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# The Netting Efficiencies of Marketwide Central Clearing

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## **The Netting Efficiencies of Marketwide Central Clearing**

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### **Abstract**

Market disruptions in response to the COVID pandemic spurred calls for the consideration of marketwide central clearing of Treasury securities, which might better enable dealers to intermediate large customer trading flows. We assess the netting efficiencies of increased central clearing using nonpublic Treasury TRACE transactions data. We find that central clearing of all outright trades would have lowered dealers' daily gross settlement obligations by roughly \$330 billion (60 percent) in the weeks preceding and following the market disruptions of March 2020, but nearly \$800 billion (70 percent) when trading was at its highest. We also find that expanded central clearing would have substantially lowered settlement fails. The estimated benefits would likely be greater if dealers' auction purchases were included in the analysis or if the increased central clearing included repo transactions.

Key words: Treasury securities, central clearing, dealers, market structure, COVID-19

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## 1. Introduction

In March 2020, unprecedented customer selling of Treasury securities triggered by the COVID-19 pandemic overwhelmed dealers' capacity to intermediate trades, leading to a marked deterioration of market functioning (see Duffie, 2020, Logan, 2020, and Schrimpf, et al., 2020). The Federal Reserve quickly took numerous steps to address the market disruptions, increasing its holdings of Treasuries (and agency mortgage-backed securities) and restarting the Primary Dealer Credit Facility. The Fed also launched the FIMA Repo Facility, to allow foreign official institutions to raise U.S. dollars against their holdings of Treasuries at the Fed, and announced a temporary change to the Supplementary Leverage Ratio (SLR), to ease strains in the Treasury market and increase lending capacity to households and businesses.

The market disruptions raise concerns given the key roles of Treasuries in financial markets and the possibility that such disruptions may be more common as the market grows. Aside from financing the government, Treasuries are used to manage interest rate risk, price offerings by other issuers, collateralize financing transactions, implement monetary policy, and as a reserve asset to foreign central banks, and all of these uses depend on the securities' high liquidity. Moreover, given that liquidity is priced, any expected reduction in liquidity would increase government borrowing costs.

It follows that market practitioners, academics, and policymakers have taken increased interest in how Treasury market resiliency could be improved, particularly at times of stress. The expansion of central clearing in Treasury cash and repo markets is one area of focus (Blackrock (2020) and Liang and Parkinson (2020), for example, discuss this idea and others). Duffie (2020), in particular, proposes a study on the costs and benefits of requiring the central clearing of Treasury transactions of all firms that are active in the market, while noting, "It would be difficult to estimate the amount of liquidity savings associated with central clearing without conducting a quantitative analysis of Treasuries transactions data."

Currently, the largest dealers, including all primary dealers, are central counterparty (CCP) members for their Treasury transactions, but few non-dealers are members.<sup>1</sup> It follows that almost

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<sup>1</sup> The primary government securities dealers are trading counterparties of the Federal Reserve Bank of New York in its implementation of monetary policy. They are also expected to make markets for the New York

all dealer trades in the interdealer market are centrally cleared, but few dealer-to-customer (D2C) trades are centrally cleared. Duffie (2020) explains how expanded central clearing would allow increased netting of dealers' trades, reducing the commitment of dealers' balance sheets needed to maintain liquid markets. Moreover, he notes central clearing's risk mitigation techniques can contribute to reduced counterparty credit risk. He further contends that increased central clearing would allow for (but not guarantee) the emergence of direct trading between non-dealer buyers and non-dealer sellers "further reducing the amount of dealer balance sheet space necessary to efficiently match buyers and sellers."

In this paper, we assess the netting efficiencies associated with market wide central clearing using non-public Treasury Trade Reporting and Compliance Engine (TRACE) transactions data collected by the Financial Industry Regulatory Authority (FINRA). We find that the netting benefits would be substantial, and especially large when trading activity is high. That is, central clearing of all outright trades would have lowered dealers' daily gross settlement obligations by roughly \$330 billion (60%) in the weeks preceding and following the market disruptions of March 2020, but nearly \$800 billion (70%) when trading was at its highest. We find that the netting opportunities are concentrated in the most actively traded Treasury securities, and that at least 80% of the benefits accrue to dealers that are subject to the Fed's leverage ratio requirements. Moreover, we find that the netting efficiencies are appreciably greater when we assume trades with the Fed are centrally cleared.

We also assess how settlement fails are affected by expanded central clearing using non-public, dealer-level FR 2004SI data, which covers both cash and repo transactions.<sup>2</sup> We find that nearly three-fourths (74%) of fails in specific issues are effectively "daisy-chain" fails, which could be paired off and hence eliminated with increased central clearing. Moreover, the percentage of fails that pair off tends to be higher when fails are higher and in issues where they are higher. It follows that expanded central clearing not only reduces the balance sheet resources needed for

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Fed on behalf of its official accountholders as needed, and to bid on a pro-rata basis in all Treasury auctions at reasonably competitive prices. The 24 primary dealers as of March 31, 2021 are listed here: <https://www.newyorkfed.org/markets/primarydealers>.

<sup>2</sup> Although our analysis relies on non-public TRACE and FR 2004 data, all the data presented here are aggregated to maintain participant anonymity.

intermediation overall through reduced settlement fails, but that the benefits are greatest when they are most needed and for the securities for which they are most needed.

While our findings suggest considerable netting efficiencies from market wide central clearing, our paper has a number of limitations. First, our main analysis (which relies on TRACE data) is limited to outright trades; the estimated benefits would likely be greater if dealers' auction purchases were included in the analysis or if the increased central clearing included repo transactions. Moreover, our analysis does not consider the equilibrium effects of expanded central clearing on market participant behavior, so whether it would necessarily improve market functioning remains an open question. The development of all-to-all trading is one possible ancillary effect we discuss and on which our analysis has some bearing. On the whole, we provide empirical evidence corroborating some of the conjectures about the benefits of expanded central clearing, but a study that also considers the costs and equilibrium effects of such a fundamental shift in market structure is warranted.

The paper proceeds as follows. In the next section, we review the current market structure, the potential market structure with expanded central clearing, and the benefits such a change might bring. In Section 3, we discuss our empirical approach and data employed to estimate dealers' netting opportunities. Section 4 presents the results of our main analysis as well as extensions looking at how settlement fails and interdealer brokers (IDBs) would be affected by expanded central clearing. We discuss various additional issues in Section 5, including the potential implications of increased central clearing for various market participant types and the prospects for all-to-all trading. Section 6 concludes.

## **2. Current and Potential Market Structure**

### *A. Secondary Market Structure*

Treasury securities trade in a dealer-intermediated over-the-counter market. The primary dealers are the principal market makers, buying and selling securities for their own accounts. In addition to trading with their customers, the dealers trade among themselves, mainly through IDBs. Historically, IDB participation was limited to dealers. In 1999, the first fully automated electronic trading platform was launched and in the mid-2000s, the electronic IDBs opened to other

professional traders, including hedge funds and principal trading firms (PTFs). A 2015 study (Joint Staff Report, 2015) found that PTFs now account for more than half of trading activity in the electronic IDB segment of the market.<sup>3</sup>

### *B. Current Clearing Structure*

Under the current market structure, dealers and IDBs are generally members of the CCP, whereas customers and PTFs are usually not.<sup>4</sup> Trades between CCP members are centrally cleared and netted, with the CCP stepping in as the buyer to every seller and the seller to every buyer shortly after a trade is agreed upon. In contrast, trades between CCP members and non-members are cleared, and typically netted, bilaterally. With netting, offsetting delivery obligations involving the same counterparts and the same security (and the same settlement day) are paired off and eliminated, reducing the number of securities that need to be delivered on settlement date (typically the next day). Box A (in the appendix) provides a simple example of how central clearing and settlement netting currently works.

It's important to note that for trades executed through an IDB, the IDB stands as principal to each side of the trade, which maintains each party's anonymity. Execution through an IDB thereby results in two trades for clearing and settlement purposes: one in which the IDB buys securities from the seller and another in which the IDB sells securities to the buyer. Historically, all electronic IDB trades were centrally cleared because the dealers trading through the IDBs, as well as the IDBs themselves, were CCP members. Now, with the opening of the electronic IDBs to other professional traders, IDB-dealer trades are still centrally cleared, but IDB-PTF trades are cleared bilaterally. That is, if an IDB intermediates a simultaneous dealer sale and PTF purchase, the IDB-dealer side is cleared centrally, while the IDB-PTF side is cleared bilaterally.

Clearing and netting matters because a market participant has credit exposure to its counterparty until a trade settles. The CCP stepping in as counterparty results in risk that is

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<sup>3</sup> The report characterizes PTFs as principal investors that deploy proprietary automated trading strategies in which low latency is typically a key element.

<sup>4</sup> See Copeland, et al. (2018) and Treasury Market Practices Group (TMPG, 2019a). The CCP for U.S. Treasury securities is the Government Securities Division of the Fixed Income Clearing Corporation (FICC), a subsidiary of the Depository Trust & Clearing Corporation. The FICC also offers a "sponsored" membership model in which eligible clients can centrally clear trades, facilitated by sponsoring members, but all sponsored activity to date has involved repos (and not cash trades).

managed in a consistent and transparent way. Moreover, the CCPs' netting of trades can reduce members' exposures, freeing up their capital and liquidity.<sup>5</sup> While bilateral netting serves the same purpose, netting efficiencies are generally greater with central clearing. For instance, if dealer A sells to dealer B, dealer B sells to dealer C, and dealer C sells to dealer A, these trades can be paired off and eliminated with central netting, but not with bilateral netting.

In 2019, the Treasury Market Practices Group (TMPG) released a white paper that thoroughly explored possible risk and resiliency issues in the clearing and settlement practices in the cash Treasury market (TMPG, 2019a). This work found that well over half of secondary market activity was bilaterally cleared and that risk management practices varied. It also found, "Market participants may not be applying the same risk management rigor to the clearing and settlement of their U.S. Treasury activities as they do to other aspects of risk taking..." The TMPG simultaneously published best practice recommendations for clearance and settlement (TMPG, 2019b).

### *C. Potential Clearing Structure and its Benefits*

The alternative market structure we discuss here is one in which the CCP is counterparty to all, or substantially all, trades. Box B (in the appendix) provides a simple example of how this would work. Such a market structure can reduce dealers' settlement obligations because dealers' trades with customers can be netted against one another and against dealers' net interdealer obligations. This can reduce the capital and liquidity dealers need for their settlement obligations, allowing them to intermediate additional trades with the same balance sheet commitment, or redeploy balance sheet for other purposes.

The netting benefits of market wide central clearing may be especially large when trades fail to settle on their scheduled settlement dates. When such settlement fails continue for an extended period, counterparty risk can build up, and dealers can be subject to regulatory capital charges.<sup>6</sup> These capital charges, and other ancillary costs of failing, can affect dealers' willingness to make

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<sup>5</sup> The risk-reducing effects of multilateral trade netting are reflected in bank capital requirements by, for example, decreasing the exposures that banks must reflect in the denominator of leverage ratios. Moreover, trades that fail to settle as scheduled can subject broker-dealers to additional capital requirements, as discussed below. That said, there are a broader set of capital and liquidity implications from central clearing, at least some of which could increase required capital.

<sup>6</sup> See Fleming and Garbade (2004, p. 4, and 2005, p.5) for example, and the net capital rule of the Securities and Exchange Commission (SEC), Code of Federal Regulations, Chapter 17, Section 15c3-1.

markets in the affected securities, adversely affecting market liquidity (see, for example, Garbade, et al., 2010, p. 52).

Market wide central clearing also reduces the barriers to (but does not guarantee) the emergence of direct trading between non-dealer buyers and non-dealer sellers. This is because market participants are not concerned about the reliability or creditworthiness of their original counterparties if the CCP immediately steps in as the new counterparty (Duffie, 2019, and Liang and Parkinson, 2020).<sup>7</sup> Greater all-to-all trading can expand intermediation capacity through broader participation in exchanges, IDBs, or request-for-quote venues and/or reduce the need for intermediation capacity to the extent end investors trade directly with one another.

Even in the absence of all-to-all trading, market wide central clearing might affect market structure. The elimination of market participants' concerns about the creditworthiness of their original counterparties reduces the frictions that inhibit customers from trading with new dealers. This could open up opportunities for smaller and medium-sized dealers in particular, promote competition among dealers, and expand dealers' capacity to intermediate trades. That said, how expanded central clearing would affect dealers that are not currently CCP members is difficult to predict, with firm exit and reduced competition a possibility.

Another benefit of market wide central clearing is that it can promote financial stability and hence market resilience independent of the reasons discussed above. That is, even if dealers did not increase their intermediation, and all-to-all trading did not emerge, and competition among dealers did not increase, central netting would reduce market participants' gross exposures. Moreover, the CCP, as counterparty to every trade, brings consistent and transparent risk mitigation to the settlement process across the whole market. All in all, market participants' counterparty risk is likely reduced with the risk that remains monitored and managed more effectively.<sup>8</sup>

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<sup>7</sup> To be sure, counterparty risk is not eliminated with market wide central clearing, but rather shifts to the CCP, and is hence invariant with respect to market participants' counterparties at the time of a trade.

