Bilateral Relationship and Electronic Trading in OTC Markets

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Abstract

This paper studies the decentralized market structure among dealers in the presence of an electronic trading platform. We provide empirical evidences that core dealers rely more on bilateral trading relationships with other core dealers when they need immediacy, and that bilateral voice trade being cheaper than electronic trade in those circumstances. We build a search-and-matching model that allows dealers to *ex post* choose trading venues based on their immediate trading needs. The difference in relationship trading availability across venues allows our model to discipline equilibrium transaction costs and venue-specific market shares. We show that it may be optimal to tax e-trade or subsidize bilateral trade in the interdealer market.

Keywords: OTC markets, bilateral relationship, electronic trading, interdealer network

1 Introduction

U.S. corporate bonds primarily trade in over-the-counter (OTC) markets. Despite rapid advancements in electronic platforms and trading technology, a significant proportion of transactions remain voice-based, occurring bilaterally between OTC market participants. While the proportion of electronic trading has shown steady but slow growth over the years, it still accounts for only about 14% of all corporate bond transactions till 2017 (O'Hara and Zhou (2021)). This raises several questions: Why do corporate bond traders continue to prefer the one-on-one bilateral voice-based trading venue instead of fully substituting it with electronic options? How do market makers choose between voice and electronic venues when providing and demanding liquidity? Could these venue preferences help explain the persistence of the decentralized trading structure in corporate bond markets?

In this paper, we address these questions by investigating the differences in relationship trading opportunities between voice-based and electronic venues. Existing literature often associates electronic venues with lower search and transaction costs, as they enable traders to simultaneously connect with multiple dealer-counterparties, thus enhancing competition among dealers (Hendershott and Madhavan (2015)). Although the introduction of electronic platforms has helped reduce transaction costs for voice-based trades and improve bond liquidity, certain constraints remain, especially for bonds that are ex-ante less liquid, trades with larger sizes and high information sensitivity, and dealer market structures (O'Hara and Zhou (2021)). However, few studies delve into how these constraints may limit the impact of e-platforms on the decentralized voice-based dealer market structure. This gap, we believe, is key to understanding the continued dominance of voice-based trading.

We suggest that the limited structural shift in dealer markets, despite the presence of electronic platforms, stems from the advantages of voice-based venues for relationship trading. Relationship trading allows traders to choose counterparties based on established connections. In voice venues, dealers and customer investors can make phone calls to select trading partners with whom they have prior relationships or established connections. In

contrast, electronic venues, such as undisclosed request-for-quote (RFQ) systems and anonymous matching via central limit order books (CLOB), typically do not permit traders to leverage pre-existing relationships for transactions. This key distinction between voice and electronic venues has largely been overlooked in current studies. Our findings indicate that the lower transaction costs and higher immediacy afforded by relationship trading, particularly for large orders, make dealers hesitant to fully transition to electronic platforms. This characterization of lower-cost, higher-speed interdealer voice-based trades contrasts with findings from studies on customer trades, which typically indicate that electronic trades offer lower costs and faster execution than voice-based trades[1].

First, we present comprehensive empirical evidence on how dealers choose between voice-based and electronic venues depending on their liquidity needs. Specifically, dealers face liquidity needs or trading incentives when their current bond positions deviate from their long-term targets, creating unbalanced inventories. Our findings reveal that dealers tend to favor voice-based venues, instead of electronic venues, to rebalance their bond inventories, leveraging bilateral relationship trades with their well-connected partners. Given the high concentration in corporate bond dealer markets, we specifically focus on venue choices among the 50 "core dealers", those with the highest market shares and who collectively account for over 80% of corporate bond transactions, to minimize potential biases from the many smaller peripheral dealers. Our analysis shows that core dealers' preference for bilateral voice venues when managing unbalanced inventory positions is primarily driven by their motivation to trade with other core dealers in the voice-based setting. Since core dealers are generally well connected, an increase in voice-based core-to-core trades under higher liquidity needs is likely to reflect relationship trading.

To further explore the likelihood of relationship trading, we examine the specific trading partners core dealers choose within the voice venue and assess whether their trade directions align with their inventory imbalances. We find that when core dealers hold significantly

[1]This advantage of electronic platforms is generally confined to more liquid bonds and smaller trade sizes (Hendershott and Madhavan (2015); O'Hara and Zhou (2021), etc.)

unbalanced inventories, either overholding or underholding bonds, they substantially increase voice-based trading with their top 10 pre-established dealer partners, while voice trades with less connected partners show minimal change or remain stable. This tendency is especially pronounced when the top 10 partners hold complementary inventories. For example, when the current dealer is overholding (underholding) a bond, their top 10 partners on average are underholding (overholding) the same bond. Additionally, various tests show that when core dealers are overholding (underholding) bonds, they significantly increase selling (buying) transactions in the voice venue, while actively reducing buying (selling) trades that do not contribute to rebalancing their inventories.

In addition to examining dealers' venue choices, we also compare transaction costs and trading immediacy between voice and electronic venues. Our analysis shows that the voice venue offers advantages in terms of lower per-volume transaction costs and faster trading immediacy, particularly for orders above \$100,000[2]. To quantify the transaction costs incurred by dealers for each trade, we employ a modified version of the Choi-Huh measure (Choi and Huh (2019)), which captures the deviation of each transaction's price from a corresponding reference price. The original Choi-Huh measure is designed for dealer-customer trades, using interdealer transactions to establish a reference price. In our modified version, which assesses dealer transaction costs, each interdealer trade is matched to a set of reference trades consisting of transactions exclusively between core dealers that occur within a 15-minute window of the current dealer trade. The reference price is then calculated as the weighted average price across all trades in this reference group. To quantify the trading immediacy, we apply a measure called the time of round-trip trade (TRTT), which is the length of time elapsed between the paired buying and selling transactions. This measure captures the frictions that dealers face when trying to find a counterparty to trade with, and can be used as a measure of search friction in decentralized bond markets. The longer the TRTT, the higher the level of frictions, and the lower the trading immediacy, as it takes longer for dealers to find a coun-

[2]Orders below \$100,000 are called "micro" orders, which in total account for less than 20% of all bond transactions in par value.

terparty. We conduct several tests demonstrating that the voice venue—particularly both voice core-to-core and voice core-to-other transactions—offers lower per-volume Choi-Huh transaction costs and greater trading immediacy.

For robustness, we conduct several additional tests: (1) We calculate the venue-specific order-splitting rate as an alternative measure of trading immediacy and examine whether this rate significantly differs between voice and electronic venues. The rationale is that a higher likelihood of dealers splitting transactions into smaller orders implies a lower transaction speed, or lower immediacy. Consistent with our findings using TRTT as the immediacy measure, results show that the voice venue has lower order-splitting rates, particularly for orders over \$100,000; (2) We further examine how immediacy and order size affect transaction costs within each venue. Our findings reveal that, within both venues, transaction costs (measured by the per-volume Choi-Huh measure) are positively correlated with trading immediacy, suggesting that trading speed is both costly and valuable for dealers' liquidity needs. Additionally, in both venues, we observe a size discount for micro orders (under \$100,000), while for larger orders (over \$100,000), intermediating higher trading volumes tends to incur higher costs; (3) We control for issuer-level earnings announcements to isolate the potential impact of dealers' motives to obscure trading incentives on their venue choices. By incorporating pre- and post-earnings announcement periods (EAPs), time windows where "information hiding" behaviors are more likely, we verify that the effect of dealers' inventory on venue choice predominantly arises during normal trading periods. This suggests that the incentives to use relationship trading for inventory rebalancing remain significant even after controlling for the influence of information-driven trading decisions.

We establish a new search-and-matching model in which dealers make *ex post* choices between trading on voice or electronic venues based on their asset positions. The main innovation of our model, compared to previous search frameworks, is the inclusion of two distinct trading venues or market places, voice and electronic, with the option for dealers in the voice venue to pay a fixed cost to maintain a higher bilateral meeting rate than in the

electronic venue. This setup aligns with our empirical finding that the voice venue provides greater trading immediacy than the MarketAxess electronic platform, through its availability of relationship trading. Another novel aspect of our model is the assumption that dealers adjust their venue choices *ex post*, meaning they can immediately switch between venues as their asset positions change. Within each venue, dealers search for trading partners and match with each other. Consistent with standard search-and-matching models, when two dealers match, bonds are reallocated between them, with the two partners' post-trade bond positions determined through a Nash bargaining process.

The inclusion of relationship trading availability, represented by the difference in bilateral meeting rates between voice and electronic venues, enables our model to generate predictions consistent with our empirical findings. Specifically, the model predicts that dealers will choose the electronic venue when their asset positions fall within a certain range (which we call "electronic range"), but will prefer the voice venue when their asset positions are either excessively high or low. In the model, positive (negative) asset positions indicate that dealers are overholding (underholding) the asset. Excessively high or low asset positions thus indicate that dealers have strong trading incentives or liquidity needs, prompting them to seek higher trading immediacy and lower per-volume costs. This aligns with our empirical observation that, as dealers' inventory positions become more unbalanced, they increasingly utilize the voice-based venue, which provides greater immediacy and lower per-volume costs through relationship trading. Also, our model is able to generate lower transaction costs and higher aggregate trading volume in the bilateral voice venue, conditional on the level of a dealer's inventory.

Beyond generating predictions that align with our empirical findings, our modified search-and-matching model with dual trading venues also introduces new predictions that enhance our understanding of the role of the voice venue in OTC markets. A particularly interesting theoretical insight is that, for transactions between two dealers within the same venue (either voice or electronic) whose asset positions are both near the boundaries of the "electronic

range," the two matched dealers' post-trade asset positions will not be equal, which is different from the typical outcome in random search models with a single venue. This inequality in post-trade positions arises from the non-strict concavity of dealers' value functions in our model. The boundaries of the "electronic range" correspond to two kink points in the value function, around which Nash bargaining produces non-equal post-trade positions. As a result, one dealer's position ends closer to their balanced position while the other's is further away. After bargaining and trading, the dealer with the more balanced position will choose the electronic venue, while their trading partner will remain in the voice venue. This dynamic suggests that dealers in the voice venue effectively provide intermediation services to those in the electronic venue, shaping the distribution of asset positions across dealers in equilibrium. Specifically, this creates the jump and peaks in the density function of dealers' inventory near the boundaries of the "electronic range." This is an insight which was not explored in prior search models. Finally, we apply the model to discuss the social optimality problem and the associate policy implications. We find that under some conditions, it may be optimal to subsidize dealers' long-term relationships to facilitate inventory reallocations.

Related literature

Our study contributes to several strands of literature. First, we extend the search model of OTC markets by incorporating dealers' *ex post* choices between voice and electronic venues, each with distinct bilateral meeting rates. Most prior models in this literature consider only a single trading venue, typically a decentralized, voice-based venue, and assume either a fully random search or a semi-decentralized market structure.[3] While some studies also examine traders' venue choices, our work differs by focusing on the role of relationship trading across venues, specifically how this availability explains the dominance of the voice-based venue,

[3]For models assuming a fully random search structure, see Duffie et al. (2005), Duffie et al. (2007), Vayanos and Wang (2007), Vayanos and Weill (2008), Weill (2008), Afonso (2011), Neklyudov (2012), Praz (2014), Trejos and Wright (2016), Afonso and Lagos (2015), Atkeson et al. (2015), Shen et al. (2018), Üslü (2019), Hugonnier et al. (2020), Liu (2020), Liu (2024), etc. For models with a semi-decentralized structure, see Weill (2007), Lagos and Rocheteau (2009), Feldhütter (2012), Lester et al. (2015), and Pagnotta and Philippon (2018). See Weill (2020) for a comprehensive review of search theory in OTC markets.

given dealers' need for high immediacy during inventory shocks. Other studies highlight different aspects of voice and electronic venue distinctions and do not target the dominance of decentralized, voice-based trading.

For example, Glebkin et al. (2023) introduces the possibility of simultaneous multilateral search by customer investors in a search model, allowing for an exploration of customers' choices between one-on-one bilateral bargaining and multilateral RFQ venues. In their model, venue shares are driven by customer choices, with bilateral bargaining appealing due to customers' higher bargaining power in one-on-one transactions. By contrast, in our model, the primary advantage of the voice-based venue lies in its support for relationship trading, which dealers use to rebalance inventories under high liquidity needs. Dugast et al. (2022) consider banks' choices between OTC markets and centralized exchanges, along with endogenous dealer and customer formation. In their model, the venue distinction rests on price determination (i.e. whether by market-clearing or bilateral bargaining), and the constraints on fully risk-sharing availability. In contrast, we position the electronic venue as a lower bilateral meeting rate OTC market rather than a centralized exchange and provide empirical evidence supporting this differentiation.

Second, our paper adds to the empirical and theoretical research on electronic trading in OTC markets by examining why dealers are hesitant to shift to electronic platforms. As electronic transactions play an increasingly significant role in OTC markets, many studies focus on the impact of electronic trading on voice-based dealer markets and customers' choices between voice and electronic trading. However, there is limited research addressing dealers' venue preferences and explaining the continued dominance of voice-based trading despite the availability of electronic options. For instance, Hendershott and Madhavan (2015) analyze customers' venue choices, treating electronic venues as double-auction central limit order books, and find that electronic venues serve as valuable liquidity sources, though the advantages are largely limited to the most liquid bonds and simpler trades. Similarly, O'Hara and Zhou (2021) provide robust evidence that electronic trading tends to offer lower

transaction costs than voice trading but primarily for bonds with high ex ante liquidity, smaller trades, and during periods of low market distress. Moreover, O'Hara and Zhou (2021) observe that, despite its early introduction, electronic trading has experienced slow growth, constrained by dealer market structure. Our study seeks to further understand dealers' reluctance to trade on electronic venues, presenting comprehensive evidence that relationship trading plays a significant role in this preference. Our study can also shed light on why the advantages of electronic trading are largely confined to assets with higher ex ante liquidity and simpler trades involving smaller sizes.[4]

Most theoretical studies on electronic OTC markets model the electronic venue as a request-for-quote (RFQ) platform and focus on customer choices between RFQ and voice markets, as seen in works by Glebkin et al. (2023), Vogel (2019), and Liu et al. (2018). However, our model highlights a distinct disadvantage of electronic platforms: they are less conducive to relationship trading. Using data to construct measures like the time-of-round-trip-trade (TRTT) and order splitting rate to capture trading immediacy, we find that although RFQ protocols on electronic venues do facilitate search for traders, they generally offer lower immediacy, especially for large orders. This suggests that electronic platforms may not consistently enhance trading speed for all bonds and all sizes of trades.

