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**ALL-TO-ALL TRADING
IN THE U.S. TREASURY
MARKET**

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OVERVIEW

- Despite the U.S. Treasury market being the deepest and most liquid securities market globally, it has faced several incidents of market disruption in recent years, raising concerns about its resilience.
- The adoption of all-to-all trading in the Treasury market could be a potential solution to enhancing market resilience. This approach would enable any market participant to trade directly with any other participant, which could be beneficial during periods of market stress when the capacity of traditional intermediaries may be strained.
- The authors investigate the concept of implementing all-to-all trading in the secondary cash Treasury market, analyzing both the potential advantages and challenges associated with its adoption.
- They also examine trading methods currently in use within the Treasury market that expand the pool of trading partners, and discuss the obstacles that may hinder the more widespread use of such protocols or the implementation of new all-to-all trading protocols.

The market for U.S. Treasury securities has experienced several episodes of market dysfunction in recent years. The market has also evolved significantly, with changes in technology, market participants, and regulation, amid a substantial increase in the quantity of Treasury securities outstanding. This increase in Treasury debt outstanding has been accompanied by an increased demand for trading, which has outpaced the elasticity of broker-dealer balance sheets at times, hindering dealers' willingness to intermediate trading in stressed market environments, such as during March 2020 (Duffie 2020).

These episodes raise concern because Treasury securities fulfill many vital functions, including financing the U.S. government, providing a pricing benchmark for other financial assets, functioning as instruments for monetary policy

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implementation, and serving as a safe haven for investors. Having a well-functioning and efficient market is critical for all these purposes. So, while the Treasury market remains the deepest and most liquid securities market in the world, there are a wide range of ongoing efforts to promote the market's resilience, as discussed in the annual progress reports of the Inter-Agency Working Group for Treasury Market Surveillance (IAWG)¹ (see, for example, IAWG 2021, 2022, 2023, and 2024).

Some market observers have proposed all-to-all trading as a way to ease dealers' intermediation constraints and promote Treasury market resilience.² In its simplest form, all-to-all trading would allow any market participant to trade directly with any other market participant. Such a practice should obviate the need for a dealer to be on at least one side of every trade, mitigating the effects of intermediation constraints and allowing the market to smoothly handle a larger volume of trading flows.

In this article, we explore the concept of all-to-all trading in the Treasury secondary cash market and evaluate the benefits and challenges around its adoption. This work leverages past research on the structure of, and trading practices in, the Treasury market and other markets. It is also informed by outreach that the IAWG conducted with a variety of market participants, including liquidity providers, liquidity consumers, and trading platforms.³ This structured outreach included nineteen in-depth discussions with representatives of trading platforms, dealers, hedge funds, principal trading firms, asset managers, and academia.

We characterize all-to-all trading as a system in which all participants can provide and consume liquidity and two parties can trade with each other without having a prior trading or contractual relationship, and we identify several potential benefits to its adoption in the U.S. Treasury market. All-to-all trading could support market resilience by providing additional opportunities for trading partners to match on a trade without use of an intermediary, as noted earlier. This could be especially valuable at times of stress when trading flows are greater and dealer intermediation capacity is constrained. All-to-all trading could also increase competition, resulting in lower transaction costs for liquidity consumers. Moreover, it might improve transparency around trade data, promoting competition and efficiency.

In practice, there are a variety of trading protocols already offered in the Treasury market that exhibit some attributes of all-to-all trading and widen the field of partners to a trade. Innovation has also occurred, both through the entrance of new trading platforms and through the introduction of new trading protocols by established platforms. Protocols that offer wider sets of trading partners generally fall into four categories: anonymous request for quote (RFQ), central limit order book (CLOB), anonymous streaming, and match auctions. The protocols offer various trade-offs among immediacy, transparency, securities traded, and trade size.

We consider several challenges to the broader use of existing protocols or to the adoption of new all-to-all trading venues. One challenge concerns clearing and counterparty risk; most platforms that offer trading protocols with attributes of all-to-all trading are the legal counterparties to trades executed over their platforms, which can create unclear and complex clearing and settlement risks for the platform and contribute to broader financial stability risks. A second challenge concerns the suitability of less liquid Treasury securities for all-to-all trading; many protocols limit trading to more liquid on-the-run or near on-the-run notes and bonds, but benefits from all-to-all trading may be greater for less actively traded off-the-run Treasuries.⁴ A third consideration is the adequacy of price transparency for supporting all-to-all

trading; more widely available information about transactions would reduce informational asymmetries, which could increase the willingness of new liquidity providers to offer liquidity in all-to-all venues.⁵ A final and more fundamental consideration is whether all-to-all trading is seen as sufficiently beneficial to liquidity demanders—who may appreciate their direct dealer relationships, especially when needing to transact large sizes in less liquid issues—and liquidity suppliers—whose buy-in may be critical to the success of new trading protocols.

The rest of this article is organized as follows. In Section 1, we provide an overview of the current structure of trading and intermediation in the U.S. Treasury secondary market. Section 2 then discusses how to think about the application of all-to-all trading in the Treasury market, what problems it might solve, and what can be learned from other markets and past studies. In Section 3, we provide an overview of the trading protocols currently offered in the Treasury market that exhibit some attributes of all-to-all trading and widen the field of partners to a trade. In Section 4, we look at the challenges to broader use of these trading protocols and the adoption of all-to-all trading more generally. Section 5 concludes.

1. U.S. TREASURY SECONDARY MARKET STRUCTURE

The secondary cash market for U.S. Treasury securities has two main components:

In the interdealer segment, trading is generally among dealers and principal trading firms (PTFs).⁶ Most interdealer trading takes place on electronic platforms provided by interdealer brokers (IDBs) that operate CLOBs.⁷ These electronic platforms are required by the U.S. Securities and Exchange Commission (SEC) to register as broker-dealers and file a notice of operation as “alternative trading systems” (“ATs”) with the SEC.⁸ Electronic interdealer cash trading is concentrated in the most recently auctioned, or on-the-run, Treasury notes and bonds, consistent with the high “ATS & Interdealer” volumes for such securities reported in Table 1.⁹ Most interdealer trading of seasoned, or off-the-run, notes and bonds occurs on voice- and manual-assisted IDB platforms for which trading is less automated and at slower speeds. A small share of interdealer trading takes place via direct bilateral streams between dealers, and between dealers and PTFs.¹⁰

In the dealer-to-customer segment, dealers buy securities from and sell securities to a variety of clients, including foreign central banks, asset managers, pension funds, and hedge funds. A range of trading methods is used, from electronic RFQ, to direct streaming, to voice trading. Trading of off-the-run securities is much more common in the dealer-to-customer market than in the interdealer market, as seen in Table 1, and relies more on broker-dealers’ intermediation capacity than does trading in more liquid on-the-run securities.¹¹

1.1 Clearing

While dealer-to-customer transactions are typically cleared and settled bilaterally, interdealer cash transactions are cleared and settled either bilaterally or through a central counterparty (CCP), depending on whether the parties to the transaction are members of the CCP.¹² Dealers generally are CCP members, while PTFs and buy-side customers generally are not members.¹³ The CCP becomes a counterparty to each side of its members’ transactions following novation

TABLE 1
Daily Trading Volume of U.S. Treasury Securities

Billions of dollars

Security Type	On the Run		Off the Run		Total
	ATS and Interdealer	Dealer to Customer	ATS and Interdealer	Dealer to Customer	
Notes and bonds	254.3	129.1	39.7	79.3	502.3
Bills	17.2	25.0	20.9	54.5	117.7
TIPS	3.0	4.3	1.2	5.1	13.6
FRNs	0.1	0.4	0.1	1.0	1.6
Total	274.6	158.8	61.8	139.9	635.2

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

Notes: The table reports average daily trading volume of U.S. Treasury securities in billions of dollars between January 3 and December 30, 2022. The reported averages are based on activity reported by FINRA dealer-members only (even though certain depository institutions started reporting their trading activity to FINRA TRACE on September 1, 2022). When-issued trading activity before securities become on-the-run is excluded from the figures. Fleming, Shachar, and Van Tassel (2020) find that such trading accounted for 4 percent of trading volume across all U.S. Treasury securities between July 1, 2019, and June 30, 2020. ATS is alternative trading system, TIPS are Treasury Inflation-Protected Securities, and FRNs are floating rate notes.

and guarantees their performance, with each participant in such transactions facing the CCP for its obligation rather than the original trade counterparty. This enables each member to settle a single long or short obligation per security with the CCP, efficiently compressing the member's trades with CCP member counterparties.