<sup>8</sup> Whether market wide central clearing reduces counterparty risk is an empirical question, but we think such a decrease would be likely in the Treasury market given the netting efficiencies that such a change would bring. Berndsen (2020) reviews the literature on central clearing and discusses the factors that determine whether it reduces counterparty risk.



A final, ancillary benefit of market wide central clearing is that it would allow for a new robust data source, supplementing Treasury TRACE data and promoting market transparency. These data might come from the CCP or they might come from any all-to-all exchanges that evolve. As with TRACE, such data might provide a detailed view to policymakers but a less fulsome view to market participants and the public.

### **3. Empirical Approach and Data**

Our empirical approach is to use FINRA's Treasury TRACE transactions data to estimate dealers' settlement obligations under different market structures. We first consider a structure that closely approximates the status quo, in which all dealers are CCP members and no customers are CCP members. We further assume that there is no netting of D2C trades.<sup>9</sup> We then consider a structure in which all trades are centrally cleared and netted. Our operating assumption is that dealers' trading activity is unaffected by the clearing structure, but we discuss how market structure changes might affect participant behavior later in the paper.

We focus on dealers in this paper for two reasons. First, it is widely argued that dealers' inability or unwillingness to intermediate the full extent of customer trading flows, amid record trading volumes, contributed to the market disruptions in March 2020. Second, the Treasury TRACE transactions data is reported by dealers, and includes dealers' names, allowing a detailed analysis of dealers' trades. In contrast, the customer side of D2C trades is not reported in the Treasury TRACE data, making it much harder to quantify how market wide central clearing would affect customers or the CCP (although we provide some rough estimates later in the paper).

The Treasury TRACE dataset is well suited for an analysis of how clearing changes might affect dealers. The dataset contains a record of every secondary market outright Treasury security transaction in which a FINRA-member dealer is a counterparty. The particular fields we rely on are dealer, CUSIP, trade date, settlement date, amount traded, and counterparty type. These fields

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<sup>9</sup> Even if dealers do bilaterally net trades with their customers, the assumption of no netting is reasonable to the extent that a given customer only trades in a single direction in a specific CUSIP with a particular dealer for trades settling on a particular day.

allow us to tabulate each dealer's activity in a given CUSIP on a given day with a given settlement date and counterparty type (dealer or customer).

The TRACE data do have limitations. First, entities that are not FINRA-member dealers, such as banks, do not report their trades. In particular, 3 of the 24 primary dealers are banks and hence do not report.<sup>10</sup> Second, the dataset does not include dealers' purchases at auction or repo market transactions (although it does include dealers' trades with the Fed). Duffie (2020) argues that there are likely significant balance-sheet economies and operational efficiencies of incorporating Treasury auction settlements and repo transactions into central clearing. It follows that our analysis may understate the netting benefits of market wide central clearing. Lastly, the dataset does not contain a record of whether a trade is centrally cleared or not, so we need to infer this information based on trade counterparties.<sup>11</sup>

TRACE data are available from July 10, 2017. We conduct the analysis for the first four months of 2020 as this sample provides a good range of crisis and non-crisis days.

## 4. Empirical Results

### A. Dealer Trading Volume

As a first step in the analysis, we calculate dealers' trading activity in Treasuries, split into interdealer and D2C trades.<sup>12</sup> Dealers' daily trading volume, plotted in Figure 1, averaged \$752

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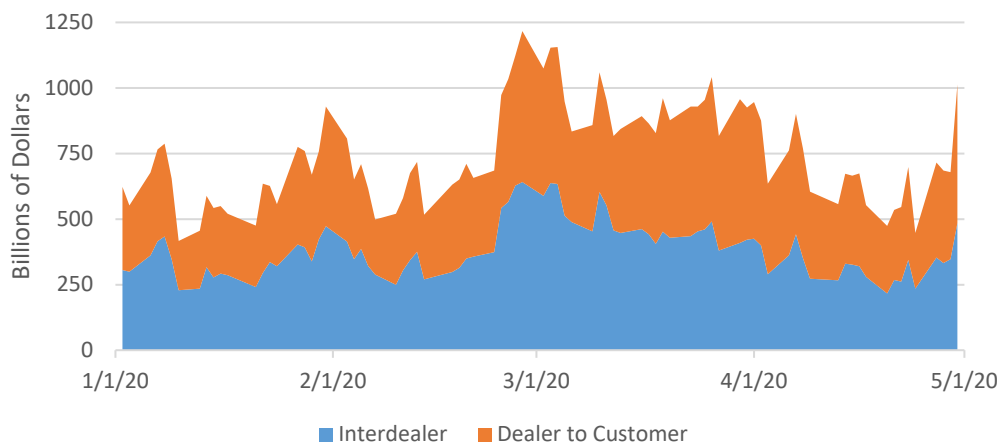
<sup>10</sup> These primary dealers are Bank of Nova Scotia, New York Agency, Credit Suisse AG, New York Branch, and Societe Generale, New York Branch. The 21 other primary dealers are broker-dealers, and hence do report, even though most are *affiliated* with banks. On January 21, 2021, the Fed invited comment on a proposal to implement reporting requirements on trading in Treasury securities (and debt and mortgage-backed securities issued by agencies) for depository institutions that meet reporting thresholds.

<sup>11</sup> On December 23, 2020, FINRA issued [Regulatory Notice 20-43](#) in which it requests comment on various enhancements to Treasury TRACE reporting, including a requirement that members include an indicator to identify whether a trade will be cleared centrally or bilaterally.

<sup>12</sup> Interdealer trades include trades that dealers execute through an interdealer broker (IDB) as well as direct dealer-to-dealer trades. For this dealer analysis, we exclude trades reported by IDBs or alternative trading systems. That is, if one dealer trades with another through an IDB, we retain the trade reports of both dealers, but not the IDB. Moreover, if a dealer trades against a PTF through an IDB, we retain the dealer's trade report but not the IDB's. If two PTFs trade against one another, we exclude the IDB's reports (so that such trades are excluded altogether from the analysis). D2C trades include dealers' trades with affiliates and the Fed.

billion (\$384 billion interdealer and \$367 billion D2C) between January and April 2020 and peaked at \$1.22 trillion on February 28 (\$641 billion interdealer and \$576 billion D2C). These volume figures are somewhat higher than the FR 2004 numbers (which capture trades of primary dealers) because they include trades of all U.S. dealers, albeit exclude trades of the three primary dealers that are banks. They also exceed the volume numbers reported by FINRA because we count both sides of dealers’ interdealer trades, like the FR 2004.

**Figure 1 – Dealer Trading Volume**



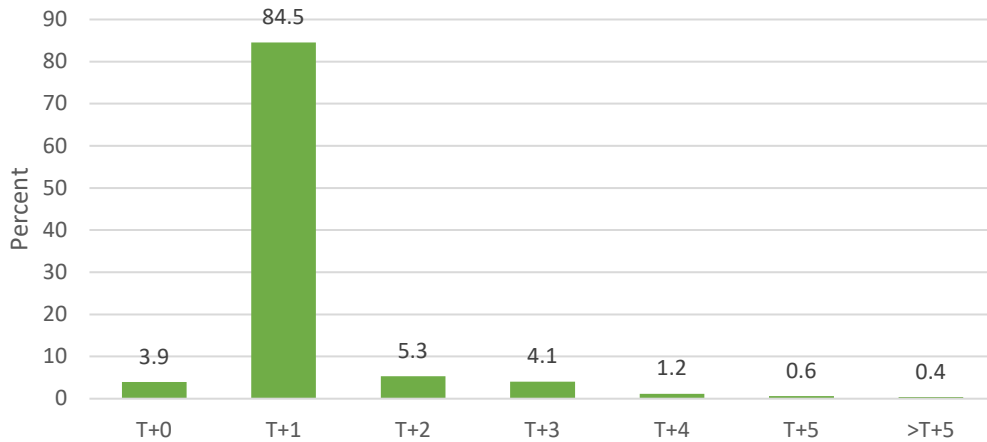
Source: Authors’ calculations, based on FINRA TRACE data.

Note: The figure plots dealers’ daily trading volume in U.S. Treasury securities, distinguishing between interdealer trades and trades with customers.

**B. Time to Settlement**

The quantity of dealers’ unsettled trades not only depends on the volume of trading and the extent of trade netting, but on the time between trade and settlement. Figure 2 shows that 84.5% of Treasury security trading activity is for regular or next-day (T+1) settlement, and only 3.9% for same-day (T+0) settlement (Brainard, 2018, reports similar percentages). The remaining 11.5% settles two or more trading days after settlement with the vast majority of this 11.5% reflecting when-issued trading.

**Figure 2 – Trading Activity by Days to Settlement**

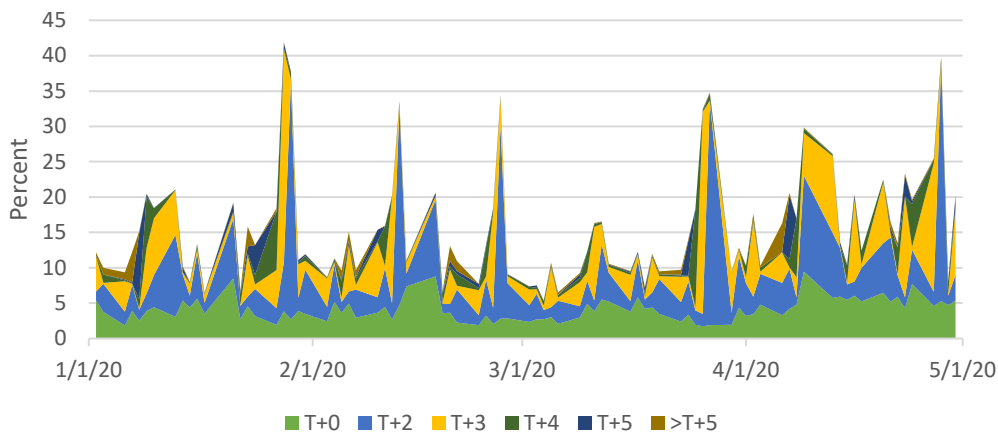


Source: Authors’ calculations, based on FINRA TRACE data.

Note: The figure plots the distribution of dealer trading volume in U.S. Treasury securities by days to settlement for the January 2, 2020 to April 30, 2020 sample period.

It’s also important to note that the distribution of trading activity by days to settlement varies tremendously over time. The share of daily trading volume not for regular settlement ranges from as low as 5% to as high as 42% over our sample period, as shown in Figure 3. As expected, this share tends to increase between Treasury auction and issuance dates when there are often multiple securities trading that are both on-the-run (so they are heavily traded) and when-issued (with settlement delayed until issuance day).

**Figure 3 – Share of Trading Activity Not for Regular Settlement**

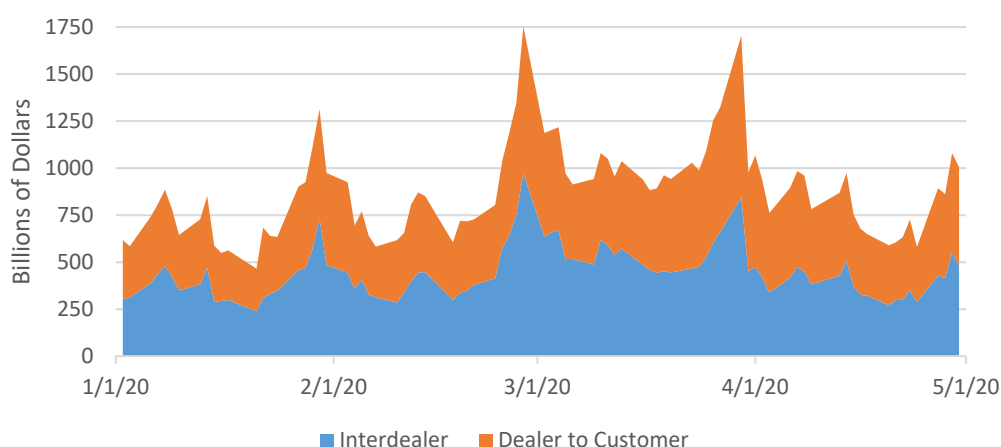


Source: Authors’ calculations, based on FINRA TRACE data.

Note: The figure plots the share of dealer trading volume in U.S. Treasury securities not for regular (T+1) settlement by day.

As the next step in our analysis, we calculate dealers’ settlement obligations (from both purchases and sales) at the end of each day before any netting occurs. Daily gross settlement obligations, plotted in Figure 4, average \$881 billion (\$449 billion interdealer, \$432 billion D2C) in the first four months of 2020, with a peak on February 28 of \$1.75 trillion (\$972 billion interdealer and \$782 billion D2C) and on March 30 of \$1.70 trillion (\$845 billion interdealer and \$859 billion D2C). These numbers differ from those in Figure 1 because we here exclude trades that settle T+0 (we’re only assessing unsettled trades at the end of the day) and, more importantly, because trades that settle T+2 or greater are counted over multiple days.<sup>13</sup> The monthly cyclicity is explained by the high volume of when-issued trades for the 2-, 5-, and 7-year notes, which all settle on the last day of the month.<sup>14</sup>

**Figure 4 – Dealers’ Gross Settlement Obligations before Netting**



Source: Authors’ calculations, based on FINRA TRACE data.