Third, our study contributes to a literature that emphasizes the critical role of relationship trading in OTC markets.[5]. These studies explore the benefits of interdealer or dealer-customer relationships in market liquidity and transaction costs but do not address the effect of relationship trading on the sustained dominance of voice-based venues amid electronic alternatives. In particular, Di Maggio et al. (2017) highlights how core dealers use interdealer relationships to maintain liquidity during stress periods, leveraging these connec-

[4]There are also some other works on the impact of financial technology on trading, includes Brogaard et al. (2014), Easley et al. (2014), Brogaard et al. (2015), Yao and Ye (2018), and etc.

[5]For works in relationship trading, most of which apply the network framework, see Di Maggio et al. (2017), Hendershott et al. (2017), Babus and Kondor (2018), and etc. There are other works also applying network framework to capture dealer-client relationship, but not focusing on the benefits of relationship trading, including Bernhardt et al. (2005), Gale and Kariv (2007), Gofman (2011), Afonso et al. (2013), Atkeson et al. (2015), Chang and Zhang (2018), Babus (2016), Glode and Opp (2016), Babus and Hu (2017), Colliard and Demange (2017), and etc.

tions for profitability by charging premiums to connected customers and peripheral dealers. Similarly, Hendershott et al. (2017) examines how customer-dealer relationships affect transaction costs, showing that customers with too small and too large dealer networks are paying higher transaction costs. Our study also relates to the work of Dick-Nielsen et al. (2023), which highlights the role of trading relationships in explaining both centrality premiums and centrality discounts in OTC markets. Specifically, they find that the immediacy provided by established relationships accounts for the centrality discount in dealer-customer markets and the centrality premium in interdealer markets. However, unlike their study, we focus on the dominance of voice-based trades in the presence of electronic trading platforms, exploring how the availability of relationship trading influences dealers' venue choices.

Our research fills a gap by showing how voice-based relationship trading affects dealer participation in electronic venues. The empirical evidence confirms that relationship trading in voice markets is a key factor for dealers who need immediacy and flexible trading options. This finding also provides insight into the question raised by Bessembinder et al. (2019) on whether high transaction costs in OTC markets stem from a decentralized trading structure or if the structure is, in fact, optimal under such costs. We demonstrate that the voice-based network of relationships indeed serves as a mechanism that supports efficient trading in specific market conditions, potentially explaining why it remains dominant despite the availability of electronic platforms.

Finally, our exploration of social optimality in the coexistence of voice and electronic trading venues is related to the empirical literature examining the welfare effects of introducing new venues into OTC markets. For instance, Allen and Wittwer (2023) investigates the potential benefits of shifting trades from OTC markets to a centralized platform. Their study analyzes the impact of restricted access to centralized platforms for some institutional investors, measuring effects on price dispersion and quantifying welfare implications through counterfactual analysis based on a structurally estimated model. Similarly, Holden et al. (2021) examines the introduction of a parallel OTC market alongside a centralized limit

order book in China's foreign exchange market, focusing on its influence on market dynamics and investor welfare. Our approach differs by focusing specifically on policies impacting relationship trading and assessing welfare from the perspective of asset reallocation among dealers.

The remainder of the paper proceeds as follows. Section 2 describes our data. Section 3 presents our main empirical findings on dealers' venue choices and compares liquidity between voice and electronic venues. Section 4 introduces the search-and-matching model with dual trading venues and dealers' *ex post* venue choices, and characterizes equilibrium solutions. Section 5 presents our calibration exercises and discusses social optimality based on the calibrated model. Section 7 concludes.

2 Data description

We use the MarketAxess and Academic TRACE data set from February 2017 to February 2018 as the main data set for U.S. corporate bond electronic and bilateral-voice-based transactions. The reports in Academic TRACE data include information on realized transactions, including bond ID, anonymous dealer ID, price, volume, execution time, and whether each transaction is electronic or voice-based, etc. The MarketAxess data set includes information only for electronic transactions[6], including bond ID, price, volume, execution time, and the electronic protocol by which each transaction is executed (e.g. request-for-quote, central limit order book, etc).

We filter the data following the standard procedure in Dick-Nielsen (2014). Then we merge the filtered data set with the Mergent Fixed Income Securities Database (FISD) to obtain bond fundamental characteristics. We exclude variable-coupon, convertible, exchangeable, puttable and newly issued bonds. We also exclude asset-backed securities, pri-

[6]MarketAxess continues to dominate dealer-to-client institutional e-trading among the primary electronic trading platforms. According to the Greenwich Associates report "Corporate Bond Trading in 2019," MarketAxess handles approximately 85% of dealer-to-client institutional e-trading, with Tradeweb, Bloomberg, Trumid, and Liquidnet following behind. Consequently, the MarketAxess dataset provides a comprehensive representation of electronic transactions in U.S. corporate bonds.

vately placed instruments, and bonds denominated in foreign currencies or issued by foreign companies. Our final filtered sample includes 10,419 bonds with total outstanding amounts as $5.6 trillion, average time to maturity as 8 years, and average credit rating as BBB.

We use the filtered data to create weekly panel dataset that include observations at both the bond and dealer levels. Specifically, we only focus on the venue choice of the 50 core dealers which are defined in Section 3.1. For the regressions concerning venue choice in Section 3.2, we calculate core dealers' proportions of trading in different venues exclusively using the "principal trades" identified in our data, as these are more closely related to their inventory positions.[7] Besides using the weekly data to test model predictions, we also create daily and monthly datasets for robustness check, to exclude the impact of data frequency on empirical results.

3 Empirical findings on dealers' venue choices

3.1 Core dealers

Following Di Maggio et al. (2017), we define core dealers as the top 50 dealers who collectively account for 80% of transactions from 2005 to 2017. [8] All other dealers are referred to as periphery dealers. We focus on the venue choice of core dealers, as they are the primary participants in both voice-based and electronic platforms. In our sample, core dealers are involved in approximately 82% of transactions (by par value) as one or both counterparties on both the voice venue and MarketAxess e-platform. In contrast, the remaining 1,900

[7] We use the identification method detailed in Section C.1 of the appendix to classify each transaction as either a principal or an agency trade. Studies such as Bessembinder et al. (2018), Friewald and Nagler (2019), and Kargar et al. (2021) suggest that customer investors are more likely to benefit from the immediacy provided by principal trades, which involve dealers committing their capital and leveraging their inventory capacity, thus leading to lower inventory and search frictions. Conversely, in "agency" trades, where the customer-seller retains the asset while the dealer finds a customer-buyer, dealers act more as matchmakers without committing their capital to the bond intermediation, and these trades are not influenced by dealers' inventory positions.

[8] We use Academic TRACE data to calculate the total transaction volume for each dealer from 2005 to 2017. Dealers are then ranked by their total trading volume, and the top 50 are designated as "core dealers."

peripheral dealers account for only 33.4% of electronic transactions and 31.4% of voice transactions. Notably, all core dealers participate in both venues, whereas only 20% of peripheral dealers engage in both voice and electronic trading.

3.2 Venue choice by core dealers

3.2.1 Standardized inventory

We use dealers' standardized inventory position as a proxy for their asset position. We follow Hansch, Naik, and Viswanathan (1998) to estimate dealers' standardized inventory positions, which is monotonically increasing with their real inventory positions. We use $Q^j_{i,t}$ to denote the (unobservable) dealer i's inventory position in bond j and month t, s.t. $0 \leq t \leq T$, where T is the last month of the sample period. We use $q^j_{i,t}$ to denote the corresponding observable signed net trading volume, which is positive (negative) when the dealer i increases (reduces) her inventory position of bond j in month t. With unobservable initial inventory $Q^j_{i,0}$, the series $\{Q^j_{i,t}\}$ satisfies:

$$Q^j_{i,t} = Q^j_{i,0} + \sum_{s=1}^{t} q^j_{i,s}, \qquad 0 \leq t \leq T. \tag{1}$$

Then we construct the standardized inventory for each dealer i, bond j, and month t:

$$I^j_{i,t} = \frac{Q^j_{i,t} - \bar{Q}^j_i}{\sigma^j_i}, \tag{2}$$

where $\bar{Q}^j_i = \frac{\sum_{s=0}^{T} Q^j_{i,s}}{T+1}$ and $\sigma^j_i = \sqrt{\frac{\sum_{s=0}^{T}(Q^j_{i,s} - \bar{Q}^j_i)^2}{T}}$ are the sample mean and standard deviation, respectively, of the monthly series $\{Q^j_{i,t}\}$.[9]

The standardized inventory $I^j_{i,t}$ essentially measures by how much the current inventory $Q^j_{i,t}$ deviates from the unobserved target level $\bar{Q}^j_{i,t}$, and the deviation is scaled by the volatility. By similar derivation in Hansch, Naik, and Viswanathan (1998), this standardization (i)

[9]For a robustness check, We also follow Friewald and Nagler (2016) to calculate $\bar{Q}^j_{i,t}$ and $\sigma^j_{i,t}$ only using the series of signed trading volumes within the fixed rolling time window $[t, t-R]$. We obtain similar results for the quantitative analysis.

excludes the effect of unobserved initial inventory position $Q^j_{i,0}$ after issuance,[10] and give standardized inventory as a linear combination of a series of signed net trading volumes $\{q^j_{i,s}\}$; and (ii) controls for differences in risk aversion to guarantee the comparability of inventories across dealers (see Friewald and Nagler, 2016).

3.2.2 Choice of bilateral voice-based v.s. electronic venues

In the main text, we define core dealers' participation in bilateral voice-based venues as encompassing two types of transactions: "voice-based transactions between two core dealers" and "voice-based transactions between a core dealer and a periphery dealer or a customer investor." We find that core dealers with more extreme inventory levels (either very low or very high) are more likely to trade in bilateral voice-based venues due to the high bilateral meeting rates. Dealers with intermediate inventory levels are more likely to trade in electronic venues and less likely to trade with previously connected counterparties. Given the significant differences in bilateral meeting rates between these two types of voice-based transactions, we further decompose the bilateral voice-based venue into "core-core voice-based venue" and "core-others voice-based venue" to examine how core dealers' standardized inventories affect their participation in these venues. Our results show that the increased participation in voice-based venues for core dealers with extreme inventories is mainly driven by the high bilateral meeting rates in the "core-core voice-based venue."

We explore the relationship between dealers' venue choice and their *ex ante* asset positions using the following regression:

$$\begin{aligned} PropVol^v_{i,j,t} = {} & \mathbb{1}(inv_{i,j,t} \geq 0) * \beta_{posinv} * inv_{i,j,t} + \mathbb{1}(inv_{i,j,t} \leq 0) * \beta_{neginv} * |inv_{i,j,t}| \\ & + \gamma_1 * PropVol^v_{i,j,t-1} + \boldsymbol{\gamma_2} * X_{i,t} + \boldsymbol{\gamma_3} * Y_{j,t} + \alpha_i + \eta_j + \kappa_t + \epsilon^v_{i,j,t}, \end{aligned} \tag{3}$$

where $PropVol^v_{i,j,t}$ is the share of transactions through venue v for dealer i, bond j in week

[10] We calculate the series of standardized inventory $\{I^j_{i,t}\}$ before dropping bond transactions during a 3-month on-the-run period following issuance.

t. For venue v, we consider both electronic and bilateral voice-based venues. Specifically, for voice-based venues, we separately consider core-to-core voice-based venues, core-to-others voice-based venues, and their combination. $invi, j, t$ represents dealer i's standardized inventory position in bond j at the start of week t. Our theoretical model predicts that as core dealers' *start-of-period* inventory positions deviate more from their unobserved target levels, they are more likely to increase the share of transactions through bilateral voice-based venues. Thus, β_{posinv} and β_{neginv} are expected to be positive for bilateral voice-based venue (including "core-core" and "core-others") or at least core-core voice-based venue, and negative for electronic venues.

We also control for the lagged dependent variable $PropVol^v i, j, t-1$, dealer-specific characteristics $X_{i,t}$, which include dealers' start-of-period aggregate standardized inventory over all bonds, and bond-specific characteristics $Y_{j,t}$, which include outstanding amount and time to maturity. Dealer, bond, and week effects are included to address potential endogeneity issues due to unobserved variables. For robustness, we also control for interactive fixed effects, such as dealer$\times$ week effect, and dealer$\times$bond effect, in regressions where the dependent variable is the share of bilateral voice-based transactions, and specifically the share of transactions between two core dealers. See Tables A1 and A2.

[Table 1 about here.]

Next, we examine whether the primary reason core dealers choose bilateral voice-based venues is to search for liquidity among their well-connected trading partners. Tables 2 and 3 show that as core dealers' inventory deviates further from their target level, the increase in their share of bilateral voice-based transactions is mainly due to trading with their top 10 connected trading partners. [11] This validates that the bilateral voice-based venue is primarily advantageous for leveraging established trading connections, whereas the electronic venue does not offer this benefit. Moreover, find that relationship trading is more pronounced when

[11] We construct pairwise total trading volume among all dealers. For each core dealer, we label their top 10 dealer-trading partners, with whom they trade most throughout the sample period, as "top 10 connected trading partners."

dealers' top 10 most connected partners tend to hold complementary inventories. Specifically, dealers more likely prefer voice-based venues when they are overholding (or underholding) bonds, and their top connected partners are underholding (or overholding) the same bonds. This is shown in Table 4, where the positive coefficients of the interaction term between dealers' inventories and the sign of their top 10 connected partners' average inventory are very significant both statistically and in magnitude.

[Table 2 about here.]

[Table 3 about here.]

[Table 4 about here.]

We then test the relationship between core dealers' main trading direction and their start-of-period inventory levels. The results in Tables 5 and 6 support that core dealers choose bilateral voice-based venues over electronic venues to correct for deviations from their target inventory levels, consistent with theoretical predictions. Specifically, when core dealers' inventory position is below their target level (i.e., they have a negative standardized inventory position), their increase in bilateral voice-based transactions focuses on buying. Conversely, when core dealers' inventory position is above their target level (i.e., they have a positive standardized inventory position), their increase in bilateral voice-based transactions focuses on selling.

[Table 5 about here.]

[Table 6 about here.]

For robustness, we undertake the following practices: (1) we repeat all the above regressions using daily and monthly data to exclude the effect of time frequency, and (2) we further decompose the bilateral voice venue into core-core and core-noncore venues, demonstrating that the above regressions apply more to the core-core venue. This also validates

that dealers' preference for bilateral voice-based venues over electronic venues is potentially due to higher bilateral meeting rates among core dealers. The appendix includes the results of all above regressions regarding bilateral voice-based venues as a whole using daily data (Tables A3-A10) and monthly data (Tables A11-A18). We also present results of regressions for core-core voice-based venues using weekly data in Tables A19-A22, daily data in Tables A23-A26, and monthly data in Tables A27-A30.