In December 2023, the SEC voted to adopt rule amendments that will significantly expand central clearing in the Treasury market.¹⁴ The rule calls for the clearing of the following types of Treasury security trades (subject to some exemptions): all repurchase and reverse repurchase agreements (repos) to which a direct FICC member is a counterparty, all cash purchases and sales over IDBs, and all cash purchases and sales between a direct FICC member and a registered broker-dealer or a government securities dealer. Cash trades subject to the rule are required to be cleared by December 31, 2025, and repos subject to the rule are required to be cleared by June 30, 2026.

1.2 Changes in Market Size and Structure

The Treasury market's size and structure have evolved in recent decades, with important implications for its liquidity and resilience. At the end of 2007, Treasury debt held by the public totaled \$5.1 trillion, or 35 percent of U.S. gross domestic product (GDP) for that year. By the end of 2022, debt held by the public had reached \$24.5 trillion, or 93 percent of GDP.¹⁵ The Congressional Budget Office projects continued growth in both the nominal debt and its size relative to GDP in the coming decades (Congressional Budget Office 2023).

Regulations adopted in response to the Global Financial Crisis of 2007-09 and changes in financial institutions' internal risk management and business strategies have influenced dealers' willingness and ability to intermediate (Duffie 2020). Following the Global Financial

Crisis, reforms were made to strengthen the regulation, supervision, and risk management of the banking sector, including the Basel III reforms, first published in 2010 by the Basel Committee on Banking Supervision. U.S. regulators adopted the supplementary leverage ratio (SLR) for large bank holding companies as part of the U.S. implementation of the Basel III reforms. The SLR has been cited as one of the factors motivating banking organizations to dedicate capital to higher-margin businesses and limiting the amount and flexibility of bank and bank-affiliated broker-dealer balance sheets dedicated to low-margin businesses, including many forms of Treasury market intermediation.¹⁶

Increased use of electronic trading and new types of market intermediaries have changed how market liquidity is provided and influenced the characteristics of that liquidity. The growth in electronic trading has contributed to a particularly marked shift in the composition of participants in the interdealer market. Before the introduction of electronic trading, dealers had been the predominant participants in the interdealer market. PTFs first gained access to electronic trading platforms circa 2004, and by 2014 they represented the majority of trading activity in the futures and electronically brokered interdealer markets (Joint Staff Report 2015).

Whereas dealers often buy and sell from customers in large amounts, hold a portion of these positions across days, and maintain a large balance sheet to support their positions, PTFs buy and sell frequently in the interdealer market and typically end the day with relatively small net directional exposure on a risk-adjusted basis. PTFs tend to make trading decisions primarily based on immediate or near-term profitability and the level of market risk and do not typically maintain strong client relationships. PTFs also prefer to transact in more liquid securities, such as on-the-runs, where there is more data availability and transparency, and with electronic trading protocols that enable them to use automated trading strategies. Many PTFs are able to operate with less capital than typical broker-dealers due to their more limited net exposure and because they are not currently subject to the same regulations as broker-dealers. High concentration among PTFs has resulted in a small number of PTFs playing a key role in price discovery and the provision of market liquidity, even as dealers have increasingly also adopted similar electronic and high-frequency trading strategies (Joint Staff Report 2015, Harkrader and Puglia 2020).¹⁷

The growth of electronic trading and resulting changes in the mix of market participants have changed trading practices and the use of market infrastructure. As firms access multiple financial markets over ever-shorter time frames, markets have become increasingly interconnected, resulting in significantly faster information and risk transmission (Joint Staff Report 2015). Increased speed and sophistication in the transmission of security prices—generally associated with high-speed algorithmic trading strategies—have been linked to rapidly changing liquidity in periods of market stress.

2. WHAT IS ALL-TO-ALL TRADING?

“All-to-all trading” describes a range of trading protocols that, in their purest form, would enable any market participant to trade directly with any other market participant. We further characterize “all-to-all trading” as having two important aspects: all participants can provide and take liquidity; and two parties can trade with each other without having a prior trading or

contractual relationship. In the context of U.S. Treasury securities, having an entirely all-to-all market structure would, at least in principle, merge the interdealer segment with the dealer-to-customer segment and allow any market participant to trade any Treasury security directly with any other participant. In practice, there are few if any markets that allow purely all-to-all trading, but many market segments, including those in the Treasury market, employ protocols that to varying degrees broaden the set of trading participants.

Note that all-to-all trading does not necessarily imply that trading must be centralized. Although a centralized exchange generally allows all-to-all trading as long as all market participants can easily become members of the exchange, it is possible to have an all-to-all marketplace in which trading itself is bilateral and decentralized. Indeed, as the U.S. Treasury market evolved organically, “all-to-all”-like platforms have focused on the aforementioned two aspects without employing a CLOB. For instance, RFQ systems in which non-dealers are allowed to respond to quote inquiries and provide liquidity have aspects of all-to-all trading without centralized trading.

Additionally, in a pure all-to-all set up, the barriers to entry to the all-to-all trading system would be very low, enabling nearly any investor type to join the system and participate in all-to-all trading. In contrast, as discussed in Section 3, there are notable hurdles to usage of the current offerings of all-to-all like trading systems in the Treasury market.

2.1 What Problems Might It Solve?

Although issuance of Treasuries has increased dramatically in the past decade, total dealer intermediation capacity has not grown commensurately (Duffie 2020, 2023). Dealers’ limited intermediation capacity proved insufficient to accommodate the extraordinary selling pressures in March 2020 and thus contributed to the abrupt deterioration in market functioning at the time. All-to-all trading may alleviate this issue by allowing investors to trade directly with one another, without the use of an intermediary. All-to-all trading is unlikely to prevent market stress events such as those in March 2020 but may decrease the severity of such events.

All-to-all trading could also increase competition, resulting in lower transaction costs for liquidity consumers. All-to-all trading should make it easier for liquidity consumers to tap liquidity supply from a broader range of traditional intermediaries, as opposed to a limited set with which they have a prior trading or contractual relationship. Moreover, there may be times when investors have offsetting trading interests so that firms that traditionally consume liquidity compete with dealers to provide it.

All-to-all trading venues might also offer increased transparency of executable and executed prices. Increased transparency could, in turn, improve the bargaining power of liquidity consumers and lower barriers to participation for new liquidity providers that require more transparency, leading to lower trading costs and more efficient prices. Such effects could be greater for less liquid Treasuries, which have lower price transparency than more liquid securities such as on-the-run notes and bonds.

