business day, CCP member positions and margin components are recalculated on an hourly basis and the CCP reserves the right to issue adhoc margin calls.

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b. FICC DVP Repo

The FICC DVP Service enables members of the CCP to centrally clear repos in which the securities to be delivered are specified in the trade details submitted to the CCP.¹⁷ Participants settle their net positions using their bilateral clearing and settlement arrangements. Although there is a range of participant types who are members of the CCP, the typical FICC DVP Repo trade is between two dealers.

The clearing and settlement process is illustrated in one map, from trade execution to the settlement of the start-leg and the end-leg. There are four Exhibits in this section. The first two consider same-day overnight trades without and with an IDB (Exhibits 3a.iii and 3a.iv, respectively). The third illustrates the processes for a forward-starting repo (Exhibit 3a.v) and the fourth describes those for a same-day term repo (Exhibit 3a.vi).

We start with the same-day overnight repo (Exhibit 3a.iii on pages 25-27 of “Trade Flow Mapping”) and note that except for the (important) inclusion of the CCP, this process looks similar to the bilateral repo described in Exhibit 1a. The CCP members execute a trade with one another and book the trade details in their internal systems. Each member submits the trade details to the CCP which then matches the trade details and affirms the eligibility of the trade for central clearing. Upon successful trade matching, the CCP novates the trade.

The start-leg of these trades are settled on a trade-by-trade basis. In the example illustrated in the map, the Repo CCP member starts the settlement process by delivering securities to the CCP’s account and receiving cash. In the map, these transfers are shown as occurring on the books of Clearing Bank 1. The CCP then delivers these securities to the Reverse CCP member and receives cash, where this transfer takes place over Fedwire Securities as the Reverse CCP member’s account is at Clearing Bank 2.

The CCP incorporates the off-leg settlement of this trade into its netting calculation, which are done at the security-type level (CUSIP). Unlike in the GCF Repo case, this netting calculation includes FICC DVP repo trades as well as secondary market cash transactions that are cleared by the CCP.

On the following business day, the trade is unwound with the settlement of the end-leg. This process starts with the Reverse CCP member delivering the securities it received to the CCP’s account and receiving cash. The CCP then delivers the securities back to the Repo CCP member and receives cash. Upon the successful completion of these transfers, the end-leg of the FICC DVP repo trade is settled.

The next stylized clearing and settlement case, Exhibit 3a.iv, layers in the role of an IDB that provides a venue for trade pricing and execution and faces each party on a resulting trade. As illustrated in the map, the use of the IDB implies that two trades are submitted to the CCP, where the IDB stands between the Repo and Reverse CCP members (and so ensures the anonymity of the counterparties from one another). Each trade’s details are sent to the CCP, and after a successful comparison the CCP novates each trade, which results in the IDB securities’ position netting down to zero. The subsequent clearing and settlement processes follow the process already described above in Exhibit 3a.iii. Further details about this case can be found in the accompanying notes on page 29 of “Trade Flow Mapping”.

The third stylized clearing and settlement case for FICC DVP repo, Exhibit 3a.v, considers a forward-starting overnight repo trade, without an IDB. As with the case of a same-day overnight repo, trade execution and the submission of trade details to the CCP occur on the same business day, T+0. After

¹⁷ Often the specific securities to be delivered at settlement are agreed to at the time of trade execution.

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successful comparison of trade details, the CCP novates the trade. The settlement of the start-leg does not start until the next business day (T+1), reflecting the trade's terms of agreement. A consequence is that the start-leg is incorporated into the CCP's netting calculation at the end of T+0. Otherwise, the clearing and settlement procedures are the same as those described for the same-day overnight case in Exhibit 3a.iii.

The fourth and final stylized clearing and settlement case for FICC DVP repo, Exhibit 3a.vi, considers a same-day term repo. The processes for clearing and settlement are the same as those described for the same-day overnight case, where the key difference is the number of days between the settlement of the start-leg and end-leg.

Credit Risks

Across all four cases, the two CCP members hold counterparty credit risk to one another after trade execution as indicated by the red-bordered ellipses in the maps. In Exhibit 3a.iv, the IDB also holds counterparty credit risk. These risks are transformed after the CCP successfully compares the details of the trade, where this transformation is illustrated in the maps with the switch from red to green-bordered ellipses.

As detailed in the GCF Repo credit risk discussion in Section 3.a, the CCP manages its counterparty credit risk using various tools, including but not limited to (i) Clearing Fund margin collection and (ii) mark-to-market adjustments. Once again, a key difference between overnight and term FICC DVP Repo trades is that the CCP needs to manage the counterparty credit risk from a trade for a longer period of time.

Unlike with GCF Repo trades, but similar to non-centrally cleared repos settled on a bilateral basis, settlement of the start- and end-legs require intraday credit extension or liquidity support. This credit extension is required because securities are transferred on a delivery-versus-payment basis. In particular, during the settlement of the start-leg, the Reverse CCP member receives a temporary credit extension from Clearing Bank 2 as Clearing Bank 2 receives securities on behalf of the Reverse CCP member and delivers cash. Clearing Bank 2's extension of credit is extinguished once the Reverse CCP member fully funds its obligation.