3.3 Difference in liquidity between bilateral voice-based and electronic venues

In this section, we compare bilateral voice-based venue and electronic venue in terms of two liquidity measures: transaction cost (by Choi-Huh measure in Choi and Huh (2019)) *per par value of bond*, and the immediacy of trading measured by time of round-trip trade. We further show that the main advantage of bilateral voice-based venues over electronic ones is the higher meeting rate (i.e., more trading immediacy) based on well-established trading connections.

In our dataset, which includes only transactions involving core dealers,[12] we calculate the Choi-Huh measure[13] for each transaction. By dividing the Choi-Huh measure by the order size, we obtain the transaction cost per par value of the bond. Next, we test how the transaction cost per par value varies across different venues while controlling for order size, dealer inventory, and bond characteristics.

Using our data, we also construct round-trip trades to specifically capture the process of dealers intermediating bonds between sellers and buyers[14]. For each identified round-trip

[12]Similar to Section 3.2, we exclude transactions that only involve periphery dealers and/or customer investors to avoid potential selection bias.

[13]The formula for transaction-level Choi-Huh is: $(\text{Choi-Huh})_n = 2Q_n \times \frac{P_n - \text{Ref-P}_n}{\text{Ref-P}_n}$, where for each transaction n, Q_n is equal to $+1(-1)$ when a customer buys from (sells to) a dealer, and the reference price Ref-P_n is taken to be the volume-weighted average price of interdealer trades larger than $\$100,000$ for the same bond in the same bond-day..

[14]The concept of "round-trip trades" refers to pairs of buying and selling transactions completed by the same dealer for the same bond. To qualify as a round-trip trade, the pair of transactions must start with the dealer buying from a customer investor, and end with the dealer reselling the bond to another

trade, we calculate the time of round-trip trade (TRTT), which is the length of time elapsed between the paired buying and selling transactions. It captures the frictions that dealers face when trying to find a counterparty to trade with, and can be used as a measure of search friction in decentralized bond markets. The longer the TRTT, the higher the level of frictions, as it takes longer for dealers to find a counterparty.

We use our transaction-level data to run the following regression:

$$\begin{aligned} CH_{i,j,k}^{perparval} &= \beta_1^{CH} * \mathbb{1}_{i,j,k}^{Bilateral} + \beta_2^{CH} * \mathbb{1}(Order_{i,j,k} \geq \$100k) \\ &+ \beta_3^{CH} * \mathbb{1}_{i,j,k}^{Bilateral} * \mathbb{1}(Order_{i,j,k} \geq \$100k) \\ &+ \gamma_{\mathbf{1}}{}^{CH} * X_{i,kd} + \gamma_{\mathbf{2}}{}^{CH} * Y_{j,kd} + \alpha_i + \eta_j + \kappa_{kd} + \epsilon_{i,j,k}, \end{aligned} \tag{4}$$

where the dependent variable $CH_{i,j,k}^{perparval}$ is the Choi-Huh measure per par value of transaction k that dealer i completes for bond j. The indicator variable $\mathbb{1}_{i,j,k}^{Bilateral}$ equals one if the current transaction is implemented through bilateral voice-based venue, which could be either core-core venue or core-other venue. The indicator variable $\mathbb{1}(Order_{i,j,k} \geq \$100k)$ controls whether the size of current transaction is micro level or not.[15] We additionally control dealer-specific daily aggregate inventory $X_{i,kd}$, bond characteristics $Y_{j,kd}$, and dealer, bond and day fixed effects.

The regression result for (4) shows that bilateral voice-based venue is associated with lower transaction cost per par value of bond, especially for non-micro size orders. See the estimates on β_3^{CH} in Table 7. In the table, we further break down the bilateral voice-based venue into core-core and core-other voice-based venues. We find that for non-micro size orders executed through either of these two venues, the transaction cost per par value is lower. These findings remain consistent even when we change the reference price used for

customer investor or another dealer. To ensure that the identified round-trip trades accurately reflect dealers' willingness to provide liquidity to buyers and sellers, we begin by identifying the subset of "principal trades" in the data, which involve dealers' commitment of capital. We then use these principal trades to construct round-trip trades. Further details on the identification of round-trip trades is in Internet Appendix C.2.

[15] We categorize the order sizes into four groups: micro (order<\$100k), oddlot (\$100k≤ order <\$1million), roundlot (\$1million≤ order <\$5million), and block (order ≥\$5million).

calculating the Choi-Huh measure.[16]

[Table 7 about here.]

We use the collection of all identified round-trip trades to run the following regression:

$$\begin{aligned} TRTT^{v}_{i,j,r} = {} & \beta_1^{TRTT} * \mathbb{1}^{Bilateral}_{i,j,r} + \beta_2^{TRTT} * OrderSize_{i,j,r} \\ & + \beta_3^{TRTT} * \mathbb{1}^{Bilateral}_{i,j,r} * \mathbb{1}(Order_{i,j,r} \geq \$100k) \\ & + \boldsymbol{\gamma_1}^{TRTT} * X_{i,rd} + \boldsymbol{\gamma_2}^{TRTT} * Y_{j,rd} + \alpha_i + \eta_j + \kappa_{rd} + \epsilon_{i,j,r}, \end{aligned} \tag{5}$$

where the dependent variable $TRTT^{v}_{i,j,r}$ is the time of the round-trip trades r that dealer i[17] intermediates for bond j. Different from regression (4) above, we control for the exact order size of the round-trip trades $OrderSize_{i,j,r}$, and all other controls are same as before.

The regression result for (5) shows that bilateral voice-based venue is associated with shorter TRTT, i.e. higher trading immediacy, also especially for non-micro size orders. Similarly, we further divide the bilateral voice-based venue into core-core and core-other voice-based venues. We find that the electronic venue may be more advantageous for executing micro size orders (less than $100,000), but for larger orders, core dealers are more likely to achieve immediacy in both core-core and core-other voice-based venues. Additionally, when we change the dependent variable to TRTT divided by order size (i.e., TRTT per par value of the intermediated bond), the results remain consistent. See Table 8 and Table 9.

[Table 8 about here.]

[Table 9 about here.]

In addition to the above regressions focusing solely on "principal trades," which are more influenced by dealers' inventory positions, we also analyze the unfiltered data that

[16] See columns (7) and (8) in Table 7.

[17] Dealer i is the core dealer who firstly buys the bond from a customer-investor or dealer, and re-sells the same bond to another customer-investor or another dealer. In other words, dealer i is the core dealer who intermediates the bond between a buyer and a seller, and participates in both the two legs of the same round-trip trades.

includes both "principal" and "non-principal" trades.[18] This analysis allows us to compare voice-based and electronic venues in terms of the probability of principal trades. A higher probability of principal trades suggests that potential trading counterparties in a venue are more likely to provide immediacy to liquidity demanders by committing their capital and leveraging their inventory capacity.

We adopt the same specification as (4), but change the dependent variable to $\mathbb{1}_{i,j,k}^{principal}$, which equals one if transaction k that dealer i completes for bond j is a principal trade, and equals zero otherwise. The results in Table 10 indicate that for non-micro size orders, both core-core and core-other voice-based venues have a higher probability of principal trades compared to the electronic venue. Notably, the advantage of implementing principal trades is more significant for the core-other venue than for the core-core venue.

[Table 10 about here.]

3.4 Robustness

To further examine whether trading immediacy drives dealers' preference for relationship trading in voice venues, we conduct additional robustness tests. First, We calculate venue-specific order-splitting rates as an alternative measure of trading immediacy, and examine whether these rates differ significantly between voice and electronic venues. Specifically, we perform transaction-level regressions with a dependent variable indicating if a transaction is a split from a larger order.[19] The analysis controls for dealer, bond, and trade-level char-

[18] "Non-principal" trades, also known as "agency trades," are pairs of buy and sell trades pre-arranged by dealers acting as matchmakers. See Section C.1 for more details.

[19] The identification of order-splitting rates in our analysis is based on the following approach. For both voice trades and electronic trades, we create clusters of transactions that meet specific criteria. Each cluster includes *consecutive* transactions conducted by the same dealer for the same bond, restricted to the same transaction type (buy/sell) within the same (voice/electronic) venue, and occurring within a 72-hour time window, which is the median value of TRTT (time to round trip) across all trades. We selected this window to account for typical delays in large order completions. Additionally, we exclude any transactions with a par value over $100 million, assuming that split orders primarily occur in smaller trade sizes, categorized as micro (under $100,000) or odd-lot ($100,000 to $1,000,000) orders. We apply this restriction since micro and odd-lot orders together account for over 90% of trades by count and 40% by par value in our sample. After identifying clusters of trades that satisfy these criteria, we label them as "split trades" separately for voice and electronic venues.

acteristics, allowing us to assess the likelihood of order splitting across venues. Consistent with results using TRTT to measure immediacy, our findings show a lower likelihood of split orders in voice-based venues, particularly for orders over $100,000, indicating higher immediacy[20]. See Table 8. These results align with the findings of Hendershott and Madhavan (2015) and O'Hara and Zhou (2021), which suggest that electronic platforms are better suited for simpler and smaller trades.

Second, to further investigate whether immediacy incurs higher costs for large orders, we analyze transaction costs at the intensive margin within each venue. Using round-trip trades, we regress the per-volume Choi-Huh cost of each round trip's second leg on corresponding TRTT and order size. Our findings indicate a positive correlation between per-volume transaction costs, trading immediacy, and order sizes over $100,000 across both voice and electronic venues, with a size discount for micro-orders (under $100,000), as shown in Table 12. The correlation between trading immediacy and transaction cost is more significant in voice venue than in electronic venue. This supports our hypothesis that both immediacy and large-size intermediation are costly, incentivizing core dealers to incur additional costs to maintain long-term relationships.

Finally, we control for issuer-level earning announcements, to isolate the influence of dealers' motives to obscure trading incentives on their venue choices. Around earning announcement dates, dealers are more likely to engage in informed trading, possibly acting on behalf of connected customers with inside information. These customers may prefer voice-based OTC markets to avoid information dissemination, influencing dealers to either choose voice venues or split orders within electronic platforms. This "information hiding" behavior could confound our analysis of the relationship between inventory imbalances and venue selection. To mitigate this, we incorporate two dummy variables marking the pre- and post-earnings announcement periods (EAPs) for each bond issuer[21]. These dummies

[20]Lower order splitting rate is associated with higher trading immediacy, as splitting requires searching for and bargaining with more counterparties.

[21]For robustness, we employ two alternative time windows to define pre- and post-earnings announcement periods (EAPs). Specifically, pre- and post-EAPs are separately defined as either (1) the two weeks before

are further interacted with dealers' positive and negative inventory levels, enabling us to examine variations in core dealers' participation across voice and electronic venues during EAPs versus regular periods. The robustness results, presented in Table 13 and 14, indicate that the effect of inventory positions on voice venue participation is predominantly determined by trades in normal periods, other than EAPs. Notably, pre- and post-EAPs account for only 7.2% of the sample by count and 7.8% by par value at the dealer-bond-week level, suggesting limited overall influence. While informed trading in EAPs does not significantly alter dealers' choices between voice and electronic venues, it appears to have a negative impact on inter-core dealer trading within the voice venue. This reduction could reflect core dealers' preference to avoid information diffusion risks inherent in trading with other highly central core dealers. Instead, core dealers may shift trades to smaller dealers or customers within the voice venue, which is a hypothesis left for future exploration.

[Table 11 about here.]

[Table 12 about here.]

[Table 13 about here.]

[Table 14 about here.]

4 Model

Consider an environment with two market places, a voice-based bilateral market and an electronic all-to-all trading platform. Time is continuous and indexed by $t \in [0, \infty)$. There is a continuum of dealers of total measure 1.

and after, or (2) the four weeks before and after, but not including, the week of a bond issuer's earnings announcement. By varying the time window lengths, we aim to ensure that the robustness of our findings is not sensitive to the specific definition of pre- and post-EAP periods.

Preference and inventory costs The present value of a dealer's utility is

$$\mathbb{E}_0 \int_0^\infty e^{-rt} \left[u(a_t) + T_t \right] dt \tag{6}$$

where a_t denotes the dealer's inventory holding at date t, T_t denotes transfers between dealers at date t from trading assets and the costs of maintaining long-term relationships, and utility function satisfies

$$u(a) = -\frac{\kappa}{2} a^2 \tag{7}$$

where κ represents the balance sheet cost associated with dealers' inventory positions.[22] This interpretation aligns with the understanding that holding inventories can expose dealers to risks such as price fluctuations, funding constraints, or regulatory capital requirements, which affect their risk tolerance and trading strategies.

A dealer receives inventory shocks at Poisson rate δ, following which her inventory shifts from current asset position a to ε_i where ε_i follows an iid distribution, $\varepsilon_i \sim N(0, \sigma^2)$. Denote the distribution function of post shock inventory level as G. The inventory shock represents the liquidity demand from the dealer's customers.[23]

Under the preference by (7), the efficient allocation of inventory is 0 for all dealers. Search frictions and recurrent inventory shocks prevent the inventory allocation from reaching the efficient level.

Market places as matching technologies Dealers have two distinct market places, bilateral voice markets and electronic platforms, where they can search for trading counterparties. At any moment, each dealer is only able to choose to search within *one* of the market places and dealers can switch between the two market places as needed. The probability of matching in each venue is determined by its specific meeting rate: α^B for the bilateral

[22] In our model, the balance sheet cost also serves as a proxy for dealers' risk aversion levels concerning uncertainties in their inventory holdings.

[23] We assume each dealer is endowed with a persistent customer network, generating random liquidity demands over time. This framework aligns with the setup proposed by Babus and Kondor (2018).

market and α^E for the electronic platform.

The matching process follows a quadratic matching function: $m^i(N^i) = \alpha^i (N^i)^2$ for market place $i \in \{B, E\}$, where N^i denotes the measure of dealers in the market place. The matching function is increasing returns to scale, consistent with Duffie et al. (2005). Under this matching function, the bilateral matching between dealers is independent and not subject to congestion. The rate at which a dealer finds another dealer in market place i is $\frac{\alpha^i}{2}$. Likewise, the rate at which that other dealer finds the dealer is also $\frac{\alpha^i}{2}$. When meeting a counterparty, dealers bargain over the terms of trade bilaterally. Each dealer has equal bargaining power as $1/2$, which means the trade outcomes are split symmetrically.

We assume that the matching between dealers in the bilateral market is more efficient, $\alpha^B > \alpha^E$, but also more costly. Dealers searching for trading counterparties in the bilateral market pay a flow cost $\alpha^B x$, while dealers searching in the electronic platform do not pay such flow cost.