2.2 All-to-All Attributes in Some Other U.S. Financial Markets

Broadly speaking, the more centralized a financial market is, in terms of trading venues and trade clearance, the more easily should all-to-all trading be able to arise. For instance, a financial market consisting of a single exchange where all types of participants trade should provide

an ideal environment for all-to-all trading to become prevalent. Besides the opportunity that a single trading venue affords for all traders to potentially match, the fact that the exchange is the central counterparty to all participants removes the credit constraint that may prevent some participants from interacting with one another. Even in that environment, however, since some participants may choose to only consume liquidity or to only provide liquidity, preventing matching within each group, the extent of all-to-all trading would still depend on the trading behavior of market participants. One extreme version of this type of centralized financial market is the primary market for Treasury issuance, where the U.S. Treasury operates a one-to-all-like model, as described in Box 1.

In contrast, a completely decentralized over-the-counter (OTC) market, where customers can only trade by approaching a liquidity-providing intermediary affords no opportunity for direct trading among those customers. But intermediaries in OTC markets may still trade among themselves in “interdealer” trading venues where interactions among all intermediaries are possible, especially if a central counterparty eliminates concerns about credit risk. As described in Section 1, this is approximately the current organization of the secondary market for U.S. Treasury securities.

Trading in Treasury futures, in contrast, is closest to the first model described previously. Treasury futures are traded on a single exchange, the Chicago Board of Trade (CBOT, part of the Chicago Mercantile Exchange, the CME). All Treasury futures positions are centrally cleared by CME Clearing, which acts as the counterparty to every trade. Futures market transparency is also higher than in the cash market, likely because its centralized nature makes the capture and distribution of trading information more feasible and less costly. The reduction in information asymmetry among participants should also facilitate all-to-all trading by encouraging a larger number of participants to supply liquidity. Nonetheless, in practice, large dealers still play a material role in providing liquidity in the Treasury futures market, especially in the intermediation of large block transactions.

The U.S. equities market, with both an exchange-traded component and an OTC component, also has features that allow for all-to-all trading, although it is not clear how the increasing complexity of its market structure may affect all-to-all growth. As late as the early 2000s, the vast majority of trading activity, from both retail and institutional customers, occurred on two exchanges: the NYSE and NASDAQ. As of 2023, however, stocks could be traded on sixteen exchanges and also in other venues, including so-called dark pools in which large orders from institutional investors can be directly matched. In addition, a few large firms now internalize an important share of order flow, bypassing exchanges and ATSS. Even with the high number of trading venues, the strong regulatory oversight of the market, including the reference to a market-wide price, seeks to approximate a unified market driven by the trading activity of all participants. Moreover, all exchange-traded equity transactions are centrally cleared by the National Securities Clearing Corporation. The exchange-based market structure and the prevalence of central clearing are factors that favor all-to-all trading despite the recent increased complexity of this market.

In the corporate bond market, most trading is OTC and intermediated by broker-dealers, in many respects similar to trading for less liquid off-the-run Treasury securities. Clearing and settlement is done bilaterally. In recent years, the share of trading over electronic trading platforms has increased (Kozora et al. 2020), and a subset of that trading has all-to-all attributes. For example, since 2012, MarketAxess, the largest electronic platform in corporate bonds, has

offered its Open Trading protocol, which allows all-to-all-like trading in its RFQ trading mechanism. For trades executed through the Open Trading protocol, MarketAxess becomes the counterparty to both sides of the trade, and each side of the trade clears and settles with the platform (this practice is discussed in more detail in Section 3.1). However, even with Open Trading in place, dealers have remained, by far, the most important liquidity providers on the platform (Hendershott, Livdan, and Schurhoff 2021). This experience suggests that all-to-all protocols can supplement liquidity provision by dealers rather than replace it.

In the interest rate swap (IRS) market, following the implementation of Title VII of the Dodd-Frank Act (DFA) in 2014, swap market participants were required to use swap execution facilities (SEFs) to trade certain swaps, and those trades were required to be centrally cleared. Trading now occurs on SEFs using primarily RFQ protocols, while prior to the implementation of the DFA, most trading was voice or message based. As a result of the legislation and subsequent regulation, through usage of the SEFs, central clearing increased notably in the swap market, as did the use of more automated processes and the opportunity to trade with a wider range of counterparties. Note that the market structure change in the IRS market was the result of a change in regulation, while the market structure change in the corporate bond market was engineered by trading platforms, with no regulatory mandate.

Box 1

One-to-All in the Primary Market

The one-to-all nature of the primary market for U.S. Treasury securities may help illustrate the possible benefits of an all-to-all secondary market.

In auctions for U.S. Treasury securities, investors can participate in one of three ways: (1) directly as a submitter; (2) indirectly through a depository institution or a registered government securities broker or dealer (that is, as a customer); or (3) noncompetitively through a Treasury-Direct[®] account.^a The primary market for Treasury securities thus shares some similarities with an all-to-all market in that it does not require dealer balance-sheet space to intermediate between the seller, the Treasury, and the buyer, the Treasury security investor. In fact, as shown in the chart, a large and increasing share of Treasury issuance is purchased by entities other than primary dealers.

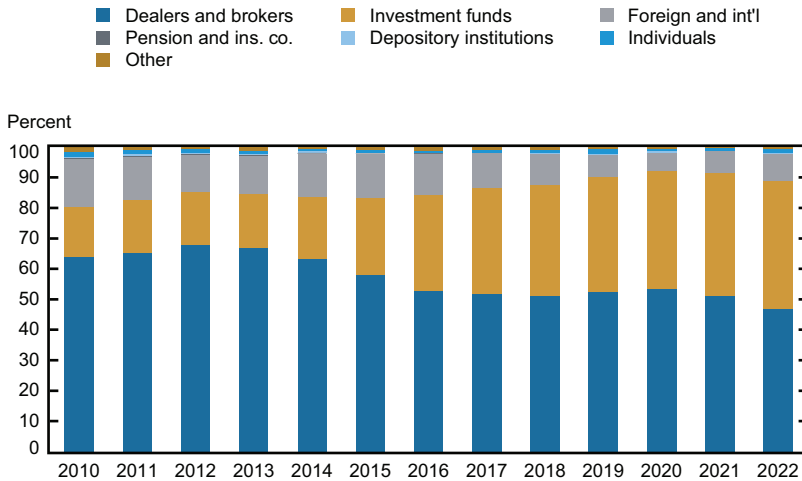
To be sure, primary dealers still play a key role in the smooth distribution of new issuance. Primary dealers are expected “to bid on a pro-rata basis in all Treasury auctions at reasonably competitive prices.”^b This obligation ensures that auctions are covered at reasonably competitive prices even when other investors’ bids are less numerous or less aggressive. So while the growth of bidding by other investors in Treasury auctions has prompted discussion on the reduced importance of the primary dealer model, this reduced reliance on dealer balance-sheet space has generally been considered beneficial for the Treasury, investors, and primary dealers. Of course, there are reasons why the one-to-all structure of the primary market is successful that may not be applicable to the secondary market. In particular, the Treasury is a regular and predictable seller of sizable and highly liquid on-the-run issues. Nonetheless, the primary market shows how a liquidity demander’s access to a broad range of investors, and not just dealers, can be beneficial.

(CONTINUED)

Box 1 (CONTINUED)

CHART

Investor Class Auction Allotments of Treasury Securities



Source: Authors' calculations, based on data from the U.S. Treasury Department.

Notes: The chart plots investor class allotment shares of U.S. Treasury securities by year. Shares are calculated excluding Federal Reserve purchases and are averaged across all U.S. Treasury securities (bills, notes, bonds, Treasury Inflation Protected Securities, and floating rate notes) issued in a given year.