Similar, for the settlement of the end-leg, the Repo CCP member receives a temporary credit extension from Clearing Bank 1 because Clearing Bank 1 receives the securities on behalf of the Repo CCP member and delivers cash. Clearing Bank 1's extension of credit to the Repo CCP member is extinguished once the Repo CCP member fully funds its obligation.

c. Sponsored DVP Repo

The Sponsored Services provides central clearing services for repos between eligible direct-clearing members of the CCP, deemed sponsoring members, and their customers, deemed sponsored members of the CCP. Sponsored DVP repo trades leverage the processes used to clear and settle FICC DVP repo trades, discussed in Section 3.b. As a result, the specific securities to be delivered in the trade need to be listed in the trade details submitted to the CCP as part of the clearing process. For the typical Sponsored DVP Repo trade, the sponsoring member is a securities dealer or bank. For instances when the sponsored member is delivering cash against securities, a typical sponsored member is a money market

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mutual fund. For instances when the sponsored member is delivering securities against cash, a typical sponsored member is a hedge fund.¹⁸

The clearing and settlement process is illustrated in one map, from trade execution to the settlement of the start-leg and the end-leg. There are two cases for Sponsored DVP Repo. The first, Exhibit 3b.i, shows the clearing and settlement process of a same-day overnight Sponsored DVP repo paired with the clearing and settlement processes of an overnight FICC DVP repo, where the sponsoring member is delivering securities against cash in the Sponsored DVP repo trade. This pairing of trades highlights how the sponsoring member can source securities from FICC DVP repo for delivery to a sponsored member via Sponsored DVP repo. The second, Exhibit 3b.ii, shows the clearing and settlement process when the sponsoring member is engaging in back-to-back overnight Sponsored DVP Repo trades. Both comparisons are illustrated to highlight the gains from balance sheet netting that the Sponsored DVP Repo service provides to the sponsoring member.¹⁹

We start with the clearing and settlement case that pairs the Sponsored DVP repo trade with the FICC DVP repo trade (Exhibit 3b.i, pages 39-42 in “Trade Flow Mapping”). The sponsoring member executes two repo trades. In the first, the sponsoring member agrees to delivery of securities against cash to a sponsored member (the upper panel of the map). In the second, the sponsoring member agrees to delivery of cash against securities to another CCP member, when the specific securities to be delivered are the same across the two trades. Clearing begins shortly thereafter, with the trade details of each trade being submitted to the CCP by each member. Once the CCP successfully compares the trade details, the end-leg settlements of both trades are novated and guaranteed, and the start-leg settlement of the FICC DVP Repo trade is also novated and guaranteed. Given that the FICC DVP repo clearing and settlement processes are discussed in Section 3.b, we now focus just on Sponsored DVP repo.

The start-leg of the Sponsored DVP repo trade is settled on a trade-by-trade basis, away from the CCP. For the trade illustrated in the map in Exhibit 3b.i, settlement involves the sponsoring member’s omnibus account at Clearing Bank 2 delivering securities to and receiving cash from the sponsored member’s account at the Custody Bank. The CCP incorporates the off-leg settlement of the Sponsored DVP repo trade into its netting calculation, which is done at the security type level (CUSIP).

The following business day the trade is unwound with the settlement of the end-leg. This process starts with the sponsored member delivering securities against cash to the sponsoring member’s omnibus account. These securities are then delivered onward against cash to the sponsoring member’s securities account, where they can be used to satisfy other obligations incurred by the sponsoring member. In the stylized map these securities are used to settle the end-leg of the paired FICC DVP repo trade. Details are provided in the accompanying notes to Exhibit 3b.i.

The next stylized clearing and settlement case, Exhibit 3b.ii, shows the clearing and settlement processes for two Sponsored DVP repo trades, where the sponsoring member is intermediating between two sponsored members, and therefore acting as the cash-investor/buyer in one trade and the

¹⁸ A link to the current list of sponsored members is provided at this [Member Directories website](#).

¹⁹ The balance sheet netting gains come about because after the trades are accepted by the CCP the dealer acting as a sponsoring member faces the CCP as a counterparty for both trades. If these two trades are not centrally cleared, then the dealer would face two different clients as counterparties, which would not allow those two trades to be netted on the balance sheet.

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securities-provider/seller in the other. The clearing and settlement processes are the same as those described in the previous Exhibit 3b.i. Of note is that the start-leg of each trade is settled away from the CCP on a trade-by-trade basis, whereas the end-leg of the trade is incorporated into the CCP's netting calculation. Furthermore, the sponsoring member delivers and receives securities from the sponsored members through its sponsoring member omnibus account.