We use the more efficient matching technology to represent communications in bilateral long-term relationships. More generally, long-term relationships between dealers may differ in priority. We can extend the baseline model and introduce N types of dealers indexed by $j = 1, 2, \ldots, N$. The meeting rates between dealers of different types and across the two market places differ. In the bilateral market, the rate at which a type i dealer meets a type j dealer is α_{ij}. Dealer i's bargaining power with a dealer j is θ_{ij}. In the all-to-all electronic trading platform, the rate at which a dealer trades is α_{i0}. A dealer of type i receives inventory shocks at rate δ_i, following which the dealer's inventory shifts from current asset position a to $a + \varepsilon_i$ where ε_i follows an iid distribution, $\varepsilon_i \sim N(0, \sigma_i^2)$.

Value functions and post-trade asset allocations Let $V(a)$ denote the value function of a dealer with inventory a in a stationary equilibrium. A dealer can choose between trading venues contingent on her inventory holding, so the value function is the maximum of the

dealer's value from accessing the two trading venues.

$$V(a) = \max(V^B(a), V^E(a)) \tag{8}$$

where $V^B(a)$ denotes her value conditional on her current inventory holding if she chooses to search within bilateral market place, $V^E(a)$ denotes her inventory-contingent value if she searches in the electronic platform.

The value from searching within bilateral relationships satisfies

$$rV^B(a) = u(a) + \frac{\alpha^B}{2}\int S(a,a')dF^B(a') - \alpha^B x + \delta\left[\mathbb{E}V(\widetilde{a}) - V(a)\right] \tag{9}$$

where $S(a,a')$ denotes the surplus from trade between a dealer with inventory a and a counterparty with inventory a', and $\mathbb{E}V(\widetilde{a})$ is the expected value when a dealer receives an inventory shock.

$$S(a,a') = \max_{a_1,a_2} V(a_1) + V(a_2) - V(a) - V(a') \tag{10}$$

subject to bilateral inventory constraint

$$a_1 + a_2 = a + a'. \tag{11}$$

Dealers cannot discard the inventories so that the inventory constraint always bind. Dealers might have incentive to discard asset in the current setting because the marginal utility from inventory can be negative. This is an innocuous assumption. If $u(a) = \kappa_0 a - \frac{\kappa_1}{2}a^2$ with κ_0 sufficiently large, the marginal utility from holding inventory will be positive with almost probability 1.

The expected value after receiving an inventory shock is

$$\mathbb{E}V(\widetilde{a}) = \int V(\widetilde{a})dG(\widetilde{a}). \tag{12}$$

Likewise, the value from searching in the electronic market satisfies

$$rV^E(a) = u(a) + \frac{\alpha^E}{2}\int S(a,a')dF^E(a') + \delta\left[EV(\widetilde{a}) - V(a)\right]. \tag{13}$$

We conjecture and verify that the value functions $V(a)$, $V^E(a)$, and $V^B(a)$ are quasiconcave and symmetric around 0 and that there exists a threshold $\bar{a} > 0$, such that $V^E(a) < V^B(a)$ if and only if $|a| > \bar{a}$.

Thus, the value function $V(a)$ satisfies

$$V(a) = \begin{cases} V^B(a) = \frac{\frac{\alpha^B}{2}\int S(a,a')dF^B(a') - \alpha^B x + \delta EV(\widetilde{a})}{r+\delta}, & \text{when } |a| > \bar{a}, \\ V^E(a) = \frac{\frac{\alpha^E}{2}\int S(a,a')dF^E(a') + \delta EV(\widetilde{a})}{r+\delta}, & \text{when } |a| \leq \bar{a}. \end{cases}$$

Because of the optimal venue choice, the value function $V(a)$ is not concave even if $V^B(a)$ and $V^E(a)$ are concave. Consequently, through Nash bargaining, the post-trade asset allocation may not satisfy the mid-point property in Afonso and Lagos (2015), that the post inventory allocations a_1, a_2 for the two dealers in a match both equal the arithmetic average of their pretrade inventory holdings a and a',

$$a_1 = a_2 = \frac{a + a'}{2}.$$

"Mean-preserving spread" in post-trade inventory holding may be optimal. Denote $a_1 = \frac{a+a'}{2} + \Delta$, and $a_2 = \frac{a+a'}{2} - \Delta$. The spread Δ may be strictly positive. The spread is a sign that one of the two counterparties is making market for the other. Remember that the efficient inventory level is 0. The spread moves one dealer's inventory holding closer to the efficient level than the mid-point, the other further away from the efficient level. We can think of the dealer whose post trade inventory closer to 0 as the customer and the other as the customer's market maker in the trade.

Denote the policy function of post-trade asset allocation to be $a_L(a,a')$, $a_H(a,a')$ for a

matched pair with pre-trade inventory a and a'. $a_L(a,a'), a_H(a,a')$ maximizes trade surplus, and satisfy $a_L(a,a') + a_H(a,a') = a + a'$ and $a_L(a,a') \leq a_H(a,a')$.

Inventory distributions We continue with characterizing the conjectured stationary equilibrium where there exists a threshold $\bar{a} > 0$ such that dealers choose to trade in the electronic platform if and only if the distance of their pre-trade inventory a from 0 is lower than or equal to $\bar{a}$. Denote the cumulative distribution of dealers' inventory in the bilateral market $F^B(a)$, the cumulative distribution of dealers' inventory in the electronic platform $F^E(a)$, and the overall cumulative distribution $F(a)$, then

$$F(a) = F^E(a) + F^B(a). \tag{14}$$

If such an equilibrium exists, the density function of the overall distribution satisfies the following laws of motion,

$$\begin{aligned}\dot{f}(a) = \dot{f}^E(a) = &-\delta f(a) + \delta g(a) - \alpha^E f(a) \int_{|a_j|\leq\bar{a}} f(a_j) da_j \\ &+ \frac{\alpha^E}{2} \int_{|a_i|<\bar{a}} \int_{|a_j|<\bar{a}} f(a_i) f(a_j) \left[\mathbb{I}(\widehat{a}_L(a_i,a_j) = a) + \mathbb{I}(\widehat{a}_H(a_i,a_j) = a)\right] da_i da_j \\ &+ \frac{\alpha^B}{2} \int_{|a_i|>\bar{a}} \int_{|a_j|>\bar{a}} f(a_i) f(a_j) \left[\mathbb{I}(\widehat{a}_L(a_i,a_j) = a) + \mathbb{I}(\widehat{a}_H(a_i,a_j) = a)\right] da_i da_j\end{aligned} \tag{15}$$

for $|a| < \bar{a}$.

$$\begin{aligned}\dot{f}(a) = \dot{f}^B(a) = &-\delta f(a) + \delta g(a) - \alpha^B f(a) \int_{|a_j|>\bar{a}} f(a_j) da_j \\ &+ \frac{\alpha^B}{2} \int_{|a_i|>\bar{a}} \int_{|a_j|>\bar{a}} f(a_i) f(a_j) \left[\mathbb{I}(\widehat{a}_L(a_i,a_j) = a) + \mathbb{I}(\widehat{a}_H(a_i,a_j) = a)\right] da_i da_j \\ &+ \frac{\alpha^E}{2} \int_{|a_i|<\bar{a}} \int_{|a_j|<\bar{a}} f(a_i) f(a_j) \left[\mathbb{I}(\widehat{a}_L(a_i,a_j) = a) + \mathbb{I}(\widehat{a}_H(a_i,a_j) = a)\right] da_i da_j\end{aligned} \tag{16}$$

for $|a| > \bar{a}$.

Define

$$Q(a) \equiv \frac{\alpha^E}{2} \int_{|a_i|<\bar{a}} \int_{|a_j|<\bar{a}} f(a_i) f(a_j) \left[\mathbb{I}(\widehat{a}_L(a_i, a_j) \leq a) + \mathbb{I}(\widehat{a}_H(a_i, a_j) \leq a) \right] da_i da_j$$
$$+ \frac{\alpha^B}{2} \int_{|a_i|>\bar{a}} \int_{|a_j|>\bar{a}} f(a_i) f(a_j) \left[\mathbb{I}(\widehat{a}_L(a_i, a_j) \leq a) + \mathbb{I}(\widehat{a}_H(a_i, a_j) \leq a) \right] da_i da_j$$

$$q(a) \equiv \frac{dQ}{da}(a)$$

We can summary the distribution functions as

$$f(a) = \begin{cases} \frac{q(a)+\delta g(a)}{\alpha^B N^B + \delta}, & \text{if } a \leq -\bar{a}, \\ \frac{q(a)+\delta g(a)}{\alpha^E N^E + \delta}, & \text{if } -\bar{a} < a \leq \bar{a}, \\ \frac{q(a)+\delta g(a)}{\alpha^B N^B + \delta}, & \text{if } a > \bar{a}. \end{cases} \tag{17}$$

$$F(a) = \begin{cases} \frac{Q(a)+\delta G(a)}{\alpha^E N^E + \delta}, & \text{if } a \leq -\bar{a}, \\ \frac{Q(a)+\delta G(a) - Q(-\bar{a}) - \delta G(-\bar{a})}{\alpha^E N^B + \delta} + F(-\bar{a}), & \text{if } -\bar{a} < a \leq \bar{a}, \\ F(\bar{a}) + \frac{Q(a)+\delta G(a) - Q(\bar{a}) - \delta G(\bar{a})}{\alpha^E N^E + \delta}, & \text{if } a > \bar{a}, \end{cases} \tag{18}$$

where

$$N^E = \int_{|a_j| \leq \bar{a}} f(a_j) da_j, \tag{19}$$

$$N^B = \int_{|a_j| > \bar{a}} f(a_j) da_j. \tag{20}$$

Existence of equilibrium Before characterizing the stationary equilibrium in Section 5, we present two propositions that establish the theoretical foundation for its existence. Proposition 1 characterizes the existence of "mean-preserving spread" in post-trade inventory positions as described above. Specifically, it defines and proves the existence for a range of inventory levels such that, if the midpoint of two matched dealers' pre-trade positions falls within this range, their post-trade inventories will not equalize. In other words, one of

the two dealers provide intermediation service to the other. The proposition also provides sufficient conditions under which the size of this range shrinks to zero. Building on the characterization from Proposition 1, Propostion 2 establishes the existence of a stationary equilibrium, which is essential for the subsequent analysis of equilibrium outcomes, allowing for predictions about market shares, transaction costs, and welfare implications.

Proposition 1. *Given symmetric value functions $V^B(a)$ and $V^E(a)$, for $a < 0$, we denote B_n as the lower bound of negative asset position s.t. $B_n < -\bar{a}$ and for $\forall a \in [B_n, -\bar{a}]$, $\exists a' > -\bar{a}$ s.t. $V^{B\prime}(a) = V^{E\prime}(a')$; we denote E_n as the upper bound of negative asset position s.t. $E_n > -\bar{a}$ and $\forall a \in [-\bar{a}, E_n]$, $\exists a' < -\bar{a}$ s.t. $V^{B\prime}(a') = V^{E\prime}(a)$; and we denote $a_m < 0$ as all possible mid-point asset positions for any pair of two matched dealers with asset position $a' < 0$ and $a'' < 0$ (i.e., $a_m = \frac{a'+a''}{2}$) such that $\exists \Delta(a_m) > 0$ as a function of a_m which satisfies $V^{B\prime}(a_m - \Delta(a_m)) = V^{E\prime}(a_m + \Delta(a_m))$ for all a_m.*

1. *There exist $\underline{a_m}$ and $\overline{a_m}$ s.t. $-A < B_n < \underline{a_m} \leq -\bar{a} \leq \overline{a_m} < E_n < 0$ and for $\forall a_m \in [\underline{a_m}, \overline{a_m}]$:*

$$V^B(a_m - \Delta(a_m)) + V^E(a_m + \Delta(a_m)) \geq 2 \times V(a_m),$$

for $\forall a_m \in [\frac{B_n - \bar{a}}{2}, \underline{a_m}]$,

$$V^B(a_m - \Delta(a_m)) + V^E(a_m + \Delta(a_m)) \leq 2 \times V^B(a_m),$$

for $\forall a_m \in [\overline{a_m}, \frac{E_n - \bar{a}}{2}]$,

$$V^B(a_m - \Delta(a_m)) + V^E(a_m + \Delta(a_m)) \leq 2 \times V^E(a_m),$$

2. *If either of the following two conditions apply, we have $|\underline{a_m} - \overline{a_m}| \to 0$.*

   (a) $|V^{B\prime}(-\bar{a}) - V^{E\prime}(-\bar{a})| \to 0$;

   (b) $min\{|V^{B\prime\prime}(a)|, |V^{E\prime\prime}(a)|\} \to \infty$.

Similar conclusions apply for $a > 0$ by the symmetry of value functions $V^B(a)$ and $V^E(a)$.

The proof for the proposition is in Appendix A.

Proposition 2. *There exists a stationary equilibrium.*

The proof for the proposition is in Appendix B.

5 Equilibrium characterization

Transaction costs and transaction volume Figure 1 illustrates the transaction costs and trading volume in equilibrium. The expected trading volume for a dealer with inventory a is

$$\text{Vol}^B(a) = \alpha^B \int |\widehat{a}_i(a, a_j) - a| dF^B(a_j), \text{ if trade bilaterally} \tag{21}$$

$$\text{Vol}^E(a) = \alpha^E \int |\widehat{a}_i(a, a_j) - a| dF^E(a_j), \text{ if trade on electronic platform} \tag{22}$$

where $\widehat{a}_i(a_i, a_j)$ is the post-trade inventory position closer to a_i between $a_L(a_i, a_j)$ and $a_H(a_i, a_j)$.

The expected transaction cost is

$$E\tau^B(a) = \frac{\int \tau(a, a_j) dF^B(a_j)}{N^B}, \text{ if trade bilaterally} \tag{23}$$

$$E\tau^E(a) = \frac{\int \tau(a, a_j) dF^E(a_j)}{N^E}, \text{ if trade on electronic platform} \tag{24}$$

where transaction cost τ is the deviation of the transaction price from the mid-price, which happens to be 0,

$$\tau(a_i, a_j) = |p(a_i, a_j)| \tag{25}$$

where $p(a_i, a_j)$ denotes the transaction price. It splits the surplus from trade evenly between

the two counterparties:

$$\begin{aligned} & V(\widehat{a}_i(a_i, a_j)) - V(a_i) - p(a_i, a_j)(\widehat{a}_i(a_i, a_j) - a_i) \\ = \; & \frac{1}{2}\left[V(\widehat{a}_i(a_i, a_j)) + V(\widehat{a}_j(a_i, a_j)) - V(a_i) - V(a_j)\right] \end{aligned}$$

So the transaction cost

$$\tau(a_i, a_j) = \left| \frac{-V(\widehat{a}_i(a_i, a_j)) + V(\widehat{a}_j(a_i, a_j)) + V(a_i) - V(a_j)}{2(\widehat{a}_i(a_i, a_j) - a_i)} \right|. \tag{26}$$

Figure 1 shows that the transaction cost in bilateral trade (blue line) can be lower than that in electronic trade (red line). Meanwhile, the trading volume in bilateral trade can be greater than that in electronic trade. The dotted lines in the figure present the volumes and the costs in equilibrium.