^a Entities permitted to submit bids directly include, but are not limited to, individuals, primary dealers, other brokers and dealers (nonprimary), various types of investment funds (including pension, hedge, and mutual), insurance companies, depository institutions (banks), foreign and international entities (governmental and private), and the Federal Reserve (System Open Market Account). For more information about Treasury auctions, see <https://www.treasurydirect.gov/help-center/auction-faqs/>.

^b Dealer expectations and requirements are posted on the New York Fed's website at <https://www.newyorkfed.org/markets/primarydealers>.

2.3 Academic Literature on the Impact of All-to-All Trading

The academic literature on how all-to-all trading affects market functioning and quality is limited. This is in part because all-to-all trading has usually been adopted along with other changes in the market, such as increased transparency, centralized trading, and central clearing, and in part due to the lack of adoption of pure all-to-all trading, making it difficult to isolate its effects. Benos, Payne, and Vasios (2020) find increased competition among liquidity providers and lower transaction costs in the IRS market after the Dodd-Frank Act required a

subset of contracts to trade on SEFs. Hendershott, Livdan, and Schurhoff (2021) show that transaction costs decreased in the U.S. corporate bond market with the introduction of an all-to-all trading protocol. To be sure, they find that many investors still appear to prefer dealer intermediation to all-to-all trading so that, by their definition, all-to-all trading in the market stood at 12 percent as of 2018, with only 2 percent being investor-to-investor trading, 3 percent being dealers trading with new clients, and 7 percent being new liquidity providers acting like dealers. Nonetheless, they find that even a small share of all-to-all trading in a market results in a more competitive trading environment, improving liquidity, and lowering the cost of trading. Barclay et al. (1999) study the effects of the SEC's 1997 NASDAQ reform that made it easier for limit orders submitted by the public to compete directly with dealers' limit orders. Before the reform, NASDAQ was a quote-driven, dealer-centric market similar to the dealer-to-customer segment of the U.S. Treasury market. They show that the reform improved market quality, with the caveat that it is difficult to isolate the impact coming purely from more liquidity provision by nondealers.

Kutai, Nathan, and Wittwer (2023) compare the Israeli government bond market, which is a centralized exchange, and the U.S. Treasury market during March 2020. They find that the Israeli bond market performed better during this stress time and provide evidence that the better performance is due to both nondealers providing liquidity during times of stress and more efficient settlement netting. Dobrev and Meldrum (2020) suggest that, among other factors, the all-to-all trading structure in the U.S. Treasury futures market partly explains why in March 2020, during the height of the pandemic, futures market liquidity did not deteriorate as much as liquidity in the on-the-run cash market.

Most of the theoretical literature that compares OTC markets and centralized exchanges focuses on the bilateral versus centralized nature of trading.¹⁸ Although it is possible that a centralized exchange with a broader set of market participants may develop alongside the current market structure in the U.S. Treasury market, the current all-to-all-like platforms have mostly focused on allowing a broader set of participants to provide liquidity and allowing participants to trade with one another.

3. TRADING PROTOCOLS THAT OFFER A BROADER SET OF TRADING PARTNERS

While all-to-all trading in its purest form does not exist in the U.S. Treasury market, there are a range of electronic trading protocols offered by various platforms that exhibit some attributes of all-to-all trading and widen the field of partners to a trade. Innovation has occurred, both through the entrance of new trading platforms to the Treasury market and through the introduction of new trading protocols by established platforms. Additionally, there are trading platforms that serve as aggregators for multiple types of trading protocols. Protocols that offer wider sets of trading partners generally fall into four categories: anonymous request for quote, CLOB, anonymous streaming, and match auctions.¹⁹

While some market observers think about all-to-all trading platforms as offering: (1) fair and equal access for all interested parties, and (2) protocols that facilitate the interaction of trading interest among all participants without restrictions based on participant type, in

practice some trading platforms that describe their trading protocols as “all-to-all” may impose limits to platform access or interaction of trading interest among participants on the platform to limit counterparty credit risk and in response to the preferences of certain participants.

3.1 Anonymous Request for Quote

Anonymous RFQ is a frequently cited protocol when discussing an expansion of all-to-all trading in the Treasury market. To understand how anonymous RFQ works, it is helpful to revisit how disclosed RFQ works, which is widely used in the Treasury market for client trading.

In a disclosed RFQ protocol, a customer sends an order to a number of disclosed counterparties, typically four to five, with which the customer is already set up to trade. These counterparties respond with a quote and the customer can execute on whichever one it prefers, typically the one with the best price. In a disclosed RFQ, the trade is executed between the customer and the winning liquidity provider. Both have full knowledge of who is on the other side of the trade from the time the customer sends an order, and they face each other directly for clearing and settlement. Disclosed RFQ is the primary way in which off-the-run securities are traded, though any Treasury security can be traded this way.

In an anonymous RFQ protocol, a market participant can send out a request for a quote to all liquidity providers on the platform set up to engage in anonymous RFQ. This can be a much larger group of trading partners than the typical four or five available on a disclosed RFQ. The market participant will then receive a number of quotes back and can execute on the most attractive one. The trade is completed without either side of the trade having knowledge of their trading partner. In most cases, the trading platform serves as the intermediary and is the legal counterparty to both sides of the trade.²⁰ If a trade participant is a member of the CCP, the participant and platform submit that side of the trade to the CCP. The platform is thus able to step out of the trade altogether if both trade counterparties are CCP members. If a counterparty to one leg of the trade does not centrally clear, the trading platform clears and settles that side of the trade bilaterally with that counterparty, assuming the settlement risk.²¹

A key element that places anonymous RFQ along the spectrum toward all-to-all trading is that it allows a customer to send out an RFQ to counterparties with whom the customer does not have an existing counterparty relationship. Moreover, any type of institution that meets the platform’s membership criteria can sign up as a liquidity provider on an anonymous RFQ system, opening the possibility for a trading match between counterparties outside of the typical set of intermediaries. In practice, the platforms have membership requirements that can be burdensome, and the liquidity providers on these platforms tend to be the typical liquidity providers, specifically dealers.

Engaging with these protocols can also be a challenge for liquidity consumers, which need to become clients of the trading platform’s sponsoring firm or else use an agent. Depending on the platform’s membership requirements and the market participant’s needs, this can be a significant barrier to entry, unless trading through an agent is easily available.

Some platforms also offer hybrid options in which a client can send out an RFQ to a certain number of disclosed counterparties with which it has a counterparty relationship as well as to the anonymous counterparties enabled by the platform.

3.2 Central Limit Order Book

CLOBs operated by several IDBs have a major presence in the secondary market for on-the-run and near on-the-run Treasury notes and bonds. The IDBs offer the participating firms proprietary electronic screens that post the various bid and offer prices of the participants, along with the associated quantities. The IDB platforms act as blind brokers to the customers, standing in the middle of each trade as principal to each of the participants to preserve the anonymity of each party. The clearing and settlement process is similar to anonymous RFQ. The intermediating platform is the legal counterparty to each trade, and trades are centrally cleared when the counterparties are members of the CCP.

Initially, trading on major CLOBs was limited to government securities dealers that were CCP members. However, over time CLOB participation expanded to include nondealer participants, including PTFs and sometimes hedge funds. Brain et al. (2018) estimate that PTFs account for 62 percent of trading volume on IDBs, dealers account for 33 percent, and buy-side firms account for 5 percent.