Credit Risks

The credit risks associated with the Sponsored DVP trades are nuanced. The nature of this service means that the sponsoring member remains responsible for guaranteeing the performance of the sponsored member to the CCP to the extent that the sponsored member, who is primarily liable to the CCP, fails to perform. Therefore, although the sponsoring member's counterparty becomes the CCP upon novation, the sponsoring member retains risk to the sponsored member as its guarantor to the CCP. Likewise, although the sponsored member's counterparty becomes the CCP upon novation with the resulting transformation in counterparty credit risk, it is important to note that the sponsored member remains wholly dependent on the sponsoring member as its processing agent. Further, the sponsored member faces close-out risk, in that if prior to settlement the sponsoring member defaults, the CCP, in its sole discretion, determines whether to close-out the affected sponsored member's Sponsored DVP trades or permit the sponsored members to complete their settlement.

The CCP manages its counterparty credit risk in much the same way as detailed for the FICC DVP repo case. A difference is that the CCP manages its risk to the sponsored member through a guarantee provided by the sponsoring member.

Because the clearing and settlement processes for Sponsored DVP repo trades are those used to clear and settle FICC DVP repo trades, the credit extension risks highlighted in Section 3.b are also present here.

d. Sponsored General Collateral (GC) Repo

The Sponsored Services provides central clearing services for repos between eligible direct-clearing members of the CCP, deemed sponsoring members, and their customers, and deemed sponsored members of the CCP. Sponsored GC repo trades leverage the tri-party settlement platform offered by the clearing bank, discussed in Section 2. These are general collateral repos in which the parties to the trade agree that any securities within a certain set (e.g., any Treasury security) can be delivered at settlement. Currently, the typical Sponsored GC trade has a securities dealer or bank delivering securities against cash to a money market mutual fund, where the dealer is a sponsoring member and the money fund is a sponsored member.

The clearing and settlement process is illustrated in one map, from trade execution to the settlement of the end-leg. There are four cases in this section. The first, Exhibit 3c.i, shows the clearing and settlement process of an overnight Sponsored GC repo paired with the clearing and settlement processes of an overnight FICC DVP repo, in which the sponsoring member is delivering securities against cash in the Sponsored GC repo trade. This pairing of trades highlights how the sponsoring member is sourcing securities from FICC DVP repo for delivery to a sponsored member. The second case, Exhibit 3c.ii, shows the clearing and settlement process of an overnight Sponsored GC repo paired with the clearing and settlement processes of an overnight GCF Repo. This pairing of trades highlights how a sponsoring member can source securities from GCF Repo for delivery to a sponsored member. The third case,

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Exhibit 3c.iii, is an extension of Exhibit 3c.ii, showing the clearing and settlement practices for a term Sponsored GC repo trade paired with a term GCF Repo trade. Finally, the fourth case, Exhibit 3c.iv, shows the clearing and settlement process for the case in which a sponsoring member is engaging in back-to-back Sponsored GC and Sponsored DVP repo trades. All four comparisons highlight the gains from balance sheet netting that the Sponsored GC Repo Service provides to the sponsoring member.

We start with the clearing and settlement map in Exhibit 3c.i (page 46 in “Trade Flow Mapping”) which pairs a Sponsored GC repo trade with a FICC DVP repo trade. The sponsoring member executes two repo trades. In the first, the sponsoring member agrees to delivery of securities against cash to a sponsored member (the upper panel of the map). In the second, the sponsoring member agrees to delivery of cash against securities with another CCP member using the FICC DVP Service. Clearing begins shortly thereafter, with the trade details of each trade being submitted to the CCP by the sponsoring member and the other CCP member. Once the CCP successfully compares the trade details, the end-leg settlements of both trades are novated and guaranteed, and the start-leg settlement of the FICC DVP repo is also novated and guaranteed. Given that the FICC DVP repo clearing and settlement processes are discussed in Section 3b, we focus on Sponsored GC repo.

Note that both the start- and end-legs of the Sponsored GC repo trade are settled on a trade-by-trade basis using the tri-party settlement platform. For the trade illustrated in Exhibit 3c.i, settlement begins with the sponsoring member delivering securities against cash to the sponsored member. This is implemented by moving securities from the sponsoring member tri-party repo securities account against cash to the sponsored member’s tri-party repo securities account.

On the following business day, the trade is unwound with the settlement of the end-leg. This process starts with the sponsored member delivering securities against cash from its tri-party repo securities account to the sponsoring member’s tri-party repo securities account. These securities are then delivered onward against cash to the sponsoring member’s securities account at Clearing Bank 2, where they can be used to satisfy other obligations incurred by the sponsoring member. In the stylized map these securities are used to settle the end-leg of the paired FICC DVP repo trade. Details can be found in the accompanying notes to Exhibit 3c.i on pages 47-51 in “Trade Flow Mapping.”

The next stylized clearing and settlement case, Exhibit 3c.ii, shows the clearing and settlement processes for an overnight Sponsored GC trade paired with an overnight GCF Repo trade. As in the previous case, the sponsored member is delivering cash against securities. The clearing and settlement processes for the Sponsored GC trade are the same as those described in the previous Exhibit 3c.i. The clearing and settlement processes for the GCF Repo trade are described in Section 2.