These results are roughly consistent with our empirical findings. We are comparing volume in equilibrium and off equilibrium should a dealer choose a different trading venue. When we map the model results to the empirical findings, we think that dealers may choose the off-equilibrium venue with some small probability.

[Figure 1 about here.]

Equilibrium asset allocation Figure 2 illustrates the equilibrium distribution of inventories. It presents the density function of the inventory distribution. The density function jumps at the threshold inventory levels $\bar{a}$ and $-\bar{a}$ where dealers switch trading venues. Near the threshold, dealers in a bilateral match have asymmetric post-trade inventories, one making the market for the other. This creates jumps and peaks in the density function near the thresholds because dealers who make the market hold far-from-zero inventories, while dealers who act as customers hold near-zero inventories.

[Figure 2 about here.]

6 Policy implications

The social welfare of the economy equals

$$\int e^{-rt} \left[\int u(a) dF_t(a) - x\alpha^B N_t^B \right] dt \tag{27}$$

It includes the flow payoff from asset allocation and the cost of maintaining bilateral relationships. While the matching technology for bilateral trade between dealers is more efficient and thus improves inventory allocation, it is privately costly for dealers to maintain long-term relationships. Since the matching technology has increasing returns to scale, a dealer's trading venue choice imposes network externality on the matching efficiency of the trading venues.

Subsidizing bilateral relationships may improve social welfare. Figure 3 illustrates that the equilibrium bilateral trade may be inefficiently low. Thus, even though it is costly to maintain long-term relationships, it may be socially beneficial to subsidize bilateral trade. The optimal subsidy trades off between the social cost of maintaining bilateral relationships and the improved inventory allocation. We plan to calibrate the model to better evaluate policy implications.

Intuitively, subsidizing bilateral trade may be optimal because dealers do not internalize that their trading venue choices have network externalities on other dealers' venue choices. So, too few dealers choose bilateral trade in equilibrium. By aligning dealers' private incentives with the socially optimal venue choice, the subsidy expands the set of inventories when dealers choose to trade bilaterally.

[Figure 3 about here.]

7 Conclusion

Our study is the first to explain the prevalence of voice-based trading in OTC markets as a result of dealers' preference for relationship trading. Through comprehensive empirical evidence, we demonstrate that dealers favor the voice venue over electronic platforms, particularly for executing large trades aimed at rebalancing inventory positions. Relationship trading in the voice venue is linked with greater immediacy and lower per-volume transaction costs. We introduce a new search-and-matching model incorporating dealers' *ex post* venue selection, showing that relationship trading, represented by a higher bilateral meeting rate in the voice venue, is the primary mechanism driving predictions consistent with empirical findings. Additionally, our model yields a novel insight: dealers in the voice venue effectively provide intermediation services to those trading electronically. Finally, we use the calibrated model to explore social optimality and discuss relevant policy implications.

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Figures

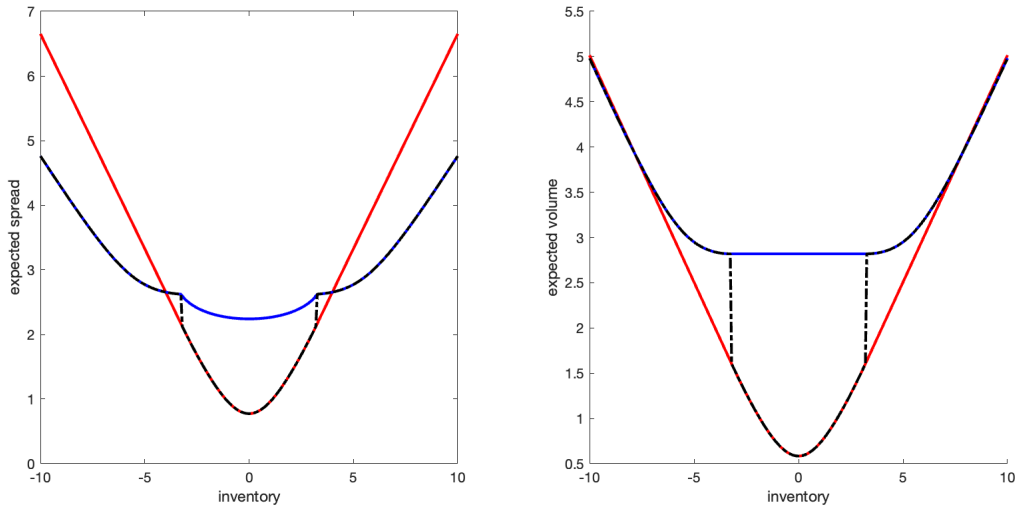


Figure 1: **Equilibrium expected trading costs and trading volume.** The vertical dotted lines represent the threshold inventory levels where dealers switch trading venues. The expected transaction cost conditional on the inventory level of a dealer is mostly lower under bilateral trade (in blue) than in electronic transactions (in red). The equilibrium trading volume under bilateral trade conditional on the inventory level of a dealer is, in general, greater than in electronic transactions.

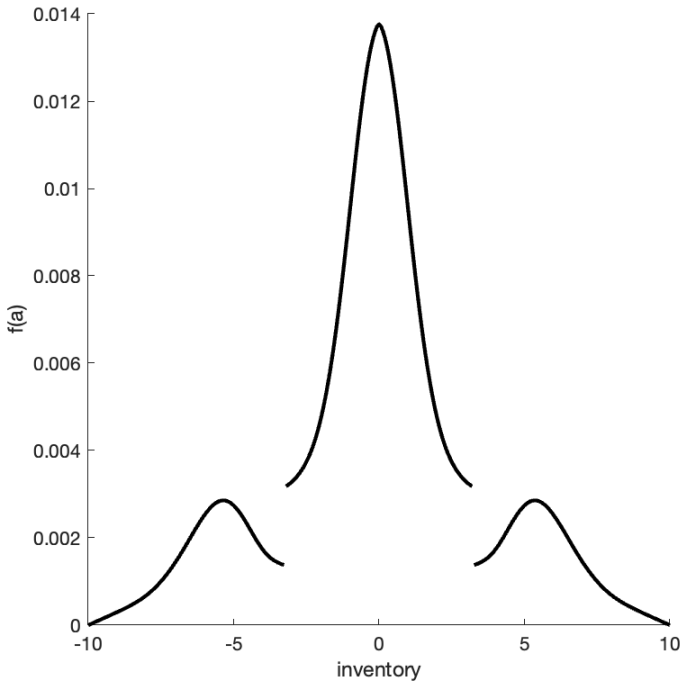


Figure 2: **Equilibrium inventory distribution.** The figure illustrates the density of equilibrium inventory distribution. The density function jumps at the threshold inventory levels $\bar{a}$ and $-\bar{a}$ where dealers switch trading venues. Near the threshold, dealers in a bilateral match have asymmetric post-trade inventories, one making the market for the other. This creates the jump and peaks in the density function near the thresholds.

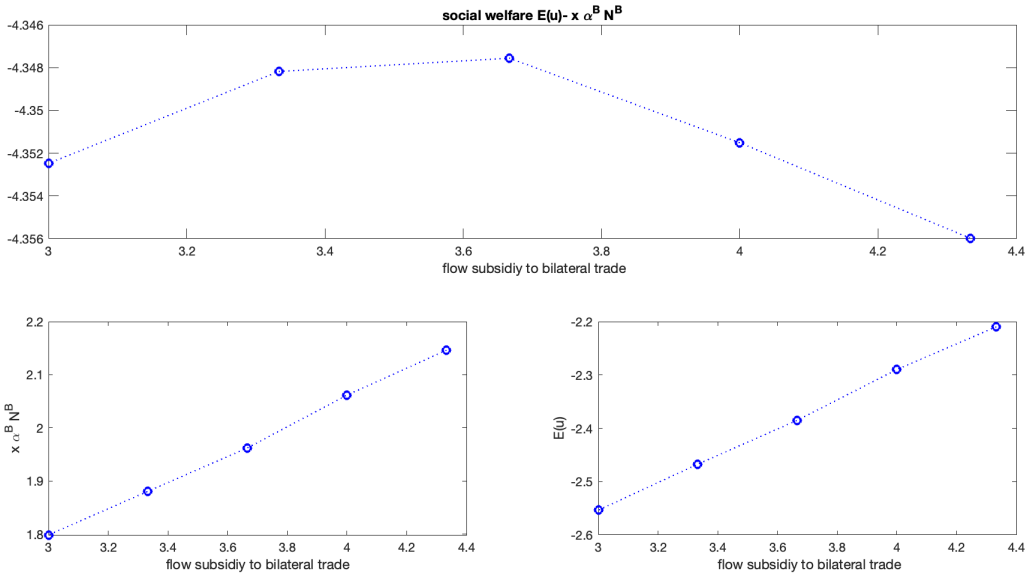


Figure 3: **Social welfare and subsidizing relationship trade.** This figure shows that the equilibrium bilateral trade may be inefficiently low. Even though it is costly to maintain long-term relationships, it may be socially beneficial to subsidize bilateral trade. The optimal subsidy trades off between the social cost of maintaining bilateral relationships and the improved inventory allocation.

Tables

Table 1: Core dealers' weekly share of transactions in different venues

	bilateral voice (%)		electronic (%)		voice core-core (%)		voice core-noncore (%)	
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	3.50***		−3.50***		1.13***		2.37**	
	(1.04)		(1.04)		(0.31)		(1.01)	
abs bond inv, $\lvert inv_{i,j,t} \rvert$		0.75		−0.75		4.32***		−3.57***
		(0.89)		(0.89)		(0.61)		(1.18)
bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer*week FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.43	0.36	0.43	0.36	0.24	0.15	0.34	0.28
Adjusted R^2	0.42	0.34	0.42	0.34	0.21	0.12	0.32	0.26
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table 2: Core dealers' weekly share of trading with top-10 connected partners through bilateral voice venue

	bilateral voice with top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	0.87**		0.73**		0.83**		0.47	
	(0.35)		(0.33)		(0.36)		(0.35)	
abs bond inv, $\lvert inv_{i,j,t} \rvert$		3.59***		3.63***		3.37***		3.58***
		(0.57)		(0.57)		(0.60)		(0.64)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
week FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*week FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.22	0.15	0.23	0.16	0.41	0.34	0.43	0.35
Adjusted R^2	0.20	0.13	0.21	0.14	0.31	0.23	0.32	0.24
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table 3: Core dealers' weekly share of trading with non top-10 connected partners through bilateral voice venue

	bilateral voice with non top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	0.42		0.39		0.01		−0.03	
	(0.36)		(0.36)		(0.34)		(0.36)	
abs bond inv, $\lvert inv_{i,j,t} \rvert$		1.81**		1.85**		0.74		0.86
		(0.78)		(0.79)		(0.79)		(0.83)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
week FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*week FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.14	0.13	0.15	0.14	0.34	0.31	0.35	0.32
Adjusted R^2	0.12	0.11	0.13	0.11	0.21	0.19	0.22	0.19
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table 4: Core dealers' weekly share of trading with top-10 connected partners through bilateral voice venue and the sign of the average bond-specific inventory of the top-10 partners

	bilateral voice with top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	1.63***		1.53***		1.78***		1.59***	
	(0.43)		(0.44)		(0.5)		(0.5)	
$inv_{i,j,t}\times$	43.17***		43.02***		53.46***		53.11***	
$\mathbb{1}\{Top10_AveInv < 0\}$	(8.47)		(8.45)		(12.78)		(12.72)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		0.2		0.25		-0.21		-0.08
		(0.68)		(0.67)		(0.84)		(0.84)
$\lvert inv_{i,j,t}\rvert\times$		68.63***		68.77***		80.68***		80.85***
$\mathbb{1}\{Top10_AveInv \geq 0\}$		(7.73)		(7.77)		(9.30)		(9.35)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
week FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*week FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.26	0.27	0.27	0.28	0.44	0.44	0.45	0.44
Adjusted R^2	0.25	0.26	0.25	0.26	0.34	0.34	0.35	0.34

Note: *p<0.1; **p<0.05; ***p<0.01

Table 5: Core dealers' weekly share of sell/buy trading through bilateral voice venue when they have positive/negative inventory positions

	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	11.46***		11.43***		13.36***		13.52***	
	(0.79)		(0.79)		(1.21)		(1.24)	
abs bond inv, $\lvert inv_{i,j,t} \rvert$		13.40***		13.35***		20.01***		20.23***
		(0.77)		(0.78)		(1.17)		(1.23)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
week FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*week FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.19	0.16	0.20	0.17	0.36	0.32	0.37	0.33
Adjusted R^2	0.17	0.14	0.18	0.14	0.24	0.20	0.24	0.20
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table 6: Core dealers' weekly share of buy/sell trading through bilateral voice venue when they have positive/negative inventory positions

	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	-7.90^{***}		-7.92^{***}		-9.18^{***}		-9.33^{***}	
	(0.62)		(0.63)		(0.76)		(0.81)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		-12.63^{***}		-12.61^{***}		-21.10^{***}		-21.46^{***}
		(0.95)		(0.94)		(1.44)		(1.48)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
week FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*week FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.23	0.16	0.23	0.17	0.37	0.32	0.38	0.33
Adjusted R^2	0.21	0.15	0.21	0.15	0.25	0.20	0.26	0.21
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table 7: Compare transaction cost per par value of bond between venues