Trade amounts on the large CLOBs are in \$1 million increments. This standardization of trade sizes allows for faster trading and processing efficiencies, attributes that are attractive to certain investor types.

Similar to the RFQ protocol, while trading on the CLOBs is typically anonymous, there is a spectrum of offerings of this product, including options with disclosed counterparty names.

Operational barriers to entry have likely limited further expansion and broadening of participants on the CLOBs, particularly for smaller participants or for those that are not members of the CCP. In addition, infrastructure costs to succeed in this trading environment are often viewed as prohibitive. Moreover, because trading venues offering CLOBs assume settlement risks, many venues have restrictions on the types of participants that can be members of the platform and place limits on the trading activity and risk taken by those participants.

A CLOB with a wider range of participants could look similar to the Treasury futures market.²² However, this protocol as currently constructed in the Treasury cash market might not be successful for less liquid Treasury securities (such as off-the-runs), unusually sized trades, or large trades. That said, it is possible that if an active trading platform were designed for these less liquid securities and/or to allow for block trades, trading activity in these securities might increase to the point that a CLOB-like structure could be successful for off-the-run trading. It is noteworthy that in the equities market, for example, a diverse set of securities with varying degrees of liquidity trade on CLOB-like structures.

3.3 Anonymous Streaming

Some electronic platforms offer the ability for liquidity providers to stream prices anonymously to platform customers. When the prices streamed are executable prices, customers are then able to immediately execute trades based on those prices. Moreover, the platform becomes the counterparty to both sides of the trade as with the anonymous RFQ and anonymous CLOB protocols. Clearing and settlement work in a similar way.

Market participants may prefer to transact with preferred counterparties, particularly in times of stress, in hopes of receiving preferential pricing and reliable execution. In those

TABLE 2

Summary of Select U.S. Treasury Market Trading Protocols

Trade Protocol	Securities Predominantly Traded	Trade Size Increment	Limitations
Anonymous request for quote	On-the-run notes and bonds	Customizable	Trades can take some time to execute; low price transparency
Central limit order book	On-the-run notes and bonds	Standardized	Difficult to trade in size increments not \$1 million
Anonymous streaming	On-the-run notes and bonds	Usually standardized	Not widely offered
Match auctions	Less liquid securities (off-the-run notes and bonds, bills, TIPS, FRNs)	Customizable	May be challenging to find a matching trade

Note: TIPS are Treasury Inflation-Protected Securities and FRNs are floating rate notes.

cases, disclosed price streaming (also called direct price streaming) may be a preferable protocol. In recent years, direct price streaming has become more common as a dealer or market maker can provide individualized price streaming to customers. Multiple direct streams set up for an individual customer are sometimes described as a “customized name-disclosed CLOB.” Importantly, this enables the customer to see prices that are available to it before a potential trade without needing to signal a desire to trade. This type of disclosed counterparty-specific trading is further from all-to-all trading than an anonymous CLOB, but allows customization for certain types of participants, which cannot be done on a CLOB as currently designed.

3.4 Match Auctions

Various approaches have been taken to creating anonymous match auctions through which market participants come together on a trading platform at particular times of the day to match offsetting orders in specific securities. These protocols are largely anonymous and are primarily used for less liquid sectors of the Treasury market such as off-the-run notes and bonds and Treasury Inflation-Protected Securities (TIPS). In anonymous match auctions, as with the other anonymous protocols, the platform becomes the counterparty to both sides of the trade.²³

3.5 Trading Protocol Trade-Offs

The trading protocols—RFQ, CLOB, streams, and match auctions—whether anonymous or not, offer trade-offs for prospective Treasury market participants, as summarized in Table 2.

RFQ trading protocols offer market participants more flexibility in the size of the trade they can execute, but the trade may take more time and have less price transparency.

CLOBs, as they are currently constructed, offer immediacy in risk transfer and enhanced

price transparency, but are best suited to trading in standardized transaction sizes with more homogeneous instruments. For example, analysis of data from the FINRA TRACE shows that nearly all trades conducted on IDBs are in round million-dollar increments, whereas just one-fourth of dealer-to-customer trades are executed in million-dollar increments.²⁴ It could be difficult for many customers to move to a CLOB given their high share of trade sizes in non-round amounts, a point mentioned by various market participants.

Anonymous streams offer immediacy and a wider range of counterparties, but disclosed streams, which have grown more significantly, further limit the number of counterparties to a trade, particularly when the streams are tailored to a particular customer.

Match auctions primarily work through matching market participants with similar and offsetting trading needs. Concentrating demand to buy and sell specific securities at certain times during the trading session increases the likelihood of finding offsetting matches for less liquid securities. However, in practice, finding offsetting matches at the same time in less liquid securities can be challenging, especially if a limited number of participants engage on the platform.

4. CHALLENGES TO ADOPTION OF ALL-TO-ALL TRADING

While all-to-all trading in the Treasury market could mitigate the effects of intermediation constraints and thereby allow the market to smoothly handle a larger volume of trading flows, there are several challenges associated with its use. In particular, whether existing protocols could expand to more of an all-to-all structure, or whether all-to-all trading could develop organically, depends on at least four factors.

4.1 Clearing and Settlement Risks

One consideration is whether the challenges associated with clearing and counterparty risks can be overcome. Trading platforms expand the range of potential trading partners and create efficiencies by consolidating trading, clearing, and settlement activity through the protocols discussed in the preceding section. However, the concentration of activity in these platforms can also increase clearing and settlement risks for the platform and add to broader financial stability risks.

In anonymous trading protocols, a trade is completed without either side having knowledge of the institution on the other side of the trade, with the trading platform standing as the counterparty to both sides of the transaction. This structure provides benefits to the trading platform clients; in particular, the costs of onboarding new counterparties are reduced because clients only have to onboard the platform as a counterparty rather than all of the potential trading partners that transact on the platform.

At the same time, this structure can create challenges for both the trading platform and the broader marketplace if it results in a concentration of risk that is not adequately managed. For trades between participants in which one or both are not CCP members, the trading platform typically accepts the credit and settlement risk associated with the trades of the non-CCP member. To manage this risk, the platform may need to limit the number of clients it onboards or provide clients with lower credit limits. Additionally, as these platforms grow, clearing and

settlement risks become more concentrated with the trading platforms, which can increase systemic risk if the platforms fail to effectively manage their direct and indirect clearing and settlement risks. Importantly, Treasury trading platforms are not subject to the same regulatory requirements for risk management as a CCP (Treasury Market Practices Group 2019). Given these clearing and settlement risks, proposals to increase the resilience of the Treasury market have advocated mandatory central clearing.²⁵

In a centrally cleared trade, the CCP becomes the counterparty to each side of the transaction. Therefore, central clearing can enable operators of trading platforms to open their venues to a wider set of market participants without increasing their clearing and settlement risks. Clearing and settlement risks instead concentrate at the CCP, which is regulated by the SEC as a covered clearing agency (CCA), and which is designated a systemically important financial market utility (which provides the Federal Reserve with certain supervisory authority). The CCA regulatory framework covers a variety of risk management and governance standards, including margin requirements, due diligence of liquidity providers, and a requirement for sufficient liquidity resources.

To be sure, CCPs' margin and liquidity requirements can impose additional costs on some market participants. That said, such additional costs may be appropriate to the extent that they are costs for risk management activities that are not being done adequately without central clearing. Moreover, even if such additional costs have a modest adverse effect on market liquidity during normal times, improved risk management can help bolster the market's resilience and promote meaningfully improved liquidity during times of stress.