The third stylized clearing and settlement case, Exhibit 3c.iii, extends the previous case by showing how term trades are processed. As such, it pairs a term Sponsored GC repo trade with a term GCF Repo trade. The processes for clearing and settlement are the same as those described in Exhibit 3c.ii, with a key difference in the number of days between the settlement of the start-leg and end-leg.

Finally, the fourth clearing and settlement case, Exhibit 3c.iv, shows the clearing and settlement processes for a term Sponsored GC repo trade paired with a term Sponsored DVP repo trade. The sponsoring member is delivering securities against cash in the Sponsored GC repo trade and is delivering cash versus securities in the Sponsored DVP repo trade. The processes for each trade are the same as those described earlier.

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Credit Risks

The credit risks associated with Sponsored GC repo trades are similar to those described above for Sponsored DVP repo trades. Although both the sponsoring member and the sponsored member face the CCP upon novation, the sponsoring member remains responsible for guaranteeing the performance of the sponsored member throughout the life cycle of the trade, and upon novation the sponsored member remains wholly dependent on the sponsoring member as its processing agent. Further, the sponsored member faces close-out risk as described in the Sponsored DVP repo credit risk section.

As described above, the CCP manages its counterparty credit risk using various tools, including but not limited to Clearing Fund margin collections and mark-to-market adjustments. Furthermore, the CCP manages its risk to the sponsored member through a guarantee provided by the sponsoring member.

Because the clearing and settlement processes for Sponsored GC repo trades are on the tri-party settlement platform, intraday credit extensions are minimized.

4. Securities lending transactions

In this final section, we focus on how securities lending transactions are cleared and settled. We consider three cases. The first two cases are securities lending trades that clear and settle on the tri-party settlement platform on a (i) DVP basis and (ii) an FOP basis. The third case is securities lending trades that clear and settle on a bilateral basis and are settled FOP.

We begin with the case of securities lending trades that are cleared and settled on the tri-party settlement platform, a system supported by the clearing bank. A typical example of these types of trades are large securities dealers borrowing securities against cash from a large institutional investor or an agent lender.

The clearing and settlement process is illustrated using one map and covers trade execution through the clearing and settlement of the on-leg. We begin with the case in which securities are settled on a DVP basis, Exhibit 4a (pages 73-74 in "Trade Flow Mapping"). There are five entities involved with the clearing and settlement process. There is the Borrower and Lender, who are the participants ultimately agreeing to borrow securities against cash and lend cash against securities, respectively. Then there are the Collateral Borrower and Collateral Lender entities, who act on behalf of the Borrower and Lender, respectively. The fifth and final participant is the tri-party clearing agent, who acts on behalf of all parties to clear and settle the securities lending trade.

The Collateral Lender and Collateral Borrower execute a securities lending trade at the beginning of the day, and then subsequently book the trade details and affirm them with the Borrower and Lender. The Collateral Lender and Collateral Borrower then send the trade details to the tri-party settlement platform, which matches the trade instructions upon receipt. Later that same day (T+0), settlement of the on-leg begins, when the Collateral Lender delivers securities to its account on the tri-party settlement platform and the Collateral Borrower delivers the cash to its tri-party settlement account. After checking that the terms of the trade have been met, the tri-party agent settles the trade, transferring the securities to the Collateral Borrower's tri-party account while simultaneously transferring the cash to the Collateral Lender's tri-party account. At the end of the day, final collateral reports for trades settled on the tri-party settlement platform are sent to the Collateral Borrower and Collateral Lender.

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The second clearing and settlement case in this section, illustrated in Exhibit 4b, is identical to the first map except that the transfer of cash and securities do not have to happen simultaneously, on a DVP basis. Rather, these transfers can happen asynchronously, or free-of-payment. This feature is valued by some participants as it simplifies the operational complexities involved behind clearing and settling a large number of securities lending trades. Details can be found in the accompanying notes in Exhibit 4b on page 76 in “Trade Flow Mapping.”

We now turn to the clearing and settlement of securities lending transaction on a bilateral basis, off the tri-party settlement platform. We consider only the free-of-payment case, and these processes are illustrated in Exhibit 4c. Like the previous two cases, the Collateral Lender and Collateral Borrower execute a trade, book the trade on their internal systems, and get affirmation of the trade details from the Lender and Borrower, respectively. The Collateral Lender and Collateral Borrower then settle the trade on bilateral and FOP basis. Before the close of business, the Collateral Lender delivers the required securities to the Collateral Borrower’s securities account. Similarly, before the close of business, the Collateral Borrower delivers the required amount of cash to the Collateral Lender’s account. After both sets of transfers have been accomplished, the on-leg of the securities lending trade is considered settled.

Credit Risks

Across all three cases, upon trade execution the Collateral Borrower and Collateral Lender hold counterparty party risk to one another, as evidenced by the red-bordered ellipses in Exhibits 4a, 4b, and 4c. This counterparty credit risk is the same as that described in the previous section for repos that are non-centrally cleared and settled on a bilateral basis (Section 1). Of note, the tri-party settlement platform does not mitigate or transform this risk for the Collateral Borrower or Collateral Lender, because the clearing bank acts solely as an agent in providing clearing and settlement services.