	CH/par val						CH/par val (ref vol > \$100k)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mathbb{1}_{i,j,k}^{Bilateral}$	0.30	0.32	0.24	0.26				
	(0.27)	(0.27)	(0.28)	(0.28)				
$\mathbb{1}_{i,j,k}^{Core-Core}$					0.21	0.30	0.58	0.72
					(0.43)	(0.46)	(0.49)	(0.46)
$\mathbb{1}_{i,j,k}^{Core-Other}$					0.24	0.25	0.48	0.47*
					(0.26)	(0.26)	(0.29)	(0.28)
$\mathbb{1}(Order \geq \$100k)$	−2.85***	−2.82***	−2.86***	−2.82***	−2.86***	−2.83***	−2.62***	−2.60***
	(0.32)	(0.33)	(0.33)	(0.33)	(0.33)	(0.33)	(0.31)	(0.31)
$\mathbb{1}_{i,j,k}^{Bilateral} * \mathbb{1}(Order \geq \$100k)$	−0.63**	−0.61**	−0.58**	−0.57**				
	(0.27)	(0.26)	(0.28)	(0.26)				
$\mathbb{1}_{i,j,k}^{Core-Core} * \mathbb{1}(Order \geq \$100k)$					−0.61	−0.66*	−0.94**	−1.01**
					(0.37)	(0.38)	(0.46)	(0.43)
$\mathbb{1}_{i,j,k}^{Core-Other} * \mathbb{1}(Order \geq \$100k)$					−0.55*	−0.53**	−0.79*	−0.73*
					(0.28)	(0.26)	(0.40)	(0.40)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	No	Yes	No	Yes	No	Yes	No
day FE	Yes	No	Yes	No	Yes	No	Yes	No
dealer*day FE	No	Yes	No	Yes	No	Yes	No	Yes
bond char	No	No	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	489,175	489,175	460,494	460,494	460,494	460,494	261,176	261,176
R^2	0.31	0.35	0.31	0.35	0.31	0.35	0.38	0.44
Adjusted R^2	0.29	0.32	0.30	0.33	0.30	0.33	0.36	0.40
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table 8: Compare TRTT between venues

	TRTT (hour)					
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}_{i,j,k}^{Bilateral}$	1.23		1.26		−0.57	
	(0.76)		(0.92)		(0.74)	
$\mathbb{1}_{i,j,k}^{Bilateral} * \mathbb{1}(Order \geq \$100k)$	−3.94***		−3.82***		−2.03***	
	(0.92)		(1.05)		(0.58)	
$\mathbb{1}_{i,j,k}^{Core-Core}$		5.14**		4.88**		3.82
		(2.01)		(2.00)		(2.45)
$\mathbb{1}_{i,j,k}^{Core-Other}$		0.13		−0.05		−1.56**
		(0.66)		(0.84)		(0.64)
$\mathbb{1}_{i,j,k}^{Core-Core} * \mathbb{1}(Order \geq \$100k)$		−7.73***		−7.80***		−5.61**
		(1.85)		(1.91)		(2.24)
$\mathbb{1}_{i,j,k}^{Core-Other} * \mathbb{1}(Order \geq \$100k)$		−2.78***		−2.35**		−1.24*
		(0.78)		(0.94)		(0.67)
OrderSize ($ million)	−1.53***	−1.52***	−1.43***	−1.43***	−1.89***	−1.88***
	(0.25)	(0.26)	(0.26)	(0.26)	(0.20)	(0.20)
dealer*day FE	Yes	Yes	No	No	Yes	Yes
bond*day FE	Yes	Yes	Yes	Yes	No	No
bond char	No	No	No	No	Yes	Yes
dealer agg inv	No	No	Yes	Yes	No	No
Observations	612,742	612,742	546,716	546,716	265,383	265,383
R^2	0.78	0.78	0.77	0.77	0.26	0.26
Adjusted R^2	0.48	0.48	0.47	0.47	0.20	0.20
Note:	*p<0.1; **p<0.05; ***p<0.01					

Table 9: Compare TRTT per par value of bond between venues

	TRTT per par value of bond (hour/$)					
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}_{i,j,k}^{Bilateral}$	0.004***		0.004***		0.004***	
	(0.0003)		(0.0002)		(0.0003)	
$\mathbb{1}_{i,j,k}^{Bilateral} * \mathbb{1}(Order \geq \$100k)$	−0.007***		−0.008***		−0.008***	
	(0.0004)		(0.0004)		(0.0004)	
$\mathbb{1}_{i,j,k}^{Core-Core}$		0.005***		0.005***		0.008***
		(0.001)		(0.001)		(0.001)
$\mathbb{1}_{i,j,k}^{Core-Other}$		0.003***		0.003***		0.003***
		(0.0005)		(0.001)		(0.0005)
$\mathbb{1}_{i,j,k}^{Core-Core} * \mathbb{1}(Order \geq \$100k)$		−0.009***		−0.009***		−0.011***
		(0.001)		(0.001)		(0.001)
$\mathbb{1}_{i,j,k}^{Core-Other} * \mathbb{1}(Order \geq \$100k)$		−0.007***		−0.007***		−0.007***
		(0.0005)		(0.001)		(0.001)
OrderSize ($ million)	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
dealer*day FE	Yes	Yes	No	No	Yes	Yes
bond*day FE	Yes	Yes	Yes	Yes	No	No
bond char	No	No	No	No	Yes	Yes
dealer agg inv	No	No	Yes	Yes	No	No
Observations	612,742	612,742	546,716	546,716	265,383	265,383
R^2	0.750	0.750	0.746	0.747	0.293	0.297
Adjusted R^2	0.415	0.416	0.421	0.422	0.237	0.241
Note:	*p<0.1; **p<0.05; ***p<0.01					

Table 10: Compare probability of principal trades between venues

	Probability of principal trades							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mathbb{1}_{i,j,k}^{Bilateral}$	-0.05^{***}		-0.05^{***}		-0.01		-0.01^{***}	
	(0.01)		(0.004)		(0.01)		(0.003)	
$\mathbb{1}_{i,j,k}^{Bilateral} * \mathbb{1}(Order \geq \$100k)$	0.10^{***}		0.10^{***}		0.06^{**}		0.08^{***}	
	(0.01)		(0.003)		(0.01)		(0.003)	
$\mathbb{1}_{i,j,k}^{Core-Core}$		-0.25^{***}		-0.25^{***}		-0.29^{***}		-0.30^{***}
		(0.01)		(0.01)		(0.005)		(0.01)
$\mathbb{1}_{i,j,k}^{Core-Other}$		-0.03^{**}		-0.03^{***}		0.02^{**}		0.02^{***}
		(0.01)		(0.003)		(0.01)		(0.003)
$\mathbb{1}_{i,j,k}^{Core-Core} * \mathbb{1}(Order \geq \$100k)$		0.26^{**}		0.26^{***}		0.30^{**}		0.32^{***}
		(0.05)		(0.01)		(0.07)		(0.01)
$\mathbb{1}_{i,j,k}^{Core-Other} * \mathbb{1}(Order \geq \$100k)$		0.08^{***}		0.09^{***}		0.04^{***}		0.06^{***}
		(0.01)		(0.003)		(0.005)		(0.003)
bond*day FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
size FE	Yes	Yes	No	No	Yes	Yes	No	No
bond char	No	No	No	No	Yes	Yes	Yes	Yes
Observations	9,055,941	9,055,941	9,055,941	9,055,941	7,186,114	7,186,114	7,186,114	7,186,114
R^2	0.39	0.39	0.39	0.39	0.06	0.07	0.06	0.07
Adjusted R^2	0.22	0.23	0.22	0.23	0.06	0.07	0.06	0.07
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table 11: Compare order splitting rates between venues

	$\mathbb{1}^{Split}_{i,j,k}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}^{Bilateral}_{i,j,k}$	0.11***		0.11***		0.10***	
	(0.029)		(0.029)		(0.031)	
$\mathbb{1}^{Bilateral}_{i,j,k} * \mathbb{1}(Order \geq \$100k)$	−0.09***		−0.09***		−0.07***	
	(0.015)		(0.016)		(0.022)	
$\mathbb{1}^{Core-Core}_{i,j,k}$		0.11***		0.11***		0.11***
		(0.030)		(0.030)		(0.029)
$\mathbb{1}^{Core-Other}_{i,j,k}$		0.12***		0.12***		0.09***
		(0.030)		(0.031)		(0.036)
$\mathbb{1}^{Core-Core}_{i,j,k} * \mathbb{1}(Order \geq \$100k)$		−0.11***		−0.11***		−0.10***
		(0.016)		(0.016)		(0.022)
$\mathbb{1}^{Core-Other}_{i,j,k} * \mathbb{1}(Order \geq \$100k)$		−0.06***		−0.06***		−0.04***
		(0.017)		(0.017)		(0.025)
OrderSize ($ million)	−0.13***	−0.12***	−0.13***	−0.12***	−0.10***	−0.09***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)
dealer*day FE	Yes	Yes	No	No	Yes	Yes
bond*day FE	Yes	Yes	Yes	Yes	No	No
bond char	No	No	No	No	Yes	Yes
dealer agg inv	No	No	Yes	Yes	No	No
Observations	1,184,155	1,184,155	1,184,155	1,184,155	1,184,155	1,184,155
R^2	0.58	0.58	0.57	0.57	0.21	0.21
Adjusted R^2	0.29	0.29	0.28	0.29	0.19	0.19
Note:	*p<0.1; **p<0.05; ***p<0.01					

Table 12: Relationship between transaction costs (Choi-Huh per volume, bps/$1M) and immediacy (TRTT per volume, hour/$1M)

	Choi-Huh per volume (bps/$1M)			
	TRTT allowing order splitting			
	(1) voice	(2) voice	(3) electronic	(4) electronic
TRTT per volume	-2.15***	-3.11***	-0.01	-0.40
(hour/$1M)	(0.86)	(1.11)	(0.10)	(0.25)
OrderSize ($ million)	−6.28e+04***	−8.59e+04***	−1.52e+03***	−3.89e+03***
	(2.15e+04)	(2.69e+04)	(5.32e+02)	(1.35e+03)
TRTT per volume×	−5.57***	−7.73***	−0.33*	−0.92*
$\mathbb{1}(Order \geq \$100k)$	(1.96)	(2.50)	(0.17)	(0.50)
OrderSize×	1.11e+05***	1.51e+05***	3.29e+03***	8.37e+03***
$\mathbb{1}(Order \geq \$100k)$	(3.80e+04)	(4.72e+04)	(1.18e+03)	(2.65e+03)
dealer FE	Yes	Yes	No	No
bond FE	Yes	Yes	No	No
day FE	Yes	Yes	No	No
dealer*bond FE	No	No	Yes	Yes
dealer*day	No	No	Yes	Yes
Observations	56,704	56,704	7,028	7,028
R^2	0.63	0.72	0.56	0.96
Adjusted R^2	0.60	0.57	0.33	0.75
	TRTT NOT allowing order splitting			
	(1) voice	(2) voice	(3) electronic	(4) electronic
TRTT per volume	-2.23**	-4.44*	-0.12	-2.42**
(hour/$1M)	(1.01)	(2.28)	(0.22)	(1.13)
OrderSize ($ million)	−6.23e+04**	−1.15e+05**	−2.32e+03**	−2.23e+03***
	(2.44e+04)	(5.44e+04)	(1.11e+03)	(6.51e+03)
TRTT per volume×	−5.67**	−10.68**	−0.49	−4.62**
$\mathbb{1}(Order \geq \$100k)$	(2.27)	(5.15)	(0.42)	(2.07)
OrderSize×	1.10e+05**	2.03e+05**	5.09e+03**	4.11e+04***
$\mathbb{1}(Order \geq \$100k)$	(4.30e+04)	(9.57e+04)	(2.41e+03)	(1.20e+04)
dealer FE	Yes	Yes	No	No
bond FE	Yes	Yes	No	No
day FE	Yes	Yes	No	No
dealer*bond FE	No	No	Yes	Yes
dealer*day	No	No	Yes	Yes
Observations	28,884	28,884	3,676	3,676
R^2	0.70	0.79	0.63	0.99
Adjusted R^2	0.65	0.60	0.30	0.93

Note: *p<0.1; **p<0.05; ***p<0.01. "TRTT allowing order splitting" is calculated using the round-trip trades with second-leg order size smaller or equal to the first leg; "TRTT NOT allowing order splitting" is calculated using the round-trip trades with second-leg order size exactly equal to the first leg.

Table 13: Core dealers' weekly share of transactions in different venues controlling for pre- and post- earning announcement periods (2-week time window)

	bilateral voice (%)		electronic (%)		voice core-core (%)		voice core-noncore (%)	
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	3.50***		−3.50***		1.14***		2.36**	
	(1.04)		(1.04)		(0.33)		(1.01)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		0.75		−0.75		4.28***		−3.51***
		(0.88)		(0.88)		(0.62)		(1.18)
bond inv, $inv_{i,j,t}$ × $\mathbb{1}\{preEAP_2week\}$	0.002		-0.002		−0.96**		0.97*	
	(0.522)		(0.522)		(0.40)		(0.51)	
bond inv, $inv_{i,j,t}$ × $\mathbb{1}\{postEAP_2week\}$	-1.08*		1.08*		−1.11**		0.02	
	(0.556)		(0.556)		(0.45)		(0.70)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$ × $\mathbb{1}\{preEAP_2week\}$		0.80		−0.80		−0.45		1.25
		(0.88)		(0.88)		(0.74)		(0.98)
abs bond inv, $\lvert inv_{i,j,t}\rvert$ × $\mathbb{1}\{postEAP_2week\}$		0.50		−0.50		−3.49***		4.00***
		(1.23)		(1.23)		(0.89)		(1.35)
$\mathbb{1}\{preEAP_2week\}$	0.029	0.11	−0.029	−0.11	−0.15	−0.56**	0.18	0.67*
	(0.166)	(0.24)	(0.166)	(0.24)	(0.18)	(0.23)	(0.28)	(0.38)
$\mathbb{1}\{postEAP_2week\}$	0.278	0.50	−0.278	−0.50	−0.62*	−1.43***	0.89**	0.91**
	(0.344)	(1.23)	(0.344)	(1.23)	(0.33)	(0.44)	(0.37)	(0.36)
bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer*week FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.43	0.36	0.43	0.36	0.24	0.15	0.34	0.28
Adjusted R^2	0.42	0.34	0.42	0.34	0.21	0.12	0.32	0.26

Note: *p<0.1; **p<0.05; ***p<0.01. The indicators $\mathbb{1}\{preEAP_2week\}$ and $\mathbb{1}\{postEAP_2week\}$ represent dummy variables that capture whether the current week falls within the two-week pre- or post-earnings announcement periods, respectively.