4.2 Suitability of Less Liquid Securities for All-to-All Trading

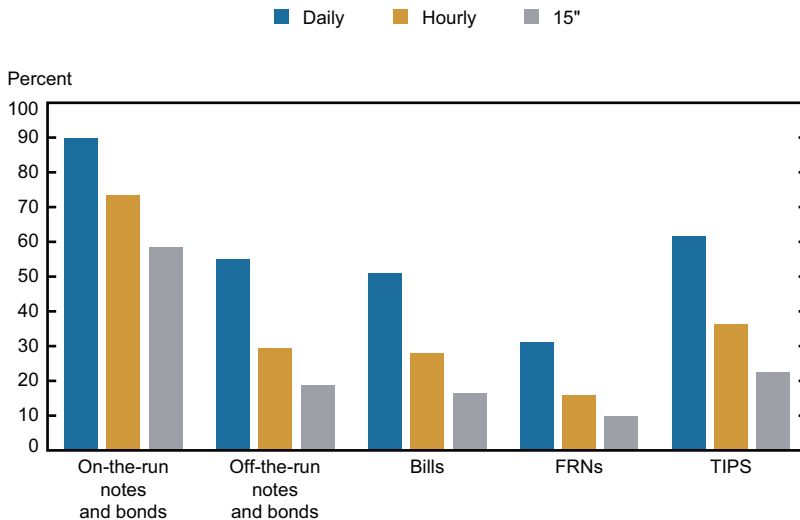
A second consideration is whether less liquid Treasury securities, such as deep off-the-run securities, are well-suited to all-to-all trading. An ideal all-to-all trading venue would allow market participants to trade the full range of Treasuries and, in fact, the benefits of all-to-all might be greatest for those that are less actively traded. However, most electronic trading protocols in the Treasury market are limited to the trading of on-the-run or near on-the-run notes and bonds, even though 98 percent of U.S. Treasury notes and bonds outstanding are off-the-run.²⁶

Dealer-to-customer trading in Treasuries currently occurs primarily through disclosed RFQ or via message/voice trades, with message/voice trading used more often in the case of block trades. At the time of trade in less liquid securities, the broker-dealer may not have an offsetting trading interest from another customer, requiring the dealer to warehouse the security on its balance sheet. As a result, trading in less liquid securities relies more on dealer balance-sheet capacity and intermediation than does trading in more liquid securities, for which there are more frequent offsetting trading interests.

The reliance on dealer balance-sheet space to intermediate customer trades became problematic in March 2020 when massive customer selling of Treasuries overwhelmed dealers' intermediation capacity (Duffie 2020). This led to a marked deterioration of market functioning, spurring a range of policy responses, including the Federal Reserve's market functioning purchases (Fleming et al. 2022). Strains were especially pronounced in off-the-run securities (Board of Governors of the Federal Reserve System 2020), because of the heavy selling of such securities (Fleming et al. 2022) and because of the outsized effects of such selling on dealers'

CHART 1

Customer Buy and Sell Volume that Offsets



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

Notes: The chart plots the percent of customer trading volume with dealers that has offsetting customer trading volume in the same security for the same settlement day within the same time interval between January 3 and December 30, 2022. As an example, if one or more customers bought \$40 million of the second off-the-run ten-year note for next-day settlement within a particular fifteen-minute interval and one or more customers sold \$10 million of the same security for next-day settlement within the same fifteen-minute interval, then we would say that \$20 million in customer trading volume was offset out of a total of \$50 million traded for that security, settlement day, and interval. Reported percentages are averages of percentages first calculated on a daily basis.

balance-sheet and risk-management constraints. This experience suggests that the off-the-run segment of the market might especially benefit from all-to-all trading, even though this segment could be more difficult to transition because of its relatively low liquidity.

Trading protocols with a wider range of trading partners do not currently enable trading in less liquid securities because such protocols likely work best when there is concurrent (or near concurrent) interest to buy and sell a given security. Such instances are presumably common for actively traded on-the-run notes and bonds, but much less common for off-the-run securities. In IAWG outreach, investors and dealers raised concerns about the information leakage of conducting block trades in off-the-runs on a CLOB or through RFQ to multiple parties, since the liquidity providers in such trades fear they would face unattractive pricing when facilitating intermediation of these securities were the trades widely known.

Analysis of FINRA TRACE data supports the conjecture that purchases and sales of less liquid Treasuries at around the same time are relatively uncommon. Only 19 percent of customer trading activity in off-the-run notes and bonds has offsetting activity in the same security within the same 15-minute interval, on average, as shown in Chart 1.²⁷ Similar dynamics are seen for TIPS (22 percent), bills (17 percent), and floating rate notes (FRNs,

10 percent). In contrast, the comparable figure for on-the-run notes and bonds is 58 percent. That said, the prevalence of matching trades increases notably when the time frame for matching is widened to an hour and especially to the entire day. The higher matching rates as the time frame widens support the idea that innovative protocols for trading less active securities (such as periodic batch auctions) could intermediate meaningful volumes of off-setting flows.

Even then, for these protocols to be successful in the currently less liquid segments of the Treasury market, trading activity would likely need to increase. The creation of a viable trading venue, perhaps supported by increased transparency, could help bring about such an increase in activity for these securities. That is, the current level of activity of Treasuries reflects the current market structure, but a different market structure could have a very different level of activity, with positive feedback effects between transparency, liquidity, and trading activity (a point also made by Musto, Nini, and Schwarz 2018).

4.3 Data Transparency

A third factor is whether data transparency is adequate to support all-to-all trading. In the current environment, liquidity providers have better information about market prices and liquidity given their level of activity and, in the case of dealers, their range of customer counterparts. This asymmetric information means that firms that are typically liquidity consumers would face adverse selection if they considered providing liquidity. That is, if an entity tried to make a market with information inferior to that of its potential counterparts, it would either have its unprofitable bids and offers picked off by better informed counterparts or it would have to post bid-ask spreads so wide that few counterparts would want to trade against it.

Increased pre- and post-trade transparency would lower informational asymmetries, which could increase the willingness of new liquidity providers to offer liquidity, supporting an all-to-all trading structure. Pre-trade transparency might include information such as bid and offer prices and associated sizes, whereas post-trade transparency could include prices, sizes, and trade times.²⁸ In addition to increased transparency making all-to-all trading more likely to develop organically, several academic papers find that increased pre- and post-trade transparency leads to more liquid markets because liquidity providers are more likely to provide liquidity when adverse selection costs are low (transparency is high), and liquidity demanders are more likely to ask for competitive prices if they have more information.²⁹

As noted earlier, all-to-all trading could spur positive feedback effects among data transparency, liquidity, and trading activity. So transparency may not only foster all-to-all trading, improved liquidity, and increased trading activity, but all-to-all trading may promote increased data transparency. Increased trading activity would improve information about prices through market-wide protocols, such as Treasury TRACE, to the extent those prices were publicly disclosed on a timely basis. Moreover, an all-to-all venue might choose to disclose information about activity on its platform to promote liquidity and activity on its platform.

4.4 Perceived Benefits

A final and more fundamental consideration is whether all-to-all trading is seen as sufficiently beneficial to spur interest in protocols that are closer to all-to-all. Some important possible

benefits of all-to-all trading, including market resilience, market efficiency, and price transparency, are public goods. Public goods are underinvested in without adequate coordination, which could impede all-to-all's development. An additional possible benefit of all-to-all trading is greater competition among liquidity providers, which could lead to lower trading costs for liquidity consumers. Even then, the benefits relative to current trading practices are uncertain, and liquidity providers may not be supportive of new protocols if they are expected to be less profitable.³⁰

Across the various trading protocols discussed in Section 3, anonymous trading is common. However, some market participants prefer to transact with known counterparties. Some protocols thus have some sort of disclosed counterparty or counterparty grouping, and this feature can be used by either liquidity providers or liquidity consumers. Trading with disclosed counterparties helps liquidity consumers maintain relationships with liquidity providers.³¹ The proliferation of direct streams from liquidity providers to liquidity consumers provides further evidence that some liquidity consumers like transacting with certain disclosed counterparties.