For the four repo cases detailed previously, the counterparty credit risk between two parties was a secured risk, because the cash and securities were exchanged on a DVP basis. For the securities lending trades that are exchanged on an FOP basis, the asynchronous exchange of cash and securities implies that there is a temporary unsecured counterparty credit risk between the two parties. For example, if the Collateral Lender delivers the securities first, then it has an unsecured exposure to the Collateral Borrower within the day, until the Collateral Borrower delivers the required amount of cash.

There are minimal intraday credit extension risks across all three securities lending cases presented here. For the trades settled on an FOP basis, the asynchronous nature of the securities and cash transfers take away the need for intraday credit or liquidity support. For the one case where settlement is DVP, clearing and settlement occur on the tri-party settlement platform (Exhibit 4a). As discussed in Section 2, the tri-party settlement platform is designed to minimize the use of intraday credit extension or liquidity support.

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Section III: Risk and Resiliency Issues

This section is intended to facilitate a discussion of clearing and settlement risks and to remind individual participants of the importance of periodically verifying that their own risk mitigation tools are sufficient for their level of market engagement and the importance of considering such risks under both normal and contingent market circumstances. This section is not intended to offer conclusions on whether structural change is necessary, but rather to provide a framework for discussion and reflection from a broad range of market stakeholders.

The TMPG has learned from its work that some market participants, even those actively involved in the Treasury SFT market, may not have fully investigated nor may fully understand all the risks associated with the clearing and settlement processes and the way those risks differ across various segments of the market. Similar to the findings in the previous TMPG work on clearing and settlement of cash Treasury trades, some market participants may not be employing the same rigor around counterparty due diligence and risk controls that they would for trading in lower-quality or forward-settling instruments because Treasury SFT activities are not perceived to be risky. Apparent gaps in understanding may be partially due to the many different clearing and settlement options that are available.

A lack of visibility into some clearing and settlement processes prevents some market participants from accurately identifying, measuring, and managing their direct and indirect counterparty risk exposure and can affect their decision-making, causing them to bear more risk than they would if they were better informed. As a result, this lack of visibility creates a level of risk that is undesirable across the market ecosystem. Participants should not assume that clearing and settlement risks are low because the underlying product is of high quality and because of the deep liquidity of the Treasury market. Participants face the credit risk of their counterparty until a trade settles (that is, they are exposed until final settlement of the end-leg of a Treasury SFT). In the event of a counterparty default, a participant faces liquidity risks, and if that default occurs during a market contingent event, these liquidity risks can rapidly escalate.

Potential risks and resiliency issues identified

Overall, clearing and settlement for SFTs is fragmented.

The maps referenced in the previous section illustrate the complex range of informational flows and operational processes involved in SFT clearing and settlement. When viewed altogether, the large number of maps included in this paper demonstrate that market participants face a fragmented clearing and settlement system. The result is that for a similar SFT (say overnight Treasury repo), a market participant faces different responsibilities and inherent risk exposures dependent on the clearing and settlement choice. This fragmentation makes putting the appropriate set of risk mitigants into place an even more complex task.

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For non-centrally cleared SFTs, market participants use bespoke clearing arrangements. For this segment of the market, then, there is considerable fragmentation in clearing and settlement services and the associated risks are discussed in the following risk highlight.

Although both agent-cleared tri-party repo and centrally cleared repo have transparent processes, they each have distinct clearing and settlement processes that result in a variety of responsibilities, from different deadlines in the settlement process to various levels of risks in the case of default. A prominent example of various degrees of risk is that if two direct clearing members of the CCP submit a trade to the FICC DVP Repo service, for both parties the counterparty risk shifts to the CCP (as the CCP becomes the counterparty to each original party of the trade; see Exhibit 3a.iii on pages 25-27 in “Trade Flow Mapping”). In contrast, consider the case of a direct clearing member sponsoring a trade with a client using the Sponsored Service. After the trade has been centrally cleared, the direct clearing member still retains exposure to a default by the client by virtue of the guaranty of the client’s performance it provides to the CCP. The sponsored client’s counterparty risk, however, shifts to the CCP, keeping in mind the sponsored client remains wholly dependent on the sponsoring member as its settlement agent and is therefore exposed to risk in the case of a failure of its sponsoring member (see Exhibit 3b.i on pages 39-42 in “Trade Flow Mapping”).²⁰

Of further note is that Sponsored Services legal agreements between a CCP sponsoring member and its sponsored clients are neither standard nor transparent, even across clients of the same CCP member. The lack of standard legal agreements makes resolving post-trade disagreements time consuming, which combined with the short period of time between execution and the beginning of settlement, increases the risk of an interruption to clearing and settlement. This dynamic is even more problematic during contingent events, when defaults and other types of disagreements are likely to be more common.