Note: The figure plots dealers’ gross settlement obligations in U.S. Treasury securities by day before any netting, distinguishing between interdealer trades and trades with customers.

<sup>13</sup> We ignore the possibility of settlement fails for now, but consider the effects of market wide central clearing on fails later in the paper.

<sup>14</sup> If the last day is not a trading day, then they settle on the first trading day of the next month.

### *C. Current Structure: Dealers are CCP Members, Customers are Not*

We proceed to estimate dealers' settlement obligations under the current market structure in which dealers are CCP members and customers are not.<sup>15</sup> That is, dealers' trades with other dealers are cleared and netted by the CCP, while those with customers are not. Dealers' interdealer settlement obligations are based on each dealer's net trade obligation with the CCP in each CUSIP and for each possible settlement day. This is calculated for each CUSIP, trade day, and settlement day as the absolute difference between each dealer's net purchases from other dealers and each dealer's net sales to other dealers (Box A, in the appendix, provides a stylized example of how this works).<sup>16</sup> We then sum across CUSIPs, settlement days, and dealers to get an overall total for each trading day.

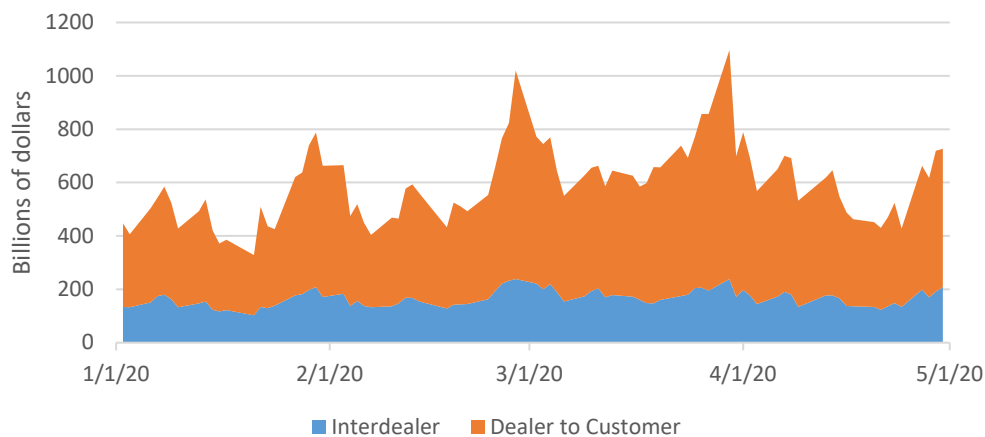
Dealers' gross settlement obligations after netting, plotted in Figure 5, average \$598 billion, \$282 billion (32%) lower than their settlement obligations before netting. By construction, the entire \$282 billion decline comes from the netting of interdealer trades, given that there is no netting of customer trades. Looking at extreme days, the decrease is a much greater \$733 billion (42%) for February 28 and \$607 billion (36%) for March 30. These two days not only see the greatest netting benefits in dollar terms over our sample, but also in proportional terms, suggesting that netting efficiencies are especially high when trading volume is high.

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<sup>15</sup> Strictly speaking, we analyze an *approximation* of the current market structure because we assume all dealers are CCP members, whereas some of the smaller ones are not, and we assume no customers are CCP members, whereas some of them surely are. These assumptions are made for simplicity and because the TRACE data do not indicate whether a trade will be cleared centrally or bilaterally and generally do not distinguish among non-FINRA members.

<sup>16</sup> Dealers are identified using the name they provide when reporting to FINRA. Names that are identical except for differences in capitalization, punctuation, spacing, legal status designator ("llc","inc", "sa", "corp"), or abbreviation ("NY" vs. "New York") are considered to be for the same firm. Results are very similar when we instead identify dealers by their market participant identifier (MPID). An MPID is a unique, four-character alphanumeric identifier created by FINRA, used to identify a FINRA member market participant. The 228 dealers in our sample are associated with 244 MPIDs.

**Figure 5 – Dealers' Gross Settlement Obligations with Interdealer Trades Centrally Cleared**



Source: Authors' calculations, based on FINRA TRACE data.

Note: The figure plots dealers' gross settlement obligations in U.S. Treasury securities by day after their interdealer trades are centrally cleared and netted, distinguishing between interdealer trades and trades with customers.

#### *D. Potential Structure: All Trades are Centrally Cleared*

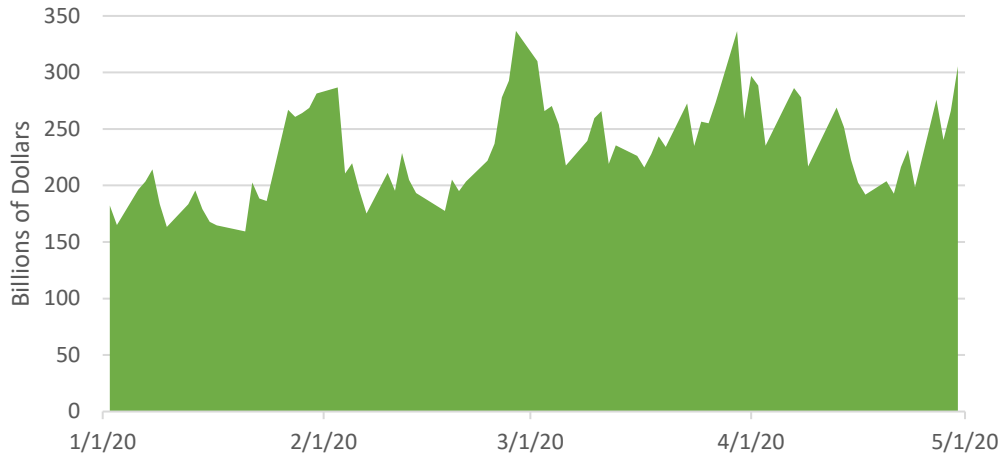
We now estimate dealers' settlement obligations under a potential market structure in which all market participants are CCP members.<sup>17</sup> That is, the CCP becomes the counterpart to all trades, and nets its obligations daily (for a given security and settlement day) with each member. It follows that a dealer's settlement obligations at the end of each trading day in a given CUSIP for a given settlement day simply equals the absolute difference between the dealer's purchases from other market participants (dealer and customers) and the dealer's sales to other participants. (Box B, in the appendix, provides a stylized example of how this clearing and netting works.) We then sum across CUSIPs, settlement days, and dealers to get an overall total for each trading day.

The findings suggest that the netting benefits to dealers from central clearing of all trades would be substantial. Dealers' gross settlement obligations with expanded central clearing average \$232 billion, \$366 billion (61%) lower than in the current structure, as shown in Figures 6 and 7, and Table 1. Importantly, the differences are even more striking for those days on which such obligations are especially high, so that dealers' netting benefits are greatest when they are most needed. On February 28 and March 30, in particular, the reductions in gross settlement obligations

<sup>17</sup> Note that this includes the Federal Reserve. We later discuss results assuming trades with the Fed are not centrally cleared.

are \$684 billion (67%) and \$760 billion (69%), respectively. Moreover, the correlation across days between the level of settlement obligations under the current structure and the reduction in such obligations with market wide central clearing is 0.71.

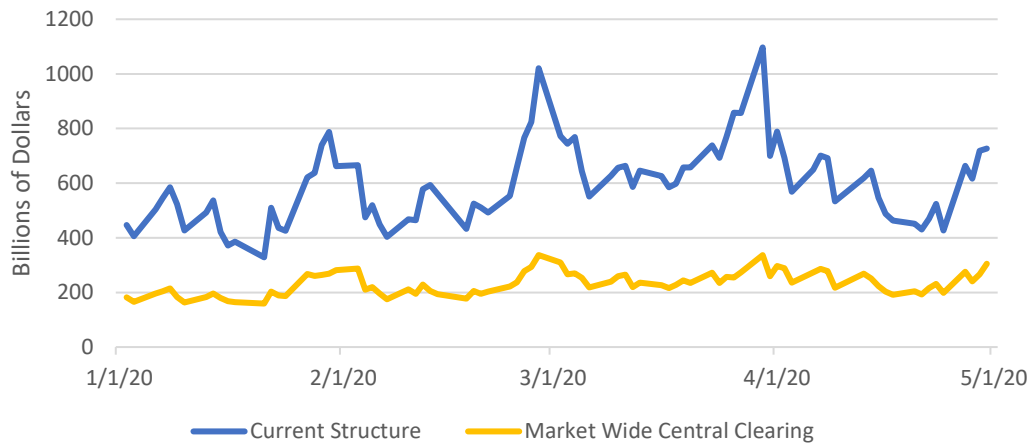
**Figure 6 – Dealers' Gross Settlement Obligations if All Trades Centrally Cleared**



Source: Authors' calculations, based on FINRA TRACE data.

Note: The figure plots dealers' gross settlement obligations in U.S. Treasury securities by day under a potential structure in which all trades are centrally cleared and netted.

**Figure 7 – Dealers' Gross Settlement Obligations by Market Structure**



Source: Authors' calculations, based on FINRA TRACE data.

Note: The figure plots dealers' gross settlement obligations in U.S. Treasury securities by day under the current structure in which dealers' interdealer trades are centrally cleared and netted and under a potential structure in which all trades are centrally cleared and netted.



**Table 1 – Dealers’ Netting Benefits from Market Wide Central Clearing**

	Overall	Non-Crisis	February 28	March 30
Settlement obligations under current market structure	598	544	1,020	1,097
Settlement obligations with market wide central clearing	232	220	337	336
Reduction in settlement obligations	366	324	684	760

Source: Authors’ calculations, based on FINRA TRACE data.

Notes: The table reports dealers’ gross settlement obligations in U.S. Treasury securities under the current market structure in which only dealers’ interdealer trades are centrally cleared and netted, under a potential structure in which all trades are centrally cleared and netted, and the difference between the two, for various time periods. Daily averages are reported for the overall (January 2, 2020 – April 30, 2020) and non-crisis periods (January 2 – February 25, 2020 and April 1 – 30, 2020) and daily values are reported for February 28, 2020 and March 30, 2020. Numbers are in billions of dollars, par value.

The fact that the netting efficiencies are proportionately greater when settlement obligations are at their highest means that the volatility of settlement obligations decreases when going from the current market structure to the potential one. The standard deviation of dealers’ daily gross settlement obligations is thus \$143 billion in the structure without central clearing of customer trades, but only \$42 billion in the structure with market wide central clearing. Moreover, consistent with the percentage declines being greater on days with higher trading volumes, the coefficient of variation (the ratio of the standard deviation to the mean) declines from 0.24 to 0.18. The balance sheet resources dealers need to intermediate trading are seemingly not only lower with market wide central clearing, but also far less volatile.

It's important to note that the reduction in dealers’ overall gross settlement obligations comes with only a modest increase in their settlement obligations with the CCP. That is, the estimated \$366 billion average decline in dealers’ gross settlement obligations with market wide central clearing comes from an average \$432 billion reduction in dealers’ settlement obligations with customers (from \$432 billion to \$0), along with an average \$66 billion increase in dealers’ settlement obligations with the CCP (from \$166 billion to \$232 billion). On March 30, the \$760 billion decline comes from a \$859 billion reduction in dealers’ settlement obligations with customers (from \$859 billion to \$0), along with a \$98 billion increase in dealers’ settlement obligations with the CCP (from \$238 billion to \$336 billion). It follows that if dealers’ capital and liquidity commitment to the CCP were to

increase as their settlement obligations with the CCP increased, there would be an offset based on a much larger reduction in dealers' settlement obligations with customers.

Are the estimated netting benefits to dealers small or large? Aside from measuring them in dollar terms and relative to dealers' settlement obligations under the current structure, we can also compare them to the netting benefits dealers currently attain from central clearing of interdealer trades (relative to their settlement obligations before netting). Overall, the \$366 billion decline in dealers' gross settlement obligations from moving from the current structure to market wide central clearing is roughly 30% greater than the \$282 billion decline dealers currently attain from central clearing of interdealer trades (as compared to their gross settlement obligations before netting).