Table 14: Core dealers' weekly share of transactions in different venues controlling for pre- and post- earning announcement periods (4-week time window)

	bilateral voice (%)		electronic (%)		voice core-core (%)		voice core-noncore (%)	
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	3.51***		−3.51***		1.16***		2.35**	
	(1.05)		(1.05)		(0.32)		(1.01)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		0.75		−0.75		4.30***		−3.54***
		(0.88)		(0.88)		(0.61)		(1.17)
bond inv, $inv_{i,j,t}$ × $\mathbb{1}\{preEAP_4week\}$	-0.27		0.27		−1.13***		0.86	
	(0.49)		(0.49)		(0.34)		(0.54)	
bond inv, $inv_{i,j,t}$ × $\mathbb{1}\{postEAP_4week\}$	-0.96*		0.96*		−0.94**		-0.03	
	(0.49)		(0.49)		(0.45)		(0.55)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$ × $\mathbb{1}\{preEAP_4week\}$		0.85		−0.85		−0.25		1.11
		(0.76)		(0.76)		(0.68)		(0.85)
abs bond inv, $\lvert inv_{i,j,t}\rvert$ × $\mathbb{1}\{postEAP_4week\}$		0.75		−0.75		−1.98**		2.71***
		(0.79)		(0.79)		(0.81)		(0.99)
$\mathbb{1}\{preEAP_4week\}$	-0.10	0.05	0.10	−0.05	−0.11	−0.57***	0.002	0.62*
	(0.22)	(0.24)	(0.22)	(0.24)	(0.17)	(0.20)	(0.24)	(0.31)
$\mathbb{1}\{postEAP_4week\}$	-0.01	-0.75***	0.01	0.75***	−0.73**	−1.16***	0.71***	0.38
	(0.20)	(0.18)	(0.20)	(0.18)	(0.29)	(0.28)	(0.22)	(0.26)
bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer*week FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.43	0.36	0.43	0.36	0.24	0.15	0.34	0.28
Adjusted R^2	0.42	0.34	0.42	0.34	0.21	0.12	0.32	0.26

Note: *p<0.1; **p<0.05; ***p<0.01. The indicators $\mathbb{1}\{preEAP_4week\}$ and $\mathbb{1}\{postEAP_4week\}$ represent dummy variables that capture whether the current week falls within the four-week pre- or post-earnings announcement periods, respectively.

Internet Appendix

A Proof of proposition 1

Proof:

1. existance of $\underline{a_m}$ and $\overline{a_m}$ By definition of B_n and E_n, we separately consider candidate midpoint asset positions $a_m \in [\frac{B_n-\bar{a}}{2}, -\bar{a}]$ and $a_m \in [-\bar{a}, \frac{E_n-\bar{a}}{2}]$. We will discuss under which conditions, the Nash bargaining solution between two matched traders with *ex ante* asset positions satisfying $\frac{a+a'}{2} = a_m$ is the midpoint position a_m, i.e. $2V(a_m) > V^B(a_m - \Delta(a_m)) + V^E(a_m + \Delta(a_m))$.

(1) For $a_m \in [\frac{B_n-\bar{a}}{2}, -\bar{a}]$, we have,

$$2V(a_m) = 2V^B(a_m) > V^B(a_m - \Delta(a_m)) + V^E(a_m + \Delta(a_m)) \tag{A1}$$

$\iff$

$$V^B(a_m) - V^B(a_m - \Delta(a_m)) > V^E(a_m + \Delta(a_m)) - V(a_m)$$

$\iff$

$$\begin{aligned} V^{B\prime}(a_m - \Delta(a_m))\Delta(a_m) + o(\Delta(a_m)) >& V^E(a_m + \Delta(a_m)) - V^E(-\bar{a}) + V^B(-\bar{a}) \\ & - V^B(a_m + \Delta(a_m)) + V^B(a_m + \Delta(a_m)) - V(a_m) \end{aligned}$$

where $V^E(-\bar{a}) = V^B(-\bar{a})$.
$\iff$

$$\begin{aligned} V^{B\prime}(a_m - \Delta(a_m))\Delta(a_m) + o(\Delta(a_m)) >& V^{E\prime}(-\bar{a})(a_m + \Delta(a_m) + \bar{a}) - V^{B\prime}(-\bar{a})(a_m + \Delta(a_m) + \bar{a}) \\ & + V^{B\prime}(a_m)\Delta(a_m) + o(\Delta(a_m)) \end{aligned}$$

$\iff$

$$\Delta(a_m)(V^{B\prime}(a_m - \Delta(a_m)) - V^{B\prime}(a_m)) > (a_m + \Delta(a_m) + \bar{a})(V^{E\prime}(-\bar{a}) - V^{B\prime}(-\bar{a}))$$

as $\Delta(a_m) \to 0$.
$\iff$

$$\Delta(a_m)V^{B\prime\prime}(a_m)(-\Delta(a_m)) > (a_m + \Delta(a_m) + \bar{a})(V^{E\prime}(-\bar{a}) - V^{B\prime}(-\bar{a}))$$

where $\Delta(a_m) \to 0$ and $V^{B\prime\prime}(a_m)$ is constant.
$\iff$

$$\Delta(a_m)V^{B\prime\prime}(a_m)(-\Delta(a_m)) > (a_m + \Delta(a_m) + \bar{a})(-V^{B\prime\prime}(a_m))(-\bar{a} - B_n)$$

where we replace $V^{E\prime}(-\bar{a}) - V^{B\prime}(-\bar{a})$ with $(-V^{B\prime\prime}(a_m))(-\bar{a} - B_n)$.
$\iff$

$$\underbrace{\frac{\Delta(a_m)}{\Delta(a_m)+a_m+\bar{a}}}_{LHS_1} > \underbrace{\frac{-\bar{a}-B_n}{\Delta(a_m)}}_{RHS_1} \tag{A2}$$

For $a_m \in [\frac{B_n-\bar{a}}{2}, -\bar{a}]$, when $a_m \to \frac{B_n-\bar{a}}{2}$,

$$\Delta(a_m)+a_m \to -\bar{a} \tag{A3}$$

$\Longrightarrow$

$$LHS_1 \to +\infty, \quad RHS_1 \to 2, \tag{A4}$$

and when $a_m \to -\bar{a}$,

$$LHS_1 \to 1, \quad RHS_1 \to \frac{-\bar{a}-B_n}{\Delta(-\bar{a})} \tag{A5}$$

where as a_m increases from $\frac{B_n-\bar{a}}{2}$ to $-\bar{a}$, whether RHS_1 increases or decreases, depends on whether $V^B(a)$ decreases more or less quickly than $V^E(a)$.

When $|V^{B\prime\prime}(a)| < |V^{E\prime\prime}(a)|$, i.e. $V^B(a)$ decreases less quickly than $V^E(a)$, then as a_m increases from $\frac{B_n-\bar{a}}{2}$ to $-\bar{a}$, $\Delta(a_m)$ decreases, then RHS_1 increases. Because LHS_1 decreases from $+\infty$ to 1, then there must exist $\underline{a_m}$ s.t. $\frac{B_n-\bar{a}}{2} < \underline{a_m} < -\bar{a}$, and for $\forall a_m \in [\underline{a_m}, -\bar{a}]$, (A2) does NOT apply, i.e. $2V^B(a_m) < V^B(a_m-\Delta(a_m)) + V^E(a_m+\Delta(a_m))$; and for $\forall a_m \in [\frac{B_n-\bar{a}}{2}, \underline{a_m}]$, (A2) applies, i.e. $2V^B(a_m) > V^B(a_m-\Delta(a_m)) + V^E(a_m+\Delta(a_m))$.

When $|V^{B\prime\prime}(a)| > |V^{E\prime\prime}(a)|$, i.e. $V^B(a)$ decreases more quickly than $V^E(a)$, then as a_m increases from $\frac{B_n-\bar{a}}{2}$ to $-\bar{a}$, $\Delta(a_m)$ increases, then RHS_1 decreases, then there may or may not exist such $\underline{a_m}$ s.t. for $\forall a_m \in [\underline{a_m}, -\bar{a}]$, Nash bargaining solution is NOT midpoint solution. Whether the $\underline{a_m}$ exists or not, depends on the speed at which RHS_1 decreases relative to LHS_1 decreases. For simplicity, in this case, we regard $\underline{a_m} = -\bar{a}$, i.e. all bilateral meeting of traders within the sell side ($a < 0$) of bilateral voice venue will generate midpoint solution only.

(2) For $a_m \in [-\bar{a}, \frac{E_n-\bar{a}}{2}]$, we have,

$$2V(a_m) = 2V^E(a_m) > V^B(a_m-\Delta(a_m)) + V^E(a_m+\Delta(a_m)) \tag{A6}$$

$\Longleftrightarrow$

$$V^E(a_m) - V^B(a_m-\Delta(a_m)) > V^E(a_m+\Delta(a_m)) - V^E(a_m)$$

$\Longleftrightarrow$

$$\begin{aligned}
&V^E(a_m) - V^E(a_m-\Delta(a_m)) + V^E(a_m-\Delta(a_m)) - V^E(-\bar{a}) - V^B(a_m-\Delta(a_m)) + V^B(-\bar{a}) \\
&= V^{E\prime}(a_m-\Delta(a_m))\Delta(a_m) + V^{E\prime}(-\bar{a})(a_m+\bar{a}-\Delta(a_m)) - V^{B\prime}(-\bar{a})(a_m+\bar{a}-\Delta(a_m)) \\
&= V^{E\prime}(a_m-\Delta(a_m))\Delta(a_m) + (V^{E\prime}(-\bar{a}) - V^{B\prime}(-\bar{a}))(a_m+\bar{a}-\Delta(a_m)) \\
&> V^{E\prime}(a_m)\Delta(a_m) + o(\Delta(a_m))
\end{aligned}$$

$\Longleftrightarrow$

$$(V^{E\prime}(-\bar{a}) - V^{B\prime}(-\bar{a}))(a_m + \bar{a} - \Delta(a_m)) > -\Delta(a_m)(V^{E\prime}(a_m - \Delta(a_m)) - V^{E\prime}(a_m))$$

$\Longleftrightarrow$

$$(-V^{E\prime\prime}(a_m))(E_n + \bar{a})(\Delta(a_m) - (a_m + \bar{a})) < \Delta(a_m)(-V^{E\prime\prime}(a_m))\Delta(a_m)$$

$\Longleftrightarrow$

$$\underbrace{\frac{E_n + \bar{a}}{\Delta(a_m)}}_{LHS_2} < \underbrace{\frac{\Delta(a_m)}{\Delta(a_m) - (a_m + \bar{a})}}_{RHS_2} \tag{A7}$$

For $a_m \in [-\bar{a}, \frac{E_n - \bar{a}}{2}]$, when $a_m \to \frac{E_n - \bar{a}}{2}$,

$$\Delta(a_m) \to \frac{E_n + \bar{a}}{2} \tag{A8}$$

$\Longrightarrow$

$$RHS_2 \to +\infty, \quad LHS_2 \to 2, \tag{A9}$$

and when $a_m \to -\bar{a}$,

$$RHS_2 \to 1, \quad LHS_2 \to \frac{\bar{a} + E_n}{\Delta(-\bar{a})} \tag{A10}$$

where as a_m decreases from $\frac{E_n + \bar{a}}{2}$ to $-\bar{a}$, whether LHS_2 increases or decreases, depends on whether $V^B(a)$ decreases more or less quickly than $V^E(a)$.

When $|V^{B\prime\prime}(a)| > |V^{E\prime\prime}(a)|$, i.e. $V^B(a)$ decreases more quickly than $V^E(a)$, then as a_m decreases from $\frac{E_n + \bar{a}}{2}$ to $-\bar{a}$, $\Delta(a_m)$ decreases, then LHS_2 increases. Because RHS_2 decreases from $+\infty$ to 1, then there must exist $\overline{a_m}$ s.t. $-\bar{a} < \overline{a_m} < \frac{E_n - \bar{a}}{2}$, and for $\forall a_m \in [-\bar{a}, \overline{a_m}]$, (A7) does NOT apply, i.e. $2V^E(a_m) < V^B(a_m - \Delta(a_m)) + V^E(a_m + \Delta(a_m))$; and for $\forall a_m \in [\overline{a_m}, \frac{E_n - \bar{a}}{2}]$, (A7) applies, i.e. $2V^E(a_m) > V^B(a_m - \Delta(a_m)) + V^E(a_m + \Delta(a_m))$.

When $|V^{B\prime\prime}(a)| < |V^{E\prime\prime}(a)|$, i.e. $V^B(a)$ decreases less quickly than $V^E(a)$, then as a_m decreases from $\frac{E_n + \bar{a}}{2}$ to $-\bar{a}$, $\Delta(a_m)$ increases, then LHS_2 decreases, then there may or may not exist such $\overline{a_m}$ s.t. for $\forall a_m \in [-\bar{a}, \overline{a_m}]$, Nash bargaining solution is NOT midpoint solution. Whether the $\overline{a_m}$ exists or not, depends on the speed at which LHS_2 decreases relative to RHS_2 decreases. For simplicity, in this case, we regard $\overline{a_m} = -\bar{a}$, i.e. all bilateral meeting of traders within the sell side ($a < 0$) of electronic venue will generate midpoint solution only.

As shown above, no matter whether $V^B(a)$ decreases more quickly than $V^E(a)$, there always exists a non-empty range of a_m, $[\underline{a_m}, \overline{a_m}]$, such that within this range, Nash bargaining solutions between two traders from the sell side of the same venue (either bilateral voice-based venue or electronic venue) are always non-midpoint solutions. By such bargaining results, one trader maintains in her current venue and the other jumps to the other venue. More specifically, when $|V^{B\prime\prime}(a)| < |V^{E\prime\prime}(a)|$, there must exist $\underline{a_m}$ s.t. $\frac{B_n - \bar{a}}{2} < \underline{a_m} < -\bar{a}$, and for $\forall a_m \in [\underline{a_m}, -\bar{a}]$, we have $2V^B(a_m) < V^B(a_m - \Delta(a_m)) + V^E(a_m + \Delta(a_m))$, and $\overline{a_m} \neq -\bar{a}$ may or may not exist; when $|V^{B\prime\prime}(a)| > |V^{E\prime\prime}(a)|$, there must exist $\overline{a_m}$ s.t. $-\bar{a} < \overline{a_m} < \frac{E_n - \bar{a}}{2}$, and for $\forall a_m \in [-\bar{a}, \overline{a_m}]$, we have $2V^E(a_m) < V^B(a_m - \Delta(a_m)) + V^E(a_m + \Delta(a_m))$, and $\underline{a_m} \neq -\bar{a}$ may or may not exist.