The growth in the number of ways that SFTs can be cleared and settled is driven by demand from market participants, and each segment provides distinct benefits. This variety in clearing and settlement processes, however, means differences in responsibilities and risks need to be well understood. In normal times when a counterparty’s risk of default is idiosyncratic and Treasury market liquidity is deep, these differences have only small implications for risk. In times of stress, however, when defaults are more common and overall Treasury market liquidity can decrease, these differences could have important risk implications.

²⁰ In the event of a default of the sponsoring member (the direct clearing member), the associated sponsored member (the client) faces close-out risk for those trades centrally cleared using the Sponsored Service. In particular, the CCP may, in its sole discretion, determine whether to close-out the affected sponsored member’s trades and/or permit the sponsored members to complete their settlement. For further discussion of challenges and risk implications of sponsored access models, see “[Client clearing: access and portability](#)” by the Bank of International Settlements and the Board of the International Organization of Securities Commissions.

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For non-centrally cleared bilateral SFTs, clearing and settlement is bespoke and opaque

For non-centrally cleared bilateral SFTs, the TMPG has learned the clearing and settlement arrangements are both bespoke and opaque to the market, reflecting its over-the-counter nature.

Individualized bilateral clearing arrangements may work well and be robust during the ordinary course of business. However, during times of stress (when errors may occur to a greater degree), the bespoke nature of this system can make resolving a large number of post-trade disruptions a complex and difficult task. As a result, it is more likely that there could be an interruption of timely clearing and settlement processes, which is an outcome that could create unexpected credit exposures.

The bespoke nature of these bilateral clearing arrangements implies that some market participants face different levels of risk exposure from similar SFTs. A recent example of these differences is the range of haircuts (or initial margin) offered by some dealers to clients for overnight Treasury repo trades in the non-cleared bilateral repo space.²¹ Some of these differences likely are due to business decisions in which higher levels of risk are recognized as part of the cost of doing business, and some of these differences likely are due in part to a lack of perception of the risks involved with clearing and settlement, especially in times of stress.

For the latter case, an underappreciation of risks during times of stress could lead some participants to not fully use the array of risk management tools available to mitigate the counterparty credit risk that arises with clearing and settlement. This behavior is obscured by the opaqueness of this market segment, and so a participant may not be able to fully assess the counterparty credit risk a participant incurs indirectly through the clearing chain. As result, it can be difficult for participants to accurately identify, measure and manage these risks and may cause them to bear more risk than they would if they were better informed.²²

An additional risk that arises from the opaqueness in this market segment is the inability for a participant to assess the amount of leverage or level of concentration risk at the security level (i.e., CUSIP) that exists in the market.²³ This lack of information at the market level can create an undesirable level of aggregate risk.

In contrast, clearing and settlement arrangements for both agent-cleared tri-party repo and centrally cleared repo are transparent. Further, the risk management practices of the CCP

²¹ See page 13 of the [U.S. Treasury Markets: Steps Toward Increased Resilience](#) (2021) by the Group of Thirty Working Group on Treasury Market Liquidity.

²² These risks are well illustrated with the March 2021 default of Archegos Capital Management. A post-mortem of this default revealed a failure in margining practices by some of Archegos' counterparties. Furthermore, it was noted that the opaqueness of the security-based swap market made it difficult for counterparties to understand and monitor the full extent of Archegos' leverage as well as its concentration of exposures in a limited number of firms. See Box 2: "The Failure of Archegos Capital Management" at the end of this section for more details.

²³ An example of a manifestation of this risk of opaqueness are the counterparty losses arising from the unwinding of Long-Term Capital Management's leveraged rate positions in 1998.

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leverages the CCP's horizontal view across its participants, allowing it to better manage market level risks, such as security-level concentration risk.

For non-centrally cleared bilateral SFTs and agent-cleared tri-party repo, positions carry counterparty and liquidity risks, with potential systemic implications

When one of the parties to an SFT defaults after the settlement of the on-leg, the other party to the trade takes steps to make itself whole again. For the lender of cash, a default by a counterparty typically results in the participant liquidating the securities it received with the on-leg settlement to raise cash, with the goal of recovering the principal cash amount. This sale of securities entails liquidity risk, which has two components. The first is the risk that the market price of Treasuries moves against the cash lender, and the second is that this recovery process takes longer than expected. For the larger positions observed in the non-centrally cleared repo market, these risks are not negligible.

Further, managing the liquidity risk associated with default on a large SFT position can have systemic implications. If the cash lender is forced to quickly liquidate a large amount of securities, a fire sale could result, further stressing the Treasury markets. Although the Federal Reserve has introduced the Standing Repo Facility as a tool to provide liquidity in times of stress, many types of cash lenders in the SFT market do not have direct access to this facility.

For the lender of securities, a default by a counterparty typically results in the participant using the cash it received with the on-leg settlement to purchase securities and make itself whole. Even when these securities are Treasuries, this purchase of securities entails liquidity risk. In particular, if this default occurs in a time of stress, when Treasury prices often rise, the replacement cost from a default that results in a short securities position can rapidly escalate.

For centrally cleared repos, the CCP is the sole counterparty facing a defaulted firm. Although central clearing concentrates activity into a single counterparty, the CCP is required to comply with robust risk management standards and has a transparent and orderly process to handle defaults, with a focus on minimizing the liquidity risks described above as well as contagion risk.