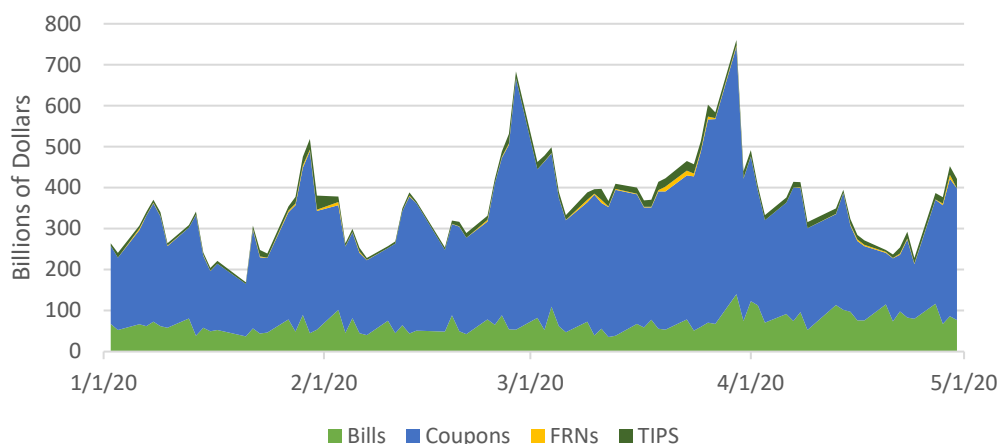
Unfortunately, it's difficult to quantify how such netting benefits would affect market functioning. Our intuition is that the expected decline in counterparty credit risk and balance sheet usage would increase dealers' capacity to intermediate trades. This could, in turn, lead to improved market functioning with reduced volatility and improved liquidity at times of market stress. Even if dealers did not expand their intermediation activities, the likely risk reduction would bring financial stability benefits. Moreover, as discussed elsewhere, expanded central clearing could pave the way for all-to-all trading, which could improve Treasury market resilience independent of dealer behavior.

#### *E. Liquidity Savings by Security Type*

In addition to estimating dealers' netting benefits overall, we can estimate the benefits for particular security types. As shown in Figure 8 and Table 2, coupon securities account for the vast majority (77%) of the netting benefits, with bills an appreciable share (19%), and floating rate notes (FRNs) and Treasury Inflation-Protected Securities (TIPS) very little (0.6% and 3.6% respectively). While these findings are largely explained by differences in trading activity across security types, they also reflect the high degree of netting among notes and bonds that is enabled by central clearing. Two-thirds (67%) of coupon security settlement obligations under the current market

structure would net if there were market wide central clearing, whereas the comparable figure for bills is just 46%, for FRNs 48%, and for TIPS 59%.<sup>18</sup>

**Figure 8 – Dealers’ Netting Benefits by Security Type**



Source: Authors’ calculations, based on FINRA TRACE data.

Note: The figure plots dealers’ reduction in gross settlement obligations by security type and day under a potential market structure in which all trades in U.S. Treasury securities are centrally cleared and netted as opposed to the current structure in which only dealers’ interdealer trades are centrally cleared and netted.

**Table 2 – Dealers’ Netting Benefits by Security Type**

	Bills	Coupons	FRNs	TIPS
Settlement obligations under current market structure	149	423	5	22
Settlement obligations with market wide central clearing	80	141	2	9
Reduction in settlement obligations	69	282	2	13

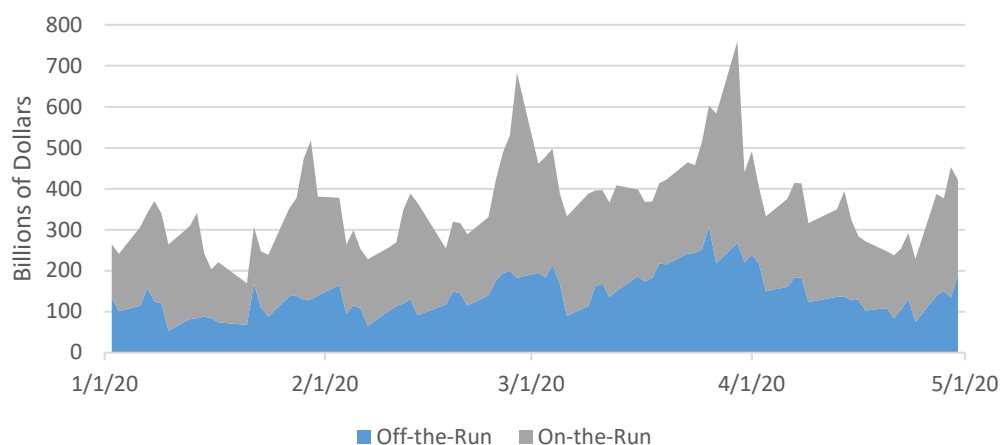
Source: Authors’ calculations, based on FINRA TRACE data.

Notes: The table reports dealers’ average daily gross settlement obligations in U.S. Treasury securities under the current market structure in which only dealers’ interdealer trades are centrally cleared and netted, under a potential structure in which all trades are centrally cleared and netted, and the difference between the two, by security type for the January 2, 2020 – April 30, 2020 sample period. Numbers are in billions of dollars, par value. Zero-coupon Treasuries (STRIPS) are included with coupon securities.

<sup>18</sup> The netting benefits of the current market structure (as compared to settlement obligations before netting) are even more disparate, whereby 38% of dealers’ coupon trades are estimated to net, but only 11% of bill trades, 2.5% of FRN trades, and 16% of TIPS trades. This reflects the disproportionate trading of coupon securities in the interdealer market, as shown in Brain, et al., 2018b.

The high level of netting among the coupon securities reflects the high level of trading in the benchmark coupons in particular. While there are roughly 400 Treasuries outstanding, the six on-the-run coupons account for over 60% of trading volume (Brain, et al. 2018b).<sup>19</sup> It follows that the netting benefits from market wide central clearing are much greater for the on-the-run securities, as shown in Figure 9 and Table 3, so that 71% of on-the-run settlement obligations under the current market structure would net if there market wide central clearing, whereas the comparable figure for off-the-run trades is just 51%.<sup>20</sup> The netting benefits are especially high near the end of each month when the newly auctioned 2-, 5-, and 7-year notes are trading as both when-issued and on-the-run securities.

**Figure 9 – Dealers’ Netting Benefits by On-the-Run/Off-the-Run Status**



Source: Authors’ calculations, based on FINRA TRACE data.

Note: The figure plots dealers’ reduction in gross settlement obligations by on-the-run/off-the-run status and day under a potential market structure in which all trades in U.S. Treasury securities are centrally cleared and netted as opposed to the current structure in which only dealers’ interdealer trades are centrally cleared and netted.

<sup>19</sup> In May 2020, after our sample period, Treasury reintroduced the 20-year bond (see Fleming and Ruela, 2020), so there are now seven on-the-run coupon securities (the 2-, 3-, 5-, 7-, and 10-year notes and the 20- and 30-year bonds).

<sup>20</sup> The netting benefits of the current market structure (as compared to settlement obligations before netting) are even more disparate, whereby 45% of dealers’ on-the-run trades are estimated to net, but only 9% of dealers’ off-the-run trades. This reflects the disproportionate trading of on-the-run securities (and on-the-run coupon securities, in particular) in the interdealer market, as shown in Brain, et al., 2018b.

**Table 3 – Dealers’ Netting Benefits by On-the-Run/Off-the-Run Status**

	On-the-Run	Off-the-Run
Settlement obligations under current market structure	307	287
Settlement obligations with market wide central clearing	88	140
Reduction in settlement obligations	219	147

Source: Authors’ calculations, based on FINRA TRACE data.

Notes: The table reports dealers’ average daily gross settlement obligations in U.S. Treasury securities under the current market structure in which only dealers’ interdealer trades are centrally cleared and netted, under a potential structure in which all trades are centrally cleared and netted, and the difference between the two, by on-the-run/off-the-run status for the January 2, 2020 – April 30, 2020 sample period. Numbers are in billions of dollars, par value. Zero-coupon Treasuries (STRIPS) are excluded.

*F. Liquidity Savings by Dealer Type*

While our analysis so far is for dealers as a group, there are reasons to think that different types of dealers are subject to different constraints. Dealers that are subsidiaries of U.S. bank holding companies (BHCs) or intermediate holding companies (IHCs) are subject to Federal Reserve regulations, including the leverage ratio capital requirements at the U.S. BHC and IHC levels into which the dealer activities are rolled up. As noted earlier, the Fed announced on April 1, 2020 a temporary change to the SLR “to ease strains in the Treasury market resulting from the coronavirus and increase banking organizations' ability to provide credit to households and businesses.”<sup>21</sup> To better understand the relevance of dealer type, we repeat our earlier analysis separately for

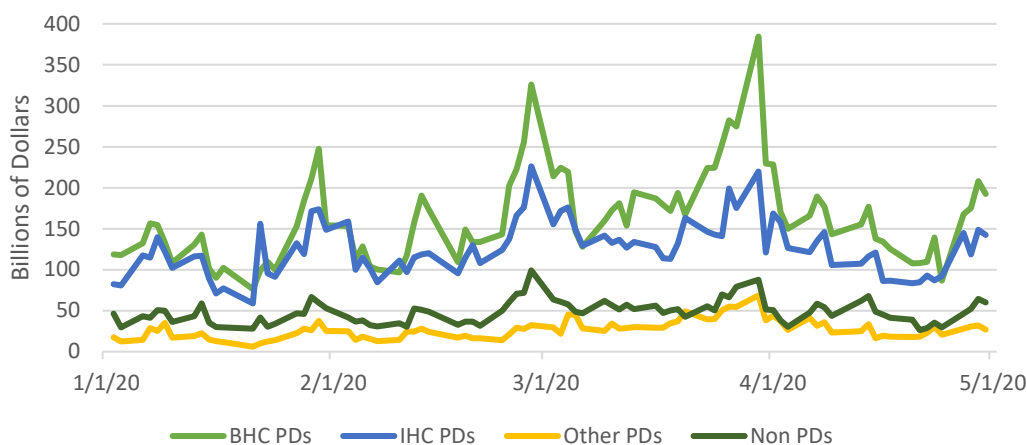
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<sup>21</sup> See <https://www.federalreserve.gov/newsevents/pressreleases/bcreg20200401a.htm>. On March 19, 2021, the Fed announced that the temporary change to the SLR would expire as scheduled on March 31, 2021. It also announced that it would soon seek comment on measures to adjust the SLR given the recent growth in the supply of central bank reserves and the issuance of Treasury securities. See: <https://www.federalreserve.gov/newsevents/pressreleases/bcreg20210319a.htm>.

primary dealer subsidiaries of BHCs, primary dealer subsidiaries of IHCs, non-bank affiliated or foreign-owned primary dealers, and all other dealers.<sup>22 23</sup>

As shown in Figure 10 and Table 4, almost 80% of the netting benefits from moving to market wide central clearing would go to the 16 primary dealers that are subsidiaries of a BHC or IHC and hence subject to the Fed’s leverage ratio requirements. Other primary dealers and non-primary dealers would account for the remaining 7% and 13%, respectively. These percentages aren’t far from the trading volume shares of these various dealer types, although “other” primary dealers would see smaller netting benefits relative to their gross settlement obligations, and non-primary dealers would see larger benefits.

**Figure 10 – Dealers’ Netting Benefits by Dealer Type**



Source: Authors’ calculations, based on FINRA TRACE data.

Note: The figure plots dealers’ reduction in gross settlement obligations by dealer type and day under a potential market structure in which all trades in U.S. Treasury securities are centrally cleared and netted as opposed to the current structure in which only dealers’ interdealer trades are centrally cleared and netted.

<sup>22</sup> While this analysis need not be split by the primary dealer designation, the 21 primary dealers that are not banks account for 86% of all dealer trading volume over our sample period. Moreover, this split allows us to avoid having to classify the 207 other dealers in our database, which account for the remaining 14% of trading volume. As noted earlier, dealers that are banks are not FINRA members and hence don’t report their trades to TRACE, precluding an analysis of these firms.

<sup>23</sup> Of the 21 primary dealers for which we have data, 7 are subsidiaries of BHCs (BofA Securities, Inc., Citigroup Global Markets Inc., Goldman Sachs & Co. LLC, HSBC Securities (USA) Inc., J.P. Morgan Securities LLC, Morgan Stanley & Co. LLC, Wells Fargo Securities, LLC), 9 are subsidiaries of IHCs (Barclays Capital Inc., BMO Capital Markets Corp., BNP Paribas Securities Corp., Deutsche Bank Securities Inc., Mizuho Securities USA LLC, NatWest Markets Securities Inc., RBC Capital Markets, LLC, TD Securities (USA) LLC, UBS Securities LLC), and 5 are non-bank affiliated or foreign-owned (Amherst Pierpoint, Cantor Fitzgerald & Co., Daiwa Capital Markets America Inc, Jefferies LLC, Nomura Securities International, Inc.).

**Table 4 – Dealers’ Netting Benefits by Dealer Type**

	BHC PDs	IHC PDs	Other PDs	Non PDs
Settlement obligations under current market structure	281	187	64	68
Settlement obligations with market wide central clearing	116	60	37	19
Reduction in settlement obligations	164	126	27	48

Source: Authors’ calculations, based on FINRA TRACE data.

Notes: The table reports dealers’ average daily gross settlement obligations in U.S. Treasury securities under the current market structure in which only dealers’ interdealer trades are centrally cleared and netted, under a potential structure in which all trades are centrally cleared and netted, and the difference between two, by dealer type for the January 2, 2020 - April 30, 2020 sample period. Numbers are in billions of dollars, par value.

#### *G. Federal Reserve Transactions*

While our analysis to this point assumes that the Fed’s trades are centrally cleared along with those of other customers, we also calculate dealers’ netting benefits assuming all customer trades *except* those with the Fed are centrally cleared. As shown in Table 5, the benefits of expanding central clearing beyond dealers but excluding the Fed are lesser for the various time frames as compared to Table 1. That said, the differences are only substantive on days that the Fed purchased an appreciable quantity of Treasuries. On March 30, for example, the estimated netting benefits are \$672 billion, \$78 billion less than the \$760 billion in savings when Fed trades are assumed to be centrally cleared, shown in Table 1.