More generally, many customers value their long-term relationships with their broker-dealers and seem comfortable with their current mode of execution, making them hesitant or unmotivated to transact more in anonymous trading venues. They believe they receive better pricing from a direct counterparty relationship with a dealer than through an anonymous trade, and that dealers are particularly important for discreetly handling large trades in less liquid securities. Moreover, at times of market stress, having pre-existing relationships is seen as important for giving dealers' added incentive to take the other side of a trade. The broker-dealer relationship is also cited as providing benefits besides execution, such as financing and information about market conditions.

The view that dealers can often provide better pricing when engaging with them directly may be a product of the current market structure in which trading is more relationship-based and in which price transparency is limited. Were all-to-all to be adopted, pricing could become more competitive, reducing customers' preference for relying on established relationships for certain transactions. Moreover, all-to-all trading could result in increased price transparency, which could further reduce the benefits of disclosed trading with trusted counterparties. Aside from liquidity consumers, buy-in from liquidity suppliers may also be important for the adoption of new trading protocols. Liquidity providers benefit from intermediation revenues in the current dealer-intermediated market structure. Some of them might choose to not engage with all-to-all trading if they perceived it as negatively affecting their business model. This could reduce the venues' ability to attract customers, although lack of participation by some liquidity providers would presumably increase profit opportunities for others.

Unsuccessful attempts by platforms to launch all-to-all trading protocols reveal the importance of buy-in by key stakeholders. For example, dealer support may be a necessary, but not sufficient, element for success. Without explicit demand from the largest and most active customers, the downstream providers of connectivity and post-trade services (order management services, vendors, clearinghouses, and so forth) may not have sufficient incentive to provide the systems connectivity necessary to make all-to-all trading attractive for many market participants. That said, these barriers to success could be lower if the Treasury market environment were to become more favorable for all-to-all trading, via increased central clearing and data transparency especially.

On the other hand, were all-to-all trading to be successful in narrowing bid-ask spreads in the market, dealers might choose to reduce their activity in the market due to decreased profitability, and hence be less present to provide liquidity in times of stress. This could be especially problematic in parts of the market in which dealers' warehousing of risk is important. In off-the-run securities, for example, buyers and sellers are less likely to arrive at the same time, so dealers generally provide intermediation by taking on customer positions and the associated risks until the positions can be closed out. It follows that if dealers were to reduce their intermediation activities, customers might have to wait longer to trade. However, it is also possible dealers would remain important liquidity providers in a market with all-to-all trading, especially for large trades (Duffie 2020).

5. CONCLUSION

Although the U.S. Treasury market remains the deepest and most liquid securities market in the world, recent disruptions have increased discussion of how its resilience might be improved. One proposal is for the adoption of all-to-all trading, in which any market participant could trade with any other. All-to-all trading could improve market resilience by providing opportunities for trading partners to match on a trade without use of an intermediary. This could be especially helpful at times of stress when trading flows are greater and intermediation capacity is constrained. All-to-all trading could also increase competition, resulting in lower transaction costs for liquidity consumers, and it might improve transparency around trade data, promoting competition and efficiency.

Several trading protocols currently operate in the Treasury market that exhibit some attributes of all-to-all trading and offer a broader range of trading partners. These include anonymous request for quote, CLOB, anonymous streaming, and match auctions. The protocols offer various trade-offs among immediacy, transparency, securities traded, and trade size. CLOBs, for example, offer immediacy and transparency but only for on-the-run notes and bonds in standardized sizes. Other protocols allow for customizable sizes in the full range of Treasuries, but lower transparency and less assurance that a trade interest can be met on a timely basis.

Whether existing protocols could expand to more of an all-to-all structure or whether new all-to-all trading venues could arise depends on several factors. One issue concerns clearing and counterparty risks. Many existing protocols involve the trading platform sponsors serving as legal counterparties to the trades executed over their platforms, which can create unclear and complex clearing and settlement risks and contribute to broader financial stability risks. Given these risks, proposals to increase the resilience of the Treasury market have advocated for mandatory central clearing. Broader central clearing could enable operators of trading platforms to open their venues to a wider set of market participants without increasing their clearing and settlement risks.

A second challenge concerns the suitability of less liquid Treasury securities for all-to-all trading. The benefits from all-to-all trading may be greater for less liquid Treasuries, as it is more costly for dealers to intermediate securities that trade less actively among dealers, but the

infrequent trading means that customer purchases and sales infrequently occur around the same time, raising concerns about all-to-all's viability. Innovative protocols for trading less liquid Treasuries and improved pricing transparency could help solve this paradox, possibly creating a virtuous feedback loop between data transparency, liquidity, and trading activity.

A third consideration is the adequacy of price transparency for supporting all-to-all trading. More widely available information about transactions would reduce informational asymmetries, which could increase the willingness of new liquidity providers to offer liquidity in all-to-all trading venues. All-to-all trading could also promote price transparency—through market-wide protocols if trading activity were to increase—or via all-to-all venues that disclose information about activities on their platforms.

A final and more fundamental consideration is whether all-to-all trading is considered sufficiently beneficial to liquidity demanders (such as customers) and liquidity suppliers (such as dealers). Liquidity demanders may appreciate their direct dealer relationships, especially when needing to transact large sizes in less liquid issues, and hence may be hesitant to migrate to venues without such relationships. Liquidity suppliers—whose buy-in may be critical to the success of new trading protocols—may choose not to engage with new venues if they see them as negatively affecting their business model. Moreover, many of the potential benefits of all-to-all trading, including market resilience, market efficiency, and price transparency, are public goods and hence underinvested in without adequate coordination.

Trading protocols are continuing to evolve in the Treasury market and trading platforms are introducing new ways of transacting. The mix of trading among types of institutions is also shifting, and new entrants are further altering the landscape of trading. Moreover, the regulatory landscape is changing, with the official sector making progress toward its goal of enhancing the resilience of the Treasury market. Market structure innovations such as all-to-all trading – which could provide new avenues of trading—might also enhance the Treasury market's liquidity, efficiency, and resilience.

NOTES

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¹ The IAWG consists of staff from the U.S. Department of the Treasury, the Board of Governors of the Federal Reserve System, the Federal Reserve Bank of New York, the U.S. Securities and Exchange Commission (SEC), and the Commodity Futures Trading Commission (CFTC). The IAWG was formed by the Treasury Department, SEC, and Federal Reserve Board in 1992 to improve monitoring and surveillance and strengthen interagency coordination with respect to the Treasury market following the Salomon Brothers auction bidding scandal (U.S. Department of the Treasury, Securities and Exchange Commission, and Board of Governors of the Federal Reserve System 1992).

² See Duffie (2020), Liang and Parkinson (2020), Group of Thirty Working Group on Treasury Market Liquidity (2021), Alderighi, Benos, and Gurrola-Perez (2022), and Cantrill et al. (2022).