For all SFTs, third-party credit extension arrangements may not be fully understood

As illustrated in the maps in the previous section, clearing and settlement processes usually involve a third party providing intraday credit to facilitate settlement. These temporary extensions of credit or intraday liquidity support vary widely across market participants and are often opaque to the counterparties of the SFT. When such liquidity arrangements are uncommitted, an unanticipated change in credit terms or availability of funds could prove problematic in the daily settlement of SFTs or otherwise adversely impact the settlement process. Furthermore, the opaque nature of these arrangements makes it difficult for market participants to anticipate these problems when entering into SFTs, especially with a varied group of bilateral counterparties.

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A notable exception to this issue is the committed and limited credit terms offered to market participants using the tri-party repo settlement platform, a direct result of the tri-party repo reforms.²⁴

The opaqueness of the SFT market may obscure some participants' ability to accurately identify and manage clearing and settlement risks.

Reflecting the over-the-counter nature of the SFT marketplace, there is substantial opaqueness in the pricing of the SFTs as well as the quantity traded. Electronic platforms provide real-time pricing for some types of repo contracts (e.g., on-the-run Treasury repos), but real-time pricing for a large share of Treasury SFTs, as well as for agency MBS and agency debenture SFTs, is often not available. In addition, aggregate information on quantity traded is only available for some segments, and often with a substantial delay. Finally, other contractual terms of an SFT, such as the haircut (initial margin), are typically not made public (with the exception of the statistics on the distribution of haircuts in tri-party repo published by the Federal Reserve Bank of New York).

This opaqueness means that some participants and regulators lack a comprehensive view of the SFT marketplace, and this is especially true for the non-centrally cleared bilateral SFT segment. This lack of transparency also makes it difficult to discern if market participants have the capacity to enter into additional SFTs or if they may be facing internal constraints. In general, it can be difficult for some participants and regulators alike to determine Treasury SFT market functioning, especially on a real-time basis. As a result, the opaqueness of the SFT market makes it difficult for some participants to accurately identify and manage clearing and settlement risks.

As noted in the November 2021 Interagency Working Group (IAWG) report, transparency can bring benefits to the Treasury market by bolstering public confidence and fair trading.²⁵ Further, public data releases can be carefully designed to incentivize liquidity provision by market participants by fostering a greater understanding of market activity.

The TMPG Data & Transparency workstream is considering this issue for SFTs as well as more generally. In addition, current regulatory initiatives could reduce the opaqueness of SFTs.²⁶

²⁴ See the NY Federal Reserve statement "[Update on Tri-Party Repo Infrastructure Reform](#)" on June 24, 2015.

²⁵ See page 22 of the InterAgency Working Group white paper "[Recent Disruptions and Potential Reforms in the U.S. Treasury Market: A Staff Progress Report](#)" published on November 8, 2021.

²⁶ The Treasury Department's Office of Financial Research is developing a bilateral repo collection survey to complement its existing centrally cleared repo survey. Also, the Securities and Exchange Commission has proposed reporting requirements for securities lending transactions (Proposed Rule 10c-1, Securities Exchange Release No. 34-93613, 86 FR 69802 (proposed November 18, 2021) (S7-18-21), <https://www.federalregister.gov/documents/2021/12/08/2021-25739/reporting-of-securities-loans>).

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Consequences of not recognizing and pricing these risks

The risks highlighted in the previous section may be small under normal market conditions. However, in times of stress, when market conditions deteriorate, these risks could increase, and participants would then be tested on how well the risks are managed and mitigated.

Although defaults are rare, they can lead to capital losses for the counterparties or entities involved in facilitating the clearing and settlement of trades. As documented in the maps, this counterparty exposure arises at the time of trade execution and lasts until the final settlement of the off leg. Defaults can occur at any node of the clearance and settlement chain, with varying levels of impact.

For non-centrally cleared bilateral SFTs, the risk management processes are bespoke and opaque, which likely creates uncertainty about the levels of exposure across market participants. In contrast, for centrally cleared repo and agent-cleared tri-party repo, the clearing and settlement management process is transparent, making it easier for market participants to manage their risk.

After establishing that a default has occurred, the defaulting firm's positions are closed out by its counterparties. Any loss on the close-out will result in a reduction in the non-defaulting counterparty's capital unless the loss is secured by credit support, offset by gains on other outstanding positions with the defaulting firm, recovered from the defaulting firm, or with respect to centrally cleared repo, covered by resources available to the CCP pursuant to its rules.

It is incorrect to assume that the risk of clearing and settling Treasury SFTs is necessarily low because of the asset's high quality and the deep liquidity of the Treasury market in normal times. In times of stress when Treasury securities prices often rise, the cost of purchasing Treasuries to replace those lost in default by a cash lender can rapidly escalate. Further, in a contingent market event when there is a dash-for-cash and Treasury securities prices fall, the costs of selling Treasuries by a cash lender to make itself whole again can be significant. This latter scenario is particularly problematic for non-centrally cleared bilateral SFTs as well as agent-cleared tri-party repo because the liquidation of securities can be disorderly which increases the risk of a fire sale, a financial stability risk.