Interestingly, not only does including the Fed in the CCP reduce settlement obligations, but the amount of the reduction tends to be greater than the amount of the Fed’s purchases. That is, dealers’ settlement obligations excluding the Fed tend to be greater than those including the Fed. On March 30, for example, dealers’ gross settlement obligations with counterparties other than the Fed (assuming all those entities centrally cleared) were \$358 billion, and those with the Fed were \$66 billion, whereas the overall number from Table 1 is \$336 billion.

**Table 5 – Dealers’ Netting Benefits with the Fed outside the CCP**

	Overall	Non-Crisis	February 28	March 30
Settlement obligations under current market structure	598	544	1020	1097
Settlement obligations with market wide central clearing	253	233	338	425
Reduction in settlement obligations	345	311	682	672

Source: Authors’ calculations, based on FINRA TRACE data.

Notes: The table reports dealers’ gross settlement obligations in U.S. Treasury securities under the current market structure in which only dealers’ interdealer trades are centrally cleared and netted, under a potential structure in which all trades, except those with the Federal Reserve, are centrally cleared and netted, and the difference between the two, for various time periods. Daily averages are reported for the overall (January 2, 2020 – April 30, 2020) and non-crisis periods (January 2 – February 25, 2020 and April 1 – 30, 2020) and daily values are reported for February 28, 2020 and March 30, 2020. Numbers are in billions of dollars, par value.

The high netting efficiencies from including Fed trades in the central net arise because dealers’ sales to the Fed offset dealers’ purchases from others. Moreover, these offsets occur at the dealer level. So it’s not just the case that dealer A buys securities from customers and dealer B sells securities to the Fed, with the dealers rebalancing their positions on another day. Rather, the evidence is suggestive of the same dealer buying securities from customers and selling those same securities to the Fed on the same day, to a large extent.<sup>24</sup> The findings illuminate the high netting benefits to dealers of including customers in the CCP who are trading in the opposite direction of other customers. In late March and early April 2020, in particular, Fed purchases were large and offsetting customer sales at a time when overall trading volume was high and dealers were less able or willing to intermediate the full extent of customer flows.

#### *H. Market Values vs. Par Values*

While our results so far are reported in terms of par values, we also calculate them in terms of market values and find that the netting benefits are somewhat higher, as shown in Table 6.<sup>25</sup> The

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<sup>24</sup> Alternatively, it could be that dealer A buys securities from customers, dealer B sells those securities to the Fed, and dealer A sells them to dealer B, all on the same day.

<sup>25</sup> Netting is still done in terms of quantities (par values) for this analysis, but daily par amounts are then multiplied by daily market values (per \$1 par) for notes, bonds, and TIPS, for days after their auction dates. Daily market values are calculated for each CUSIP as the average trade price for that CUSIP as calculated from



netting benefits of going from the current structure to the potential one with market wide central clearing increase by about 3% overall (from \$366 billion to \$378 billion), by about 2% on February 28 (from \$684 billion to \$700 billion), and by about 4% on March 30 (from \$760 billion to \$791 billion). The benefits are proportionally larger on March 30 because yields were relatively low then, and market prices commensurately higher.

**Table 6 – Dealers’ Netting Benefits in terms of Market Values**

	Overall	Non-Crisis	February 28	March 30
Settlement obligations under current market structure	617	557	1,047	1,141
Settlement obligations with market wide central clearing	239	225	347	349
Reduction in settlement obligations	378	332	700	791

Source: Authors’ calculations, based on FINRA TRACE data.

Notes: The table reports dealers’ gross settlement obligations in U.S. Treasury securities under the current market structure in which only dealers’ interdealer trades are centrally cleared and netted, under a potential structure in which all trades are centrally cleared and netted, and the difference between the two, for various time periods. Daily averages are reported for the overall (January 2, 2020 – April 30, 2020) and non-crisis periods (January 2 – February 25, 2020 and April 1 – 30, 2020) and daily values are reported for February 28, 2020 and March 30, 2020. Numbers are in billions of dollars, market value.

### *I. Settlement Fails*

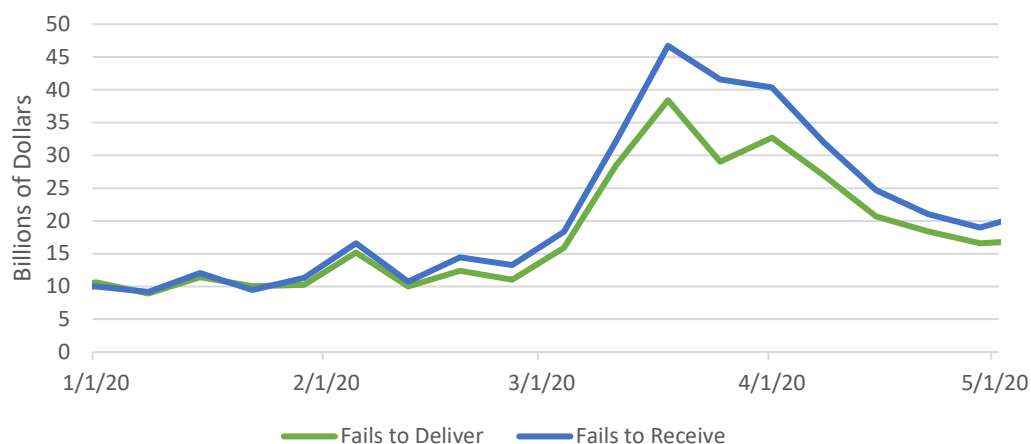
Our analysis to this point assumes that trades settle on their scheduled settlement dates. While this happens most of the time, trades sometimes fail to settle as planned (see, for example, Fleming and Garbade, 2002, Fleming and Garbade, 2005, and Garbade, et al., 2010). In such cases, the settlement date is moved forward one trading day. This process continues until the security is ultimately delivered. While dealers’ failed trades involving the CCP enter the central net for the next day, fails likely increase dealers’ gross settlement obligations. As mentioned earlier, settlement fails can cause counterparty risk to build up, subject dealers to regulatory capital charges, and threaten market liquidity.

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TRACE data. We don’t convert from par values to market values for notes, bonds, or TIPS up to and including auction date or for bills or FRNs generally. Prices remain close to par value for when-issued securities and for bills and FRNs generally. Moreover, there are data complications with the price field for these securities which make such an adjustment difficult.

Settlement fails are more likely at times of stress, such as during the 2007-09 financial crisis and in March 2020. As shown in Figure 11, primary dealers' average daily Treasury security fails by week (in both outright trades and repos) reached as high as \$85 billion in March, about evenly split between fails to receive and fails to deliver. This was roughly four times higher than average daily fails since May 2009.<sup>26</sup>

**Figure 11 – Primary Dealers' Daily Settlement Fails across all Treasury Issues**



Source: Authors' calculations, based on data from the FR 2004C report on dealer financing and fails.  
 Note: The figure plots primary dealers' average daily settlement fails in U.S. Treasury securities by week distinguishing between fails to deliver and fails to receive.

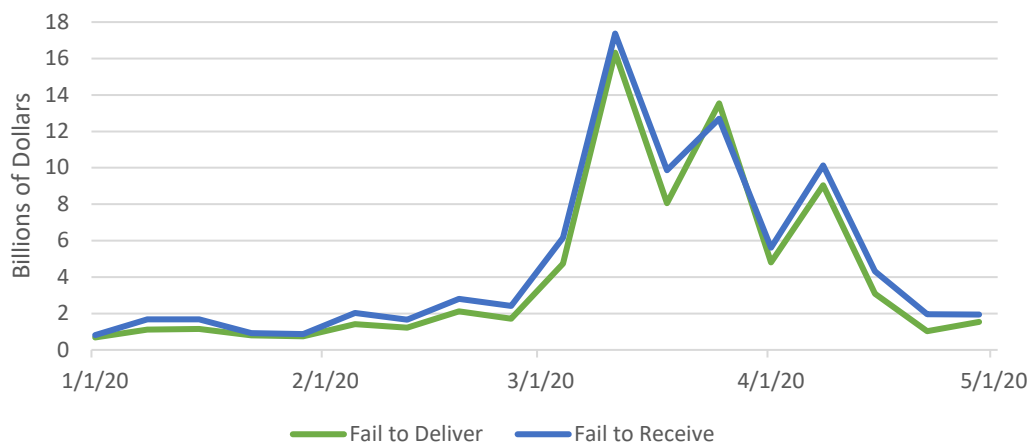
How would market wide central clearing affect fails? Box C (in the appendix) provides a simple example of how central clearing and settlement netting could reduce fails. Moreover, Duffie (2020) presents evidence that Treasury fails rose less in March 2020 for trades that were centrally cleared than for all trades involving primary dealers, and suggests as a possible explanation that central clearing reduces daisy-chain fails, which occur when firm A fails to deliver a security to firm B, causing firm B to fail to firm C, and so on. The public data on settlement fails precludes an empirical assessment of this issue because it is aggregated across securities and dealers.

We assess this issue using non-public FR 2004SI data at the dealer level. The FR 2004SI collects information on primary dealers' settlement fails in the on-the-run securities (notes and

<sup>26</sup> Between May 2009 and December 2019, average daily fails totaled \$22 billion, about evenly split between fails to receive and fails to deliver. Fails reached much higher levels before the market's adoption of a fails charge in May 2009 (see Garbade, et al., 2010), peaking at an average daily level of \$759 billion in the week ending October 22, 2008.

bonds, FRNs, and TIPS), on both outright trades and repos, as of the close of business each Wednesday. Fails in these specific issues account for about 25% of all Treasury fails over the January to April 2020 period, but half or more of fails in some weeks in March.<sup>27</sup> Data aggregated across dealers are released to the public and summarized in Figure 12.

**Figure 12 – Primary Dealers’ Settlement Fails in Specific Issues**



Source: Authors’ calculations, based on data from the FR 2004SI report on specific issues.

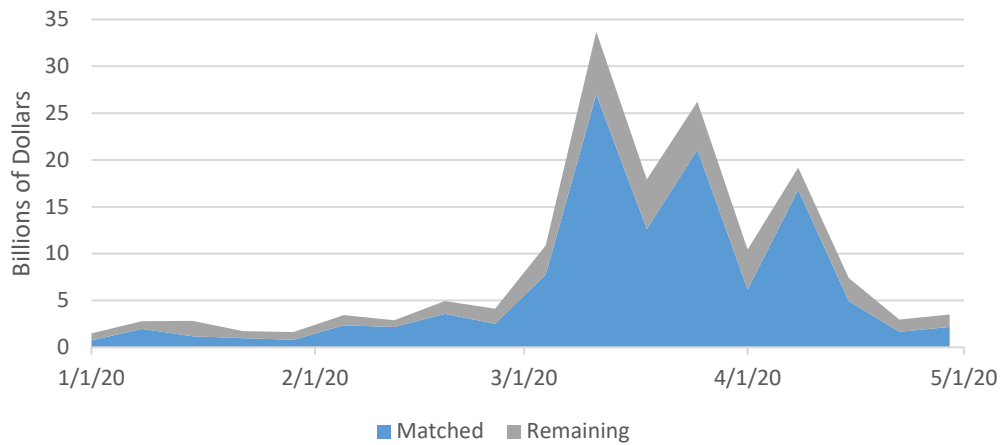
Note: The figure plots primary dealers’ settlement fails in specific issues for each Wednesday distinguishing between fails to deliver and fails to receive.

The non-public FR 2004SI data allows us to “match,” or pair off, fails to receive and fails to deliver at the dealer/CUSIP/trading day level.<sup>28</sup> As shown in Figure 13, we find that nearly three-quarters (74%) of specific issue fails can be so matched. These matched fails effectively represent daisy-chain fails that would not exist if all trades (both cash trades and repos) were centrally cleared. Importantly, the percent of matched fails increases with the volume of failed trades (correlation coefficient = 0.66), so that the netting benefits of increased central clearing for failed trades are especially high (in proportional terms, as well as dollar terms) when fails are high.

<sup>27</sup> The data aren’t perfectly comparable because the fails across all issues from the FR 2004C are reported cumulatively for the week, including non-trading days (which we then divide by seven to create an average daily series). In contrast, the fails in the specific issues from the FR 2004SI are as of the last day of the reporting week. This feature of the FR 2004SI data is helpful for our analysis, as it allows us to cleanly match delivery fails and receive fails on specific dates.

<sup>28</sup> Technically, there could be mismatches in settlement date, which is not a field in the dataset. In practice, nearly all trading volume in a given CUSIP on a given day is for settlement on the same date.