³ In this article, we define the term “liquidity” to mean the ability to buy or sell assets in size with limited price impact. Additionally, we refer to those market participants who provide purchase or sale liquidity for a variety of securities and times, such as dealers, as “liquidity providers” and those who seek to execute trades in specific securities and at particular times, such as customers, as “liquidity consumers.”

⁴ On-the-run securities are the most recently auctioned issues of a given tenor. Off-the-run securities are older issues of a given tenor.

⁵ It follows that while adoption of all-to-all trading could promote data transparency, data transparency could also promote all-to-all trading.

⁶ PTFs trade as principals for their own accounts and generally use automated trading strategies. Many PTFs are currently not registered as dealers with the SEC.

⁷ For background on CLOBs, see Fleming, Schaumburg, and Yang (2015).

⁸ A current list of ATSS that have an active Form ATS on file with the SEC can be found at <https://www.sec.gov/foia/docs/atsslist>. Relatedly, in January 2022, the SEC proposed to, among other things, amend Regulation ATS to better protect investors, promote fair and orderly markets, and enhance cybersecurity for ATSS that trade Treasuries and other government securities. For more information, see <https://www.sec.gov/news/press-release/2022-10>.

⁹ Data from the Financial Industry Regulatory Authority (FINRA) Trade Reporting and Compliance Engine (TRACE) divide trades into two categories: “ATS and Interdealer” and “Dealer-to-Customer.” The “ATS and Interdealer” category includes the sell side of a trade when a trade is executed on an ATS or when a trade is executed between two FINRA members outside of an ATS. For more information, see <https://www.finra.org/finra-data/browse-catalog/about-treasury>.

¹⁰ Brain et al. (2018) find that about 6 percent of secondary market trading volume in Treasuries occurs directly between dealers.

¹¹ Recent buy-side commentary has noted that dealers are increasingly acting as agents by shopping inquiries instead of always being willing to add to inventory, consistent with the dealer intermediation channel being narrower, and perhaps opening an opportunity for growth of all-to-all venues.

¹² There is currently one CCP for Treasury securities: the Fixed Income Clearing Corp.

NOTES (CONTINUED)

¹³ For more information on clearing arrangements across the cash Treasury market, see Treasury Market Practices Group (2019).

¹⁴ See <https://www.sec.gov/rules-regulations/2023/12/s7-23-22>.

¹⁵ U.S. Department of the Treasury. Fiscal Service, Federal Debt Held by the Public, from FRED, Federal Reserve Bank of St. Louis, <https://fred.stlouisfed.org/series/FYGFDPUN>; and U.S. Office of Management and Budget and Federal Reserve Bank of St. Louis, Federal Debt Held by the Public as Percent of Gross Domestic Product, from FRED, Federal Reserve Bank of St. Louis, <https://fred.stlouisfed.org/series/FYGFQD188S>.

¹⁶ While many bank capital requirements are adjusted for the risk of the assets, SLR adds requirements without adjustments, meaning that Treasuries require as much capital as riskier assets. For more information on the effects of higher capital requirements on markets and market making, see Adrian et al. (2017), Boissay, Collard, and Lewrick (2018), Cimon and Garriott (2019), and Haselmann et al. (2023).

¹⁷ Note that PTF intermediation activity has varied across stress episodes. During the October 15, 2014, flash rally, PTFs increased their share of activity in the IDB market, with some PTFs aggressively buying as prices were rising, and other PTFs stepping in to provide liquidity (Joint Staff Report 2015). The rapidly moving market and intraday nature of the event may have favored the higher-frequency liquidity provision provided by PTFs. In contrast, in late February and early March 2020, PTFs initially increased their activity in the IDB market as overall trading volume surged, but then decreased both their level and share of activity in mid-March as market conditions worsened. The extensive and protracted customer selling at the time and the need for liquidity provision across days may have favored the lower-frequency liquidity provided by dealers.

¹⁸ In bilateral markets, terms of trades are determined bilaterally and depend on the types of counterparties and the information available to them, resulting in price dispersion. When both an OTC market and a central exchange coexist and investors are heterogeneous, certain traders prefer the OTC market and others prefer the exchange (Yoon, 2021; Dugast, Üslü, and Weill, 2022; Lee and Wang, 2018). Weill (2020) surveys additional academic papers exploring why some investors and assets trade in OTC instead of centralized markets.

¹⁹ A variety of currently and formerly active trading platforms were studied for this article, including Bloomberg FIT, BrokerTec, CBOE, Direct Match, Fenics UST, LiquidityEdge, MarketAxess, OpenDoor, TP-ICAP, and Tradeweb.

²⁰ Throughout the remainder of this article, we often discuss a trading platform being a counterparty to a trade. In these situations, the trading platform is either a registered broker-dealer entity or has access to a registered broker-dealer.

²¹ For a detailed discussion of the role of trading platforms (IDBs) in the clearing and settlement of Treasury cash market trades, see Treasury Market Practices Group (2019).

²² In futures markets, futures commission merchants (FCMs) can place orders on behalf of customers, collect margin on behalf of customers, and ensure delivery of assets. The FCMs must be registered with the National Futures Association, as delegated by the CFTC. This allows for a wider set of market participants to participate in the futures market through the FCMs, while the FCMs are subject to routine oversight.

²³ For more information, see “Trading platform innovation of the year: OpenDoor Trading,” *Risk.net*, December 8, 2017, <https://www.risk.net/awards/5362016/trading-platform-innovation-of-the-year-opendoor-trading>.

²⁴ We analyze FINRA TRACE data for the January 3 to December 30, 2022, sample period and find that 98.4 percent of IDB trades are in round million-dollar increments, with 0.6 percent less than \$1 million and 1.1 percent greater than \$1 million but not round. In contrast, we find that 27.2 percent of dealer-to-customer trades are in round million-dollar increments, with 63.7 percent less than \$1 million and 9.1 percent greater than \$1 million but not round. Among trades greater than or equal to \$1 million, 98.9 percent of IDB trades are in round million-dollar increments versus 75.0 percent of dealer-to-customer trades.

NOTES (CONTINUED)

²⁵ See Duffie (2020), Liang and Parkinson (2020), and Group of Thirty Working Group on Treasury Market Liquidity (2021). As the SEC central clearing rule amendments are adopted, all purchases and sales occurring over IDBs will be required to be centrally cleared, which will address many of the risks we highlight.

²⁶ Source: Bloomberg, Treasury securities amount outstanding, January 23, 2023.

²⁷ While the chart presents results averaged across every day in 2022, results are very similar for the 20 percent most and 20 percent least volatile days in 2022 (based on the MOVE index) and for the first two weeks of March 2020, before the Federal Reserve started its market functioning purchases.

²⁸ There are numerous recent and ongoing efforts to improve data quality and availability in the Treasury cash and repo markets, as discussed in IAWG (2021, 2022, 2023, and 2024). Of particular note, on March 25, 2024, FINRA began disseminating data on individual transactions in on-the-run nominal coupon Treasury securities at the end of each trading day.

²⁹ See, for example, Bessembinder, Maxwell, and Venkataraman (2006), Boehmer, Saar, and Yu (2005), Loon and Zhong (2014, 2016), and Daures-Lescourret and Fulop (2022).

³⁰ There is a substantive and growing academic literature on why some investors and assets trade in OTC instead of centralized markets (see Weill [2020], Section 3.8). Dugast, Üslü, and Weill (2022), for example, present a model in which some investors find it optimal to participate in one and some in the other, and in which it is socially optimal for more customers to migrate to the centralized market.

³¹ Market participants also highlight that disclosed RFQ trades provide a clear way for asset managers to document that they are getting the best execution for their customers by showing the other prices offered at the same time.

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