Box 1: Settlement Fails Considerations

Failures of Treasury SFTs to settle on scheduled settlement dates are not uncommon. Such settlement fails are similar to settlement fails in the cash Treasury market, with some due to routine operational errors and other administrative problems, and so are not concerning from a system perspective. When driven by other circumstances, however, high and persistent fails in the market can become a concern.

A security fail can have a cascading effect on downstream counterparties who await delivery of the security to make their own deliveries to other market participants. This daisy-chain effect amplifies the impact of a settlement fail, and as such has the potential to disrupt market functioning for specific security types and introduce unwanted counterparty credit exposure until the fail is cured.

Central clearing reduces aggregate fails by compressing settlement fail daisy-chains because of the multilateral netting provided by the CCP. Furthermore, fails for SFTs that are centrally cleared are margined by the CCP, providing protection to the CCP from a buildup of related exposures. In contrast, for non-centrally cleared bilateral SFTs, there is no systematic margining of settlement fails and counterparties manage that exposure.

Finally, the tri-party repo settlement platform was designed in such a way as to minimize fails around the settlement of the end-leg. Securities that are delivered to a counterparty as part of the start-leg cannot be transferred off the tri-party settlement platform.²⁷ As a result, the original owner of the securities has a high degree of confidence over the return of its securities on the scheduled date assuming it is able to deliver the required cash amount.

²⁷ A security can be substituted out, or replaced by another security of equal value, which is eligible under the terms of the SFT.

Box 2: Failure of Archegos Capital Management

Archegos Capital Management was a family-owned investment fund that failed on March 26, 2021, causing more than \$10 billion in counterparty credit losses. The failure was driven by the firm being highly levered and having exposures concentrated in a limited number of U.S. and Chinese companies. Beginning on March 22, 2022, the price declines in certain stocks triggered substantial margin calls to Archegos that the fund was not able to meet, leading Archegos's counterparties to issue notices of default.

Even though Archegos's highly levered exposures were in equities and not Treasuries, post-mortems on the failure of Archegos highlight two lessons for market participants. The first is for firms to make sure that their margining procedures follow best practices, including "avoiding inflexible and risk-insensitive margin terms or extended close-out periods."²⁸ The second is for firms to better understand and monitor a counterparty's "aggregate portfolio composition, concentration, and exposures to other firms."²⁹

²⁸ See the Federal Reserve's Supervision and Regulation Letter, SR 29-19, "The Federal Reserve Reminds Firms of Safe and Sound Practices for Counterparty Credit Risk Management in Light of the Archegos Capital Management Default" (December 10, 2021).

²⁹ See "Box D: Failure of Archegos Capital Management" on page 109 of the Financial Stability Oversight Council 2021 Annual Report.

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Appendix: TMPG SFT Working Group Members

TMPG Member and Non-Member Firms

Andrea Pfenning	Bank of New York Mellon, Working Group Chair
Alberto Antonini	Tudor Investment Corp.
Eric Badger	Bank of New York Mellon
Michael Bicknell	Tudor Investment Corp.
Debbie Cunningham	Federated Investors
Dave DiNardo	Bank of New York Mellon
Kevin Di Russa	Loop Capital Markets
Brian Disken	DTCC
Keith Donohue	Bank of New York Mellon
David Finkelstein	Annaly Capital Management
Bradford Hahn	Morgan Stanley
Sue Hill	Federated Investors
James Hraska	DTCC
Jon Hunt	Arcola Securities
Greg Insigna	Annaly Capital Management
Ari Kavour	Wells Fargo
Thomas Kinnally	Blackrock
Laura Klimpel	DTCC
Pete Koukouras	Annaly Capital Management
Karl Mocharko	Federated Investors
Murray Pozmanter	DTCC
Charles Presho Jr.	State Street Corp.
Gerald Pucci	Blackrock
Casey Spezzano	NatWest Markets Securities
John Templeton	Bank of New York Mellon
Carolyn Sargent	Morgan Stanley
Robert Scimeca	Bank of New York Mellon
Paul Tagliareni	Morgan Stanley

Federal Reserve Bank of New York

Adam Copeland
Veronika Jastrzebski
Frank Keane
Rania Perry
Jenny Phan
Nathaniel Wuerffel

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Glossary of Terms

CCP	Central Counterparty
CUSIP	Committee on Uniform Securities Identification Procedures or a unique identification number assigned to all stocks and registered bonds in the U.S. and Canada
DVP	Delivery-versus-payment
GC	General collateral
GCF	General Collateral Finance
FICC	Fixed Income Clearing Corporation
FOP	Free-of-payment
IAWG	Interagency working group
IDB	Interdealer broker
Repo	Repurchase agreements
SEC	Securities and Exchange Commission
SFT	Secured Financing Transactions
TMPG	Treasury Market Practices Group
Treasuries	U.S. Treasury securities