**Figure 13 – Primary Dealers’ Matched and Remaining Fails in Specific Issues**



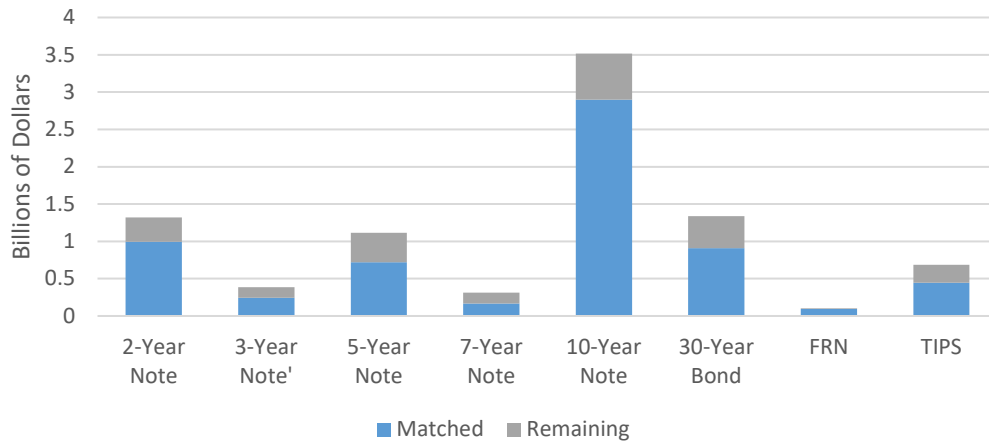
Source: Authors’ calculations, based on data from the FR 2004SI report on specific issues.

Note: The figure plots primary dealers’ daily settlement fails in specific issues by week distinguishing between fails to deliver and fails to receive that can be matched at the dealer/date/security level and those that cannot.

We also calculate average daily matched and unmatched fails by specific issue, as shown in Figure 14. Again, not only does the quantity of matched fails increase with the overall level of fails, but the proportion increases as well, so that 82% of fails match off for the 10-year note, but just 54% for the 7-year note.<sup>29</sup> Central clearing would thus appear most effective at mitigating fails in those issues where fails can persist and adversely affect market functioning. So market wide central clearing not only reduces the balance sheet resources needed for Treasury market intermediation overall through reduced settlement fails, but has the greatest benefits when they are most needed and for the securities for which they are most needed.

<sup>29</sup> It’s no surprise that we find the most fails in the on-the-run 10-year note. Notable fails episodes after September 11 (Fleming and Garbade, 2002), in 2003 (Fleming and Garbade, 2004), during the 2013 taper tantrum (Fleming, 2013), and in June 2014 (Fleming, et al., 2014) and March 2016 (Fleming and Keane, 2016) involved this same security.

**Figure 14 – Primary Dealers’ Matched and Remaining Fails by Specific Issue**



Source: Authors’ calculations, based on data from the FR 2004SI report on specific issues.

Notes: The figure plots primary dealers’ average daily settlement fails by specific issue distinguishing between fails to deliver and fails to receive that can be matched at the dealer/date/security level, and those that cannot, for the January 1 to April 29, 2020 sample period. The TIPS category combines data for the 5-, 10-, and 30-year TIPS.

The matched fails in the specific issues provide a lower bound estimate of the netting benefits of increased central clearing for all fails. As mentioned, the specific issue fails only account for about 25% of all fails over our sample period. There are likely an appreciable number of matching fails among the other CUSIPs, which we cannot observe, but that would be paired off and eliminated there were market wide central clearing. That said, the proportion of matching fails in these other CUSIPs is likely lower than in the more actively traded on-the-run CUSIPs, where daisy chains of fails are likely longer. It follows that much of the benefits of market wide central clearing at reducing fails comes from lowering fails in the benchmark issues, especially at times of market stress. The reduced settlement fails provide balance-sheet economies to dealers and benefit all market participants through improved market functioning and liquidity.

In addition to reducing settlement fails through improved matching, market wide central clearing would bring benefits in how fails are managed. First, central management of the fails charge claiming process would reduce operational costs by eliminating bilateral processes. Second, CCP margining would provide consistent and transparent risk management of fails. Lastly, more CCP participation would improve the completeness of the pass through of the fails charge from the beginning to the end of a fails chain, improving the efficacy of the fails charge practice.

### *J. Netting Efficiencies for IDBs*

While our analysis of market wide central clearing primarily concerns dealers, we're also interested in how other market participants are affected and thereby conduct a similar analysis for IDBs. The approach is more involved than it is for dealers, reflecting the additional information we have about IDB counterparties. Dealers report the names of counterparties that are also dealers, but report all non-dealer trades as being with customers, without distinguishing among them. In contrast, IDBs, for the most part, have identified their counterparts in TRACE, dealer or not, since April 1, 2019. These non-dealer counterparts are classified internally into PTFs, dealer-affiliated firms (including banks), and other customers, which we call hedge funds (because such funds account for much of this category).

For this analysis, we continue to assume that trades with dealers or other IDBs are centrally cleared and netted and that trades with anonymized customers are not cleared or netted at all.<sup>30</sup> Moreover, we assume that trades with dealer-affiliated firms are centrally cleared and netted, which largely seems to be the case. In contrast, we assume *bilateral* clearing and netting between IDBs and hedge funds and between IDBs and PTFs, given that hedge funds and PTFs are not CCP members.

Our results suggest netting benefits to IDBs from market wide central clearing on the order of \$91 billion, on average, but reaching as high as \$185 billion, as shown in Table 7 and Figure 15. The much smaller benefits to IDBs as compared to dealers is not explained by IDBs' lower level of trading, as IDBs' average daily trading volume between January and April 2020 (\$670 billion) was only modestly lower than that of dealers (\$752 billion).<sup>31</sup> Moreover, it is not because there are not netting opportunities from market wide central clearing, as such a change would allow IDBs to net down nearly all of their gross settlement obligations under the current structure. Rather, the lower benefits reflect the substantial netting that already occurs within the current market structure, whereby average daily settlement obligations before netting of \$751 billion net down to \$92 billion.

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<sup>30</sup> IDBs identify most but not all of their non-dealer counterparties. While the trades for which they do not identify their specific counterparties are likely cleared and netted bilaterally, if not centrally, the absence of firm identifiers precludes us from evaluating these trades as such.

<sup>31</sup> As with the dealers, we count both sides of an IDB's trades, so that if an IDB intermediates a \$2 million trade, buying from one party and selling to the other, we count this as \$4 million traded.

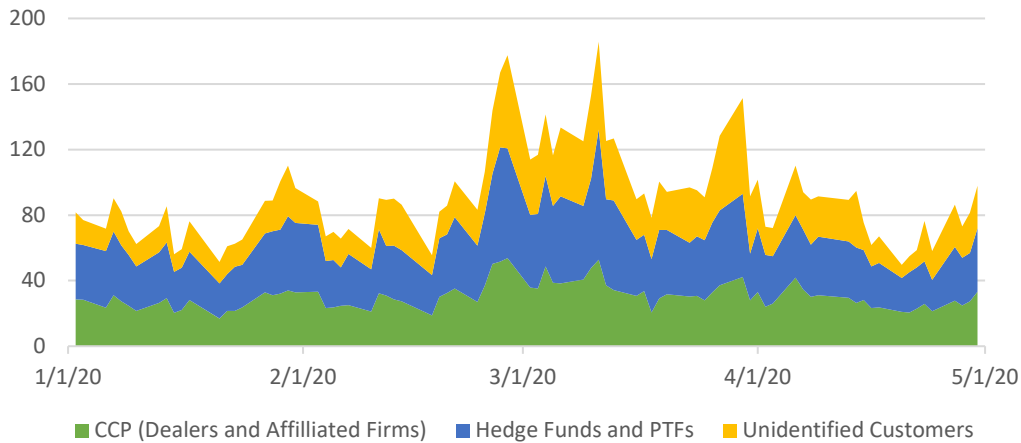
**Table 7 – IDBs’ Netting Benefits with Market Wide Central Clearing**

	Overall	Non-Crisis	February 28	March 30
Settlement obligations under current market structure	91.6	78.6	177.5	151.3
Settlement obligations with market wide central clearing	0.4	0.3	1.7	0.7
Reduction in settlement obligations	91.2	78.3	175.7	150.6

Source: Authors’ calculations, based on FINRA TRACE data.

Notes: The table reports IDBs’ gross settlement obligations in U.S. Treasury securities under the current market structure in which IDBs’ trades with dealers and dealer-affiliated firms are centrally cleared and netted, IDBs’ trades with PTFs and hedge funds are bilaterally cleared and netted, and IDBs’ trades with unidentified customers are not netted at all, under a potential structure in which all trades are centrally cleared and netted, and the difference between the two, for various time periods. Daily averages are reported for the overall (January 2, 2020 – April 30, 2020) and non-crisis periods (January 2 – February 25, 2020 and April 1 – 30, 2020) and daily values are reported for February 28, 2020 and March 30, 2020. Numbers are in billions of dollars, par value.

**Figure 15 – IDBs’ Netting Benefits by Counterparty Type**



Source: Authors’ calculations, based on FINRA TRACE data.

Note: The figure plots IDBs’ gross settlement obligations by counterparty type under the current market structure in which IDBs’ trades with dealers and dealer-affiliated firms are centrally cleared and netted, IDBs’ trades with PTFs and hedge funds are bilaterally cleared and netted, and IDBs’ trades with unidentified customers are not netted at all. The sum of these gross settlement obligations is essentially equal to IDBs’ netting benefits under a potential market structure in which all trades in U.S. Treasury securities are centrally cleared and netted (as IDBs’ obligations are close to zero under such a structure).

Importantly, the substantial netting that occurs under the current market structure is not only true for IDBs’ trades that are already centrally cleared and netted, but for their trades that are bilaterally cleared and netted. We thus find that central clearing and netting reduces IDBs’ gross

settlement obligations with dealers and dealer-affiliated firms by 93%, on average, but that bilateral clearing and settlement reduces IDBs' settlement obligations with PTFs and hedge funds by 86%, on average (89% for PTFs and 26% for hedge funds). In contrast, by construction, there is no netting of IDBs' trades with unidentified customers. The high netting percentages under the current market structure reflect the concentration of IDB trades in the on-the-run notes and bonds, especially for trades with PTFs, which focus their trading activity on electronic platforms in which no other securities are traded.

While there is substantial netting of IDBs' trades under the current market structure, it's important to note that the exposure of the IDBs and the CCP to one another is much more than in the past when all IDB participants were CCP members. Indeed, as shown in Table 7, the IDBs' and the CCP would have essentially no end-of-day exposure to one another if all participants were CCP members, reflecting the IDBs' business model of simply matching buyers and sellers, while serving as counterparty to both. By opening their platforms to PTFs and hedge funds, the IDBs not only took on counterparty exposure to these new entities, but also meaningful CCP exposure. Conversely, the CCP took on greater direct IDB exposure when the IDBs opened to non-members, as well as indirect exposure to the IDBs' non-member participants.

## **5. Additional Considerations**

### *A. Data Limitations*

There are several reasons to think that our estimated netting benefits understate dealers' true netting benefits from market wide central clearing. First, as noted earlier, the TRACE data is only collected from FINRA-registered dealers. Just among the 24 primary dealers, 3 are not dealers but banks, which do not report. Accounting for trades by these banks would likely result in an increase in the netting benefits from expanded central clearing.<sup>32</sup>

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<sup>32</sup> To be sure, there are likely a small number of trades by banks in our current dataset that are coded as customer trades by FINRA members (the TRACE data reported by dealers do not distinguish among non-FINRA members). Some of these trades are centrally cleared now, as all primary dealers are CCP members, even those that are not FINRA members. That said, direct dealer-to-dealer trades only account for about 6% of all trading volume in the Treasury market (Brain, et al., 2018a). As a result, the exclusion of banks from our analysis likely excludes a far greater number of trades that could be netted down with market wide central clearing, than trades that are currently centrally cleared but not categorized as such.



Second, our analysis is based on secondary market transactions data and hence does not account for dealers' primary market purchases, which are included in the central net. We know that dealers buy a large share of the Treasuries sold at auction and sell them off over time, including on the day of the auction and on adjacent days (see, for example, Fleming and Rosenberg, 2007). That is, dealers tend to be net sellers of Treasuries to customers in the when-issued market. It follows that dealers' purchases at auction and sales to customers likely offset to a large extent. Therefore, if we could properly account for the settlement of dealers' primary market purchases, the measured netting benefits of market wide central clearing would likely be even greater.

Third, our main analysis (which relies on TRACE data) is based on outright transactions data and hence does not account for dealers' secured financing (e.g., repurchase agreement or repo) transactions. Such transactions between dealers are centrally cleared to the extent that the legs settle one or more trading days in advance.<sup>33</sup> That is, a typical repo involves same-day settlement of the starting leg, which is not included in the net, although the closing leg is included in the net. The starting leg is included if it settles the next day or later. In any case, we know that dealers transact with their customers in the repo market and that these trades are often offset in the interdealer market. It follows that the estimated netting benefits of market wide central clearing are likely greater, perhaps much greater, if repo transactions could be taken into account.

Lastly, the dataset does not currently contain a record of whether a trade is centrally cleared or not, so we need to infer this information based on the trade counterparties. We make the simplifying assumption that all dealers are CCP members, while in fact many of the smaller ones are not. The estimated netting benefits would be somewhat larger if we took this into account.<sup>34</sup> Conversely, we assume that dealers' customers are not CCP members, whereas some of them surely are. While the inclusion of CCP members among customers causes us to misclassify some trades as not being centrally cleared when they are, many of those CCP members, such as banks, engage in trades with their own customers that are not reported to TRACE. On balance, this issue,

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<sup>33</sup> On November 19, 2020, the FICC filed [proposed rule change SR-FICC-2020-015](#), which would subject same-day settling trades to central clearing and settlement, although such trades would not go through the netting process.

<sup>34</sup> While the FICC does publish lists of its participants, suggesting that a more precise delineation of CCP members and non-members could be made, accurately matching FINRA members with FICC participants would be difficult in the absence of common firm identifiers across the two sources.

as well as the preceding ones, likely cause us to understate the true netting opportunities from market wide central clearing.

### *B. Equilibrium Implications*

Our analysis uses past data to estimate dealers' netting benefits from market wide central clearing, implicitly assuming that the behavior of institutions and markets would not change. In practice, we expect that expanded central clearing would affect behavior, which might amplify or reduce the balance sheet efficiencies we measure statically by assuming fixed trading patterns. So while our static analysis suggests that the Treasury market might be better able to absorb surges in trading demand if central clearing were broad based, equilibrium responses will matter and should be a focus of further study.

Dealers: As shown, market wide central clearing would reduce the gross settlement obligations of dealers, including dealers' settlement fails, improving the efficiency of dealer balance sheet usage. Moreover, dealers' counterparty risk would be managed in a more consistent and transparent way through the CCP, and not bilaterally through each dealer and its counterparties. These changes should decrease dealers' credit exposure, even as the creditworthiness of the CCP became more important. Our intuition is that these changes would increase dealers' capacity to intermediate trades, which could lead to improved market functioning, but acknowledge that counterparty risk is just one consideration among many in dealers' intermediation decisions.

On the contrary, broad central clearing could ease an evolution toward greater all-to-all trading, as discussed below. Customers' executing trades without dealer involvement could erode dealers' customer franchise value, even if dealers were to remain active intermediaries for trades of larger sizes or less liquid securities (as they do in other markets with all-to-all trading). Primary dealers, specifically, commit to participate in Treasury auctions and Fed open market operations. A question that then arises is whether a market structure with expanded central clearing might erode dealer franchise sufficiently so as to cause primary dealers to reconsider making these commitments.

Principal Trading Firms (PTFs): PTFs account for roughly half of trading volume in the IDB market (Harkrader and Puglia, 2020), but are not members of the CCP. In some ways, this may seem surprising given PTFs' level of activity. However, IDBs have been willing to provide PTFs with a

cheaper bilateral clearing and netting arrangement. This arrangement reduces PTFs' gross settlement obligations by about 89%, on average, as noted earlier. Moreover, we estimate that market wide central clearing would increase this percentage by just 3 percentage points, to 92%. It follows that the estimated netting benefits to PTFs of expanded central clearing average just \$8 billion for the full sample, reaching as high as \$17 billion on high volume days.

If PTFs were to become CCP members, they might pose new risk management challenges for the CCP because of the tail risk of them failing intraday due to an operational error (so-called "Knight Capital" risk).<sup>35</sup> In guarding against such risk, the CCP might impose higher costs/margins than PTFs are willing to bear to participate in the market. Conversely, the CCP might underweight such risk because of the difficulty in modelling events that are highly unlikely and outside of the Treasury market's experience. In either case, it seems important that PTFs bear an appropriate share of this risk directly.<sup>36</sup> This issue is related to a more general one as to whether there is an even regulatory playing field for PTFs and dealers.<sup>37</sup>

If CCP membership did cause PTFs to withdraw from the market or reduce their activity, market functioning could be adversely affected. That said, it's possible that increased central clearing would lead to all-to-all trading that promotes liquidity during normal times (see discussion below), with PTFs remaining actively engaged (as they are in other all-to-all venues with central clearing such as futures and equity markets). In addition, even if trading costs did increase somewhat during normal times, any offsetting improvement to market resilience, and liquidity during times of crisis, could outweigh those costs.

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<sup>35</sup> As explained in Securities and Exchange Commission (2013), "On August 1, 2012, Knight Capital Americas LLC ("Knight") experienced a significant error in the operation of its automated routing system for equity orders, known as SMARS. While processing 212 small retail orders that Knight had received from its customers, SMARS routed millions of orders into the market over a *45-minute period*, and obtained over 4 million executions in 154 stocks for more than 397 million shares. By the time that Knight stopped sending the orders, Knight had assumed a net long position in 80 stocks of approximately \$3.5 billion and a net short position in 74 stocks of approximately \$3.15 billion. Ultimately, Knight *lost over \$460 million* from these unwanted positions (*emphasis added*)."

<sup>36</sup> The current arrangement through which PTFs clear bilaterally with the IDB may indirectly expose CCP membership to PTF tail risk through the IDB. Whether PTFs adequately internalize such risk under the current structure is difficult to judge in the absence of a careful examination of how IDBs manage PTF counterparty risk and how CCPs manage IDB counterparty risk. Both are beyond the scope of this paper.

<sup>37</sup> PTFs that are not registered as dealers (as most are not) are not subject to regulatory capital requirements and not required to report transactions to FINRA's TRACE.

Customers: Central clearing of customer trades would represent a marked shift from current practice, in which customers nearly universally clear bilaterally with dealers, and would require that regulatory impediments be overcome for certain customers.<sup>38</sup> Customers' gross settlement obligations would surely decrease with central clearing, although the magnitude is uncertain and likely varies by customer type. In particular, netting would likely be more beneficial for levered customers, which tend to trade more actively, than real money customers. That said, all customers would benefit indirectly if intermediation capacity and market resilience improved.

The absence of identifying information on dealers' customers in TRACE precludes a precise estimate of how central clearing would affect the netting of customer trades. That said, a lower bound of zero on the extent of netting can be attained by assuming that none of the D2C trades that might otherwise offset one another reflect trades of the same customer. Conversely, an upper bound can be attained by assuming that virtually all of the offsetting D2C settlement obligations reflect trades of the same customer.<sup>39</sup> This upper bound averages \$225 billion overall, which equals 52% of the \$432 billion average D2C gross settlement obligations, and \$499 billion on February 28, which equals 64% of the \$782 billion D2C gross settlement obligations that day. The proportion of customer settlement obligations that offset thereby ranges between 0% and 52% overall, and between 0% and 64% on February 28.

### *C. Implications for the CCP*

Market wide central clearing would increase the role and importance of the CCP. Its gross settlement obligations would surely increase, with the magnitude depending on the extent to which dealers' and IDBs' trades net down when all of their trades with their counterparties are centrally cleared, and also on the extent to which their counterparts' trades net against one another. Our earlier analysis provides estimates of dealers' and IDBs' netting benefits from market wide central clearing and we discussed the possible benefits to PTFs and customers earlier in this section.

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<sup>38</sup> Money market funds are prohibited from mutualizing losses, which effectively prevents those funds from joining a CCP. Sponsored clearing, in which eligible clients can centrally clear trades, facilitated by sponsoring members, is one way around this issue. As noted earlier, all sponsored activity to date has involved repos (and not cash trades).

<sup>39</sup> We calculate this upper bound by assuming all D2C trades, except those with the Fed or affiliates, are with the same customer, and that all affiliate trades *of a given dealer* are with the same affiliate.

Putting these numbers together provides a rough range for the effect on the CCP's obligations, reported in Table 8.

**Table 8 – Estimated Changes in Gross Settlement Obligations by Market Participant Type**

	Overall	Non-Crisis	February 28	March 30
Dealers	-366	-324	-684	-760
Customers	-225-0	-203-0	-499-0	-463-0
IDBs	-91	-78	-176	-151
Hedge funds and PTFs	-9	-8	-17	-15
CCP	278-520	260-478	355-880	468-978

Source: Authors' calculations, based on FINRA TRACE data.

Notes: The table reports the estimated changes in U.S. Treasury security gross settlement obligations by market participant type under a potential market structure in which all trades are centrally cleared and netted as opposed to the current structure in which only dealers' interdealer trades are centrally cleared and netted. Numbers are in billions of dollars, par value. Daily averages are reported for the overall (January 2, 2020 – April 30, 2020) and non-crisis periods (January 2 – February 25, 2020 and April 1 – 30, 2020) and daily values are reported for February 28, 2020 and March 30, 2020. Figures for PTFs and hedge funds are combined here and somewhat greater than those for PTFs alone. Figures for IDBs' unidentified counterparts are not separately reported, but are considered in calculating the IDB and CCP figures.

At one extreme, in which no customer (or unidentified IDB counterpart) trades net against one another, the CCP's obligations increase by the quantity of D2C obligations under the current structure, plus the change in each of the other firm types' obligations to the CCP. For the overall sample, the CCP's average daily settlement obligations increase by \$520 billion, greater than dealers' and IDBs' netting benefits combined.<sup>40</sup> At the other extreme, every instance of a customer buying and selling a security for settlement on the same day is assumed to involve the same customer (and similarly so for unidentified IDB counterparts), leading to significant netting among customer (and unidentified IDB counterpart) trades. For the overall sample, the CCP's average daily settlement obligations increase by \$278 billion, less than the reduction in dealers' netting benefits alone.<sup>41</sup> In practice, the effect on the CCP's obligations would be somewhere between these

<sup>40</sup> \$520 billion = \$432 billion (customers) + \$66 billion (dealers) - \$30 billion (IDBs) + \$28 billion (hedge funds and PTFs) + \$25 billion (unidentified IDB counterparts).

<sup>41</sup> \$278 billion = \$207 billion (customers) + \$66 billion (dealers) - \$30 billion (IDBs) + \$28 billion (hedge funds and PTFs) + \$7 billion (unidentified IDB counterparts).

extremes (subject to the data caveats discussed earlier), but surely larger than its current obligations.

Its increased role and importance from expanded central clearing would make a Treasury market CCP even more critically important, perhaps akin to a public utility. All designated financial market utilities (DFMUs) are viewed as systemically important institutions and subject to enhanced regulatory standards. Nonetheless, a question that arises is whether it might be desirable for relevant regulators to provide higher scrutiny of a market wide Treasury CCP, with a strong focus on systemic risk and financial stability implications. In addition to sharper regulatory focus, it may be prudent to reassess the liquidity framework of CCPs if material growth occurs. Whether existing liquidity backstops under an expanded CCP would remain fit for purpose or present new moral hazards are open questions.

#### *D. All-to-All Trading*

Market wide central clearing would also reduce the barriers to (but does not guarantee) the emergence of direct trading between non-dealer buyers and non-dealer sellers. This is because market participants would not be concerned about the reliability or creditworthiness of their original counterparties, and would no longer need to negotiate bilateral clearing and settlement arrangements (Duffie, 2019, and Liang and Parkinson, 2020).<sup>42</sup> Rather, the CCP would immediately step in as the buyer to every seller and the seller to every buyer. Greater all-to-all trading can expand intermediation capacity through broader participation in exchanges, IDBs, or request-for-quote venues and/or reduce the need for intermediation capacity to the extent end investors trade directly with one another.<sup>43</sup>

While a detailed analysis of the all-to-all issue is beyond the paper's scope, one can get some sense for the feasibility of all-to-all trading by observing that 69% of customer trading activity

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<sup>42</sup> On September 28, 2020, the SEC announced a proposed amendment to Regulation ATS ([Release No. 34-90019](#); [File No. S7-12-20](#)) that would expand its coverage to Treasury market trading venues. Such a change could result in broader venue access and hence complement increased central clearing.

<sup>43</sup> The events of March 2020, when the primary market functioned more smoothly than the secondary market, might be viewed as a natural experiment on the potential benefits of an all-to-all secondary market structure. The primary market allows for direct participation by a wide range of investors, as well as indirect participation through dealers, whereas the secondary market relies entirely on dealers to intermediate customer trades.

in our sample period offsets at the day/CUSIP/settlement day level. For such trades, dealers as a group are effectively matching buyers and sellers, albeit intermediating the trades for a short period of time (intraday). Such trades would seem the best candidates for all-to-all trading, although not only do the buyer and seller need to find one another, but they need to be comfortable with the possible timing mismatch between when they would need to trade and when they would otherwise choose to trade. In contrast, the D2C trades that do not offset would seem worse candidates for all-to-all trading, as the buyer and/or seller would need to be comfortable with a timing mismatch that stretches across days in such instances and/or be comfortable trading a different security than they would have otherwise traded. It follows that even if some sort of all-to-all trading were to emerge, dealer intermediation would still be needed, especially for less liquid securities or for large one-sided flows.

An interesting question is whether expanded central clearing might affect market structure even in the absence of all-to-all trading. As mentioned, market wide central clearing would mean that market participants would not be concerned about the reliability or creditworthiness of their original counterparties. The elimination of such concerns would reduce the frictions that inhibit customers from trading with new dealers, which could open up opportunities for smaller and medium-sized dealers in particular. Increased central clearing could thus promote competition among dealers, and expand dealers' capacity to intermediate trades, even if the current dealer-intermediated structure remained largely intact. That said, how expanded central clearing would affect dealers that are not currently CCP members is difficult to predict, with firm exit and reduced competition a possibility.

#### *E. How Expanded Central Clearing Might Come About*

While market wide central clearing could lead to deeper and more resilient markets through lower counterparty risk, increased intermediation capacity, and growth of all-to-all trading, it would also involve significant costs. If it were concluded that the benefits of expanded central clearing exceed the costs, how might such an outcome be achieved? There may be a collective action problem in the current market structure due to the positive externalities (i.e., netting efficiencies) associated with any given market participant's CCP participation. An official mandate, similar to Dodd-Frank's remedy for the interest rate swap market, is one possible approach. Short of a legislative mandate,

policymakers might consider policies that would encourage increased central clearing through the design of any new Federal Reserve liquidity facilities, through payments and liquidity policies crafted for a broad Treasury market CCP, or through other means.<sup>44</sup>

Although less impactful than an official mandate, private sector groups such as the TMPG might also contribute by providing new practice recommendations or new white papers that inform the market structure debate. At its September 2020 meeting, TMPG members recommended exploring the potential roles of exchanges or central clearing as a way to enhance resiliency, particularly in times of market stress (TMPG, 2020). Recent growth in sponsored repo services might be studied by the private sector to determine whether an agent clearing model in the cash market would be useful, and whether there are sufficient incentives and competition for clearing members to offer agent services to cash market participants that forego direct netting membership.

## **6. Conclusions**

We find that dealers' netting benefits from expanded central clearing of Treasury securities would be substantial, and especially large when trading activity is high. Central clearing of all outright trades would have lowered dealers' daily gross settlement obligations by roughly \$330 billion (60%) in the weeks preceding and following the market disruptions of March 2020, but nearly \$800 billion (70%) on March 30. The fact that the benefits are particularly large on high volume days suggests that the capital and liquidity dealers need to intermediate trading are not only lower with market wide central clearing, but also far less volatile.

Not surprisingly, the netting opportunities are concentrated in the most actively traded Treasury securities, so coupon securities as a group, and on-the-run securities in particular. Moreover, we find that the benefits are appreciably larger when we assume trades with the Fed are centrally cleared. The potential netting benefits of centrally cleared Fed trades were especially large in March when dealers were buying securities from customers and selling those same securities to the Fed (and on the same day). We also find that at least 80% of the netting benefits

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<sup>44</sup> Liang and Parkinson (2020), for example, propose that the Fed create a standing repo facility, available to broker-dealers, so as to give dealers confidence that they could finance securities they purchase or finance. Note that primary dealers, the Fed's counterparties for open market operations, must be CCP members.



accrue to primary dealers that are subsidiaries of BHCs or IHCs, and hence subject to the Fed's leverage ratio requirements.

We also look at the implications of market wide central clearing for Treasury security settlement fails. We find that nearly three-fourths (74%) of fails in specific issues are effectively daisy-chain fails, which could be paired off and hence eliminated with increased central clearing. Moreover, the percentage of fails that pair off tends to be higher when fails are higher and in issues where they are higher. It follows that expanded central clearing not only reduces the balance sheet resources needed for intermediation overall through reduced settlement fails, but that the benefits are greatest when they are most needed and for the securities for which they are most needed.

Our empirical work also provides some guidance on the prospects for all-to-all trading were there to be market wide central clearing. We thus find that over two-thirds of D2C trading overall involves dealers (as a group) intermediating trades between customer buyers and customer sellers on an intraday basis. Such trades may be the best candidates for all-to-all trading. That said, they would require the buyer and seller to find one another, and to be comfortable with the possible timing mismatch between when they would need to trade and when they might otherwise choose to trade. It follows that some form of dealer intermediation would likely still be needed for many of these trades, in addition to the many trades in which the buyer and seller seek to transact on different days.

Our empirical analysis does not consider the equilibrium effects on market participant behavior, so whether market wide central clearing would necessarily improve market functioning remains an open question. Many market participants could have their trades centrally cleared now, but choose not to because of the cost. Forcing these market participants into central clearing could reduce their activity, adversely affecting market liquidity. Moreover, if all-to-all trading were to develop, some dealers could reduce their commitment to market intermediation, with potential negative effects on both primary and secondary market functioning. However, it's also possible that all-to-all trading with broad central clearing would benefit liquidity during normal times with PTFs and dealers remaining actively engaged.

In sum, we view this paper as a first step in evaluating the proposition that a new Treasury market structure with expanded central clearing would be more resilient. While our findings

suggest significant netting benefits to dealers of market wide central clearing, a thorough study of the costs and equilibrium effects of such a fundamental shift in market structure is called for. Such an inquiry should carefully consider whether risk management, liquidity, and related supervisory policies need adjustment given a material expansion in CCP scope. The experiences of other large sovereign bond markets, and what distinguishes the Treasury market from other markets that have mandated clearing should also be examined. While these issues are complex, advancing work that might strengthen Treasury market resilience seems warranted given the market's critical role within the global financial system.

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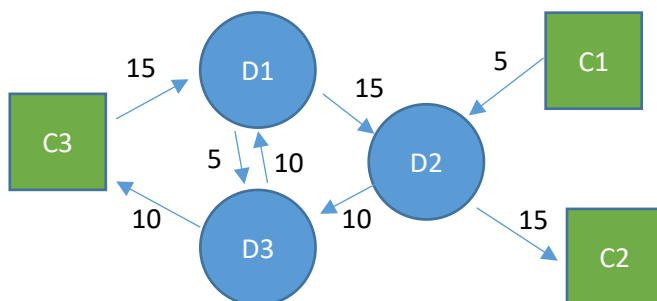
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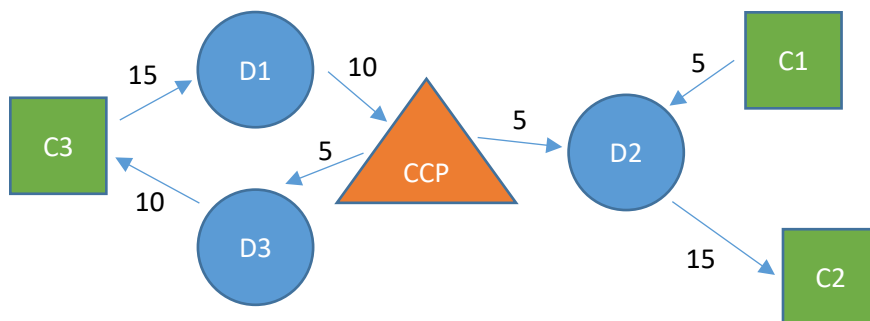
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### Box A – How Clearing and Netting Currently Work

We here consider a simple example of how clearing and netting currently work. To start, we consider a given security that trades eight times on a given day in the quantities indicated below, with the arrows pointing toward the buying party.<sup>45</sup> Before clearing or netting, security deliveries equal 85, the sum of the trading activity. Gross settlement obligations equal 170 ( $2 \times 85$ ), counting both the buy and sell sides. Dealers' gross settlement obligations equal 125 (80 with other dealers and 45 with customers) and customers' gross settlement obligations equal 45.



Under the current market structure, the CCP steps in as the counterparty for all trades between dealers and nets the obligations between itself and each of the dealers. The resulting settlement obligations are shown below. Security deliveries now equal 65 and gross settlement obligations 130. Dealers' gross settlement obligations decline to 65 (20 with the CCP and 45 with customers), customers' obligations still equal 45, and the CCP now has obligations of 20. Because of the substantial netting that occurs among the interdealer trades, the CCP's obligations are less than the reduction in dealers' obligations.<sup>46</sup>

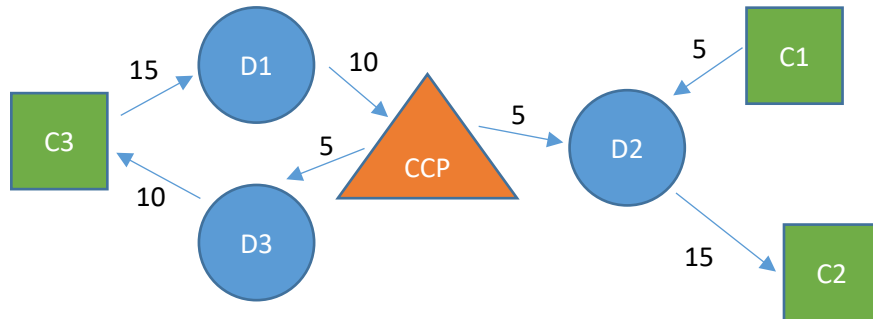


<sup>45</sup> For simplicity, we also assume these trades all settle on the same day and that there are no trades from earlier days that settle on that day.

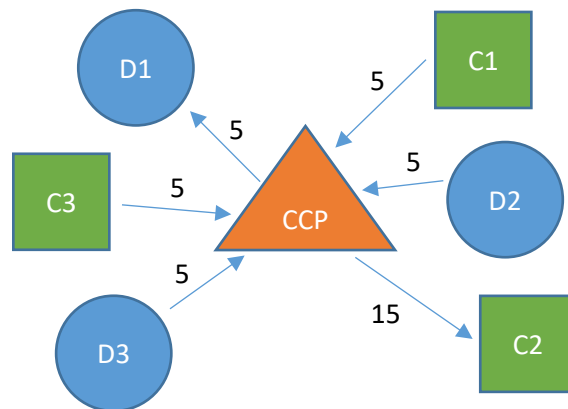
<sup>46</sup> It's easy to construct scenarios in which the CCP's obligations increase by more than dealers' obligations decline. If there were no netting among the interdealer trades, then dealers' settlement obligations would remain the same even as the CCP took on new obligations, increasing the total quantity of settlement obligations. It follows that there are also scenarios in which there is some netting, so that dealers' settlement obligations decline, albeit by less than the increase in the CCP's. In practice, one would expect substantial netting in a market with a high level of interdealer trading.

### Box B – How Market Wide Clearing and Netting Could Work

We here consider a simple example of how clearing and netting could work with market wide central clearing. We start with the same example as we concluded Box A with, shown again below. The CCP is the counterparty to dealers' trades with one another, but not dealers' trades with customers. Security deliveries equal 65 and gross settlement obligations 130. Dealers' gross settlement obligations are 65 (20 with the CCP and 45 with customers), customers' obligations are 45, and the CCP's obligations are 20.



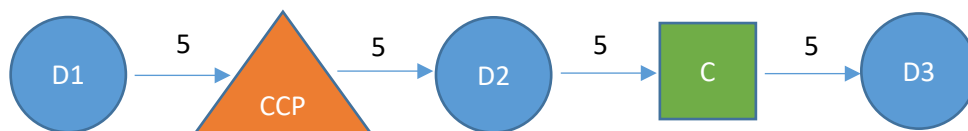
With market wide central clearing, the CCP steps in as the counterparty for all trades, including dealers' trades with customers, and nets the obligations between itself and each of the market participants. The resulting settlement obligations are shown below. Security deliveries equal 40 and gross settlement obligations 80. Dealers' gross settlement obligations are 15 (all with the CCP), customers' obligations are 25, and the CCP's obligations are 40. Dealers' gross settlement obligations decline because some of their customer trades offset their dealer trades, but also because some of the customer trades offset one another. Customers' obligations decline because some of their obligations offset one another. The CCP's obligations increase by less than the obligations of dealers and customers decrease because of all the netting.<sup>47</sup>



<sup>47</sup> Whether the CCP's obligations increase or decrease depends on the extent of netting among customer trades and between customer trades and dealer trades.

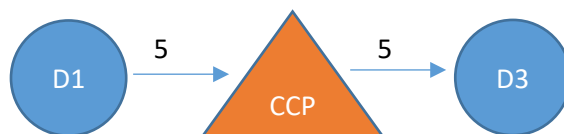
### Box C – How Market Wide Central Clearing Could Reduce Settlement Fails

We here consider a simple example of how market wide central clearing could reduce settlement fails. For a given security, we first consider a scenario under the current market structure in which Dealer 1 is failing to the CCP, which is failing to Dealer 2, which is failing to a customer, which is failing to Dealer 3. Total fails to deliver and total fails to receive both equal 20. Dealers' fails to receive and fails to deliver both equal 10, and the CCP's and customer's fails to receive and fails to deliver all equal 5.



Note that by construction, the CCP is between dealers in the chain, the customer is only adjacent to dealers, and dealers are never adjacent to one another. The CCP is between dealers because it only has counterparts that are CCP members, and we assume all dealers are members. If all dealers are members, then the CCP becomes the counterpart to every interdealer trade, so dealers cannot be adjacent to one another. Lastly, given that dealers intermediate customer trades, and that such trades are bilaterally cleared and settled, a customer can only be adjacent to dealers (although a customer could be at one or both ends of the chain).

With market wide central clearing, the chain simplifies greatly. No non-CCP entities can be failing to one another as the CCP is everyone else's counterparty. In our example, total fails to receive and total fails to deliver both drop to 10, dealers' and the customer's fails to receive and fails to deliver all drop by 5, and the CCP's fails to receive and fails to deliver are unchanged.



More generally, at worst, fails are unchanged with market wide central clearing (for a simple chain with a CCP between two dealers). As long as there is at least one customer in the chain (which could be at either end), fails are lower with expanded central clearing. Benefits of central clearing are then greater for chains with additional customers and dealers.