2. the magnitude of $|\underline{a_m} - \overline{a_m}|$.
(a) If $|V^{B\prime}(-\bar{a}) - V^{E\prime}(-\bar{a})| \to 0$, we have,

$$-\bar{a} - B_n = \frac{V^{E\prime}(-\bar{a}) - V^{B\prime}(-\bar{a})}{-V^{B\prime\prime}(a)} \to 0 \tag{A11}$$

and

$$\bar{a} + E_n = \frac{V^{E\prime}(-\bar{a}) - V^{B\prime}(-\bar{a})}{-V^{E\prime\prime}(a)} \to 0 \tag{A12}$$

$\Longrightarrow$

$$max\{-\bar{a} - B_n, \bar{a} + E_n\} \to 0 \tag{A13}$$

$\Longleftrightarrow$

$$max\{\Delta(a_m)\} \to 0, \quad \text{for } a_m \in [\frac{-\bar{a} + B_n}{2}, \frac{-\bar{a} + E_n}{2}]$$

$\Longleftrightarrow$

$$max\{|\underline{a_m} + \bar{a}|, |\overline{a_m} + \bar{a}|\} \to 0$$

(b) If $min\{|V^{B\prime\prime}(a)|, |V^{E\prime\prime}(a)|\} \to \infty$, we also have,

$$-\bar{a} - B_n = \frac{V^{E\prime}(-\bar{a}) - V^{B\prime}(-\bar{a})}{-V^{B\prime\prime}(a)} = \frac{V^{E\prime}(-\bar{a}) - V^{B\prime}(-\bar{a})}{|V^{B\prime\prime}(a)|} \to 0 \tag{A14}$$

and

$$\bar{a} + E_n = \frac{V^{E\prime}(-\bar{a}) - V^{B\prime}(-\bar{a})}{-V^{E\prime\prime}(a)} = \frac{V^{E\prime}(-\bar{a}) - V^{B\prime}(-\bar{a})}{|V^{E\prime\prime}(a)|} \to 0 \tag{A15}$$

$\Longrightarrow$

$$max\{-\bar{a} - B_n, \bar{a} + E_n\} \to 0 \tag{A16}$$

$\Longleftrightarrow$

$$max\{\Delta(a_m)\} \to 0, \quad \text{for } a_m \in [\frac{-\bar{a} + B_n}{2}, \frac{-\bar{a} + E_n}{2}]$$

$\Longleftrightarrow$

$$max\{|\underline{a_m} + \bar{a}|, |\overline{a_m} + \bar{a}|\} \to 0$$

□

B Proof of proposition 2

Proof: We prove under the condition that (a) and/or (b) in Proposition 1 apply. Then in both electronic and bilateral voice-based venues, for any pair of matched traders, the bargaining results are always the mid-point value of the two traders' *ex ante* asset positions.

Based on properties of $V^E(a)$, $V^B(a)$ and $f(a)$, we consider the following normed linear spaces:

$V_S^E = \{V^E(a) : V^E(a) \in C^1([-\bar{a}, \bar{a}])$ and is twice differentiable and quasiconcave;

$$V^E(a) \text{ is symmetric w.t. } a=0, \text{ s.t. } V^{E\prime}(a)>0\,(V^{E\prime}(a)<0) \text{ for } a<0\,(a>0),$$
$$V^{E\prime}(0)=0, V^{E\prime\prime}(0)<0 \text{ and } V^{E\prime\prime}(a) \text{ is constant on } [-\bar{a},\bar{a}]\}, \tag{A17}$$

$$V_S^B = \{V^B(a) : V^B(a) \in C^1([-A,-\bar{a}]\cup[\bar{a},A]) \text{ and is twice differentiable and quasiconcave;}$$
$$V^B(a) \text{ is symmetric w.t. } a=0, \text{ s.t. } V^{B\prime}(a)>0\,(V^{B\prime}(a)<0) \text{ for } a<0\,(a>0),$$
$$\text{and } V^{B\prime\prime}(a) \text{ is constant on } [-A,-\bar{a}]\cup[\bar{a},A]\}, \tag{A18}$$

$$F^E = \{f^E(a) : f^E(a) \in C^1([-\bar{a},\bar{a}]); 0 \le f^E(a) \le \bar{C}\} \tag{A19}$$

$$F^B = \{f^B(a) : f^B(a) \in C^1([-A,-\bar{a}]\cup[\bar{a},A]); 0 \le f^B(a) \le \bar{C}\} \tag{A20}$$

where $A > \bar{a} > 0$ and all of the normed linear spaces are with the norm $\|V\|_\infty = \underset{-A\le a\le A}{max}|V(a)|$.

Then the mappings are as follows:

$$T\begin{bmatrix} V^E(a) \\ V^B(a) \\ f^E(a) \\ f^B(a) \end{bmatrix} = \begin{bmatrix} T_1(V^E(a)) \\ T_2(V^B(a)) \\ T_3(f^E(a)) \\ T_4(f^B(a)) \end{bmatrix} \tag{A21}$$

where

$$T_1(V^E(a)) = V^E(a)(1-r-\delta) + \frac{\alpha^E}{2}\int_{|a'|<\bar{a}} S(a,a')dF^E(a') + \delta EV(\tilde{a}) \tag{A22}$$

$$T_2(V^B(a)) = V^B(a)(1-r-\delta) + \frac{\alpha^B}{2}\int_{|a'|>\bar{a}} S(a,a')dF^B(a') - \alpha^B f + \delta EV(\tilde{a}) \tag{A23}$$

$$\begin{aligned} T_3(f^E(a)) = {} & (1-\delta)f^E(a) + \delta g(a) - \alpha^E f^E(a)\int_{|a_j|\le\bar{a}} f^E(a_j)da_j \\ & + \underbrace{\alpha^E \mathbb{1}\left(|a| < |\overline{a_m}|\right)\int_{|a_i|<\bar{a},|2a-a_i|<|\bar{a}|} f(a_i)f(2a-a_i)da_i}_{\text{inflow due to Nash Bargaining in electronic venue}} \\ & + \underbrace{\alpha^B\int_{a_i<-\bar{a},2a-a_i>\bar{a},|a|<\bar{a}} f(a_i)f(2a-a_i)da_i}_{\text{1st inflow due to Nash Bargaining in bilateral voice-based venue}} \\ & + \underbrace{\alpha^B\int_{a_i>\bar{a},2a-a_i<-\bar{a},|a|<\bar{a}} f(a_i)f(2a-a_i)da_i}_{\text{2nd inflow due to Nash Bargaining in bilateral voice-based venue}} \\ & + o(|\overline{a_m}+\bar{a}|) \end{aligned} \tag{A24}$$

$$
\begin{aligned}
T_4(f^B(a)) = {} & (1-\delta)f^B(a) + \delta g(a) - \alpha^B f^B(a) \int_{|a_j|\geq \bar{a}} f^B(a_j)da_j \\
& + \underbrace{\mathbb{1}\left(a < \underline{a_m} < -\bar{a}\right) \int_{\bar{a}<|a_i|<A, \bar{a}<|2a-a_i|<A} f(a_i)f(2a-a_i)da_i}_{\text{1st inflow due to Nash Bargaining in bilateral voice-based venue}} \\
& + \underbrace{\mathbb{1}\left(a > |\underline{a_m}| > \bar{a}\right) \int_{\bar{a}<|a_i|<A, \bar{a}<|2a-a_i|<A} f(a_i)f(2a-a_i)da_i}_{\text{2nd inflow due to Nash Bargaining in bilateral voice-based venue}} \\
& + o(|\underline{a_m} + \bar{a}|)
\end{aligned} \tag{A25}
$$

and for both the domain and codomain functional spaces, $V_S^E \times V_S^B \times F^E \times F^B$ and $T_1(V_S^E) \times T_2(V_S^B) \times T_3(F^E) \times T_4(F^B)$, we apply the norm $\|[V^E(a) \quad V^B(a) \quad f^E(a) \quad f^B(a)]^T\|_\infty = \sqrt{(\max_{-A\leq a\leq A}|V^E(a)|)^2 + (\max_{-A\leq a\leq A}|V^B(a)|)^2 + (\max_{-A\leq a\leq A}|f^E(a)|)^2 + (\max_{-A\leq a\leq A}|f^B(a)|)^2}$.

We use $(\overline{V^E}(a), \overline{V^B}(a), \overline{f^E}(a), \overline{f^B}(a))$ to denote the fixed points of operator T: $V_S^E \times V_S^B \times F^E \times F^B \longrightarrow T_1(V_S^E) \times T_2(V_S^B) \times T_3(F^E) \times T_4(F^B)$. Then we will verify that, there always exists a fixed point which satisfies,

$$
T\begin{bmatrix} \overline{V^E}(a) \\ \overline{V^B}(a) \\ \overline{f^E}(a) \\ \overline{f^B}(a) \end{bmatrix} = \begin{bmatrix} T_1(\overline{V^E}(a)) \\ T_2(\overline{V^B}(a)) \\ T_3(\overline{f^E}(a)) \\ T_4(\overline{f^B}(a)) \end{bmatrix} = \begin{bmatrix} \overline{V^E}(a) \\ \overline{V^B}(a) \\ \overline{f^E}(a) \\ \overline{f^B}(a) \end{bmatrix}. \tag{A26}
$$

It is trivial that the function spaces V_S^E,V_S^B,F^E and F^B are all convex and bounded linear spaces. By (A22)-(A25), T_1-T_4 are all continuous mappings. Therefore, $T_1(V_S^E)$,$T_2(V_S^B)$,$T_3(F^E)$ and $T_4(F^B)$ are all bounded.

Equicontinuity Next we prove that any sequence of vector of functions in the new normed linear space $T_1(V_S^E) \times T_2(V_S^B) \times T_3(F^E) \times T_4(F^B)$ is equicontinuous. We do this by two steps: in step-1, we prove that the derivative of any function from $T_1(V_S^E)$, $T_2(V_S^B)$, $T_3(F^E)$ or $T_4(F^B)$ is bounded over $a \in [-A, A]$; and in step-2, we prove any collection of vector of functions in the normed linear space $T_1(V_S^E) \times T_2(V_S^B) \times T_3(F^E) \times T_4(F^B)$ is equicontinuous by definition.

Step-1: for any $V^E(a) \in V_S^E$, $V^B(a) \in V_S^B$, $f^E(a) \in F^E$ and $f^B(a) \in F^B$, we prove the derivatives of the mapped functions, $\frac{d(T_1V^E)(a)}{da}$, $\frac{d(T_2V^B)(a)}{da}$, $\frac{d(T_3f^E)(a)}{da}$ and $\frac{d(T_4f^B)(a)}{da}$, are all bounded.

Given that $V^E(a)$, $V^B(a)$, $f^E(a)$ and $f^B(a)$ are all second-order differentiable, we have that $V^{E\prime}(a)$, $V^{B\prime}(a)$, $f^{E\prime}(a)$ and $f^{B\prime}(a)$ are all bounded. Additionally, we have that $V^{E\prime\prime}(a)$ is constant on $a \in [-\bar{a}, \bar{a}]$, and $V^{B\prime\prime}(a)$ is constant on $a \in [-A, -\bar{a}] \cup [\bar{a}, A]$. In other words, for both $V^E(a)$ and $V^B(a)$, as asset position a increases, their slopes decrease at a constant speed. If condition (a) and/or (b) in Proposition 1 applies, then $\underline{a_m}$ and $\overline{a_m}$ ($|\underline{a_m}|$ and $|\overline{a_m}|$) are close enough to $-\bar{a}$ ($|\bar{a}|$), we have,

$$
\begin{aligned}
& \left|\frac{d(T_1V^E)(a)}{da}\right| \\
= {} & \left|V^{E\prime}(a)(1-r-\delta) + \frac{\alpha^E}{2}\frac{d}{da}\left[\int_{-\bar{a}}^{\bar{a}} S(a,a')dF^E(a')\right]\right|
\end{aligned} \tag{A27}
$$

$$
\begin{aligned}
&= \left| V^{E\prime}(a)(1-r-\delta) + \frac{\alpha^E}{2}\frac{d}{da}\left[\int_{\overline{a_m}<\frac{a+a'}{2}<|\overline{a_m}|}\left(2V^E(\frac{a+a'}{2}) - V^E(a) - V^E(a')\right)dF^E(a')\right]\right| \\
&+ o(|\overline{a_m}+\bar{a}|) \\
&= \left| V^{E\prime}(a)(1-r-\delta) + \frac{\alpha^E}{2}\frac{d}{da}\left[\int_{max\{2\overline{a_m}-a,-\bar{a}\}}^{min\{2|\overline{a_m}|-a,\bar{a}\}}\left(2V^E(\frac{a+a'}{2}) - V^E(a) - V^E(a')\right)dF^E(a')\right]\right| \\
&+ o(|\overline{a_m}+\bar{a}|) \\
&= \Bigg| V^{E\prime}(a)(1-r-\delta) + \frac{\alpha^E}{2}\frac{d}{da}\Bigg[\mathbb{1}(-\bar{a}<a<2\overline{a_m}+\bar{a})\int_{2\overline{a_m}-a}^{\bar{a}}\left(2V^E(\frac{a+a'}{2}) - V^E(a) - V^E(a')\right)dF^E(a') \\
&\qquad + \mathbb{1}(2\overline{a_m}+\bar{a}<a<2|\overline{a_m}|-\bar{a})\int_{-\bar{a}}^{\bar{a}}\left(2V^E(\frac{a+a'}{2}) - V^E(a) - V^E(a')\right)dF^E(a') \\
&\qquad + \mathbb{1}(2|\overline{a_m}|-\bar{a}<a<\bar{a})\int_{-\bar{a}}^{2|\overline{a_m}|-a}\left(2V^E(\frac{a+a'}{2}) - V^E(a) - V^E(a')\right)dF^E(a')\Bigg]\Bigg| \\
&+ o(|\overline{a_m}+\bar{a}|) \\
&\leq \left| V^{E\prime}(a)\right| |1-r-\delta| + \left|\frac{\alpha^E}{2}\Bigg[\mathbb{1}(-\bar{a}<a<2\overline{a_m}+\bar{a})\int_{2\overline{a_m}-a}^{\bar{a}}\left(V^{E\prime}(\frac{a+a'}{2}) - V^{E\prime}(a)\right)dF^E(a')\right. \\
&\qquad + \mathbb{1}(2\overline{a_m}+\bar{a}<a<2|\overline{a_m}|-\bar{a})\int_{-\bar{a}}^{\bar{a}}\left(V^{E\prime}(\frac{a+a'}{2}) - V^{E\prime}(a)\right)dF^E(a') \\
&\qquad + \mathbb{1}(2|\overline{a_m}|-\bar{a}<a<\bar{a})\int_{-\bar{a}}^{2|\overline{a_m}|-a}\left(V^{E\prime}(\frac{a+a'}{2}) - V^{E\prime}(a)\right)dF^E(a') \\
&\qquad + \mathbb{1}(-\bar{a}<a<2\overline{a_m}+\bar{a})\Big(2V^E(\overline{a_m}) - V^E(a) - V^E(2\overline{a_m}-a)\Big) \\
&\qquad \left. - \mathbb{1}(2\overline{a_m}+\bar{a}<a<2|\overline{a_m}|-\bar{a})\Big(2V^E(|\overline{a_m}|) - V^E(a) - V^E(2|\overline{a_m}|-a)\Big)\Bigg]\right| \\
&+ o(|\overline{a_m}+\bar{a}|) \\
&\leq \left| V^{E\prime}(a)\right| |1-r-\delta| + \frac{\alpha^E}{2}\Bigg[\mathbb{1}(-\bar{a}<a<2\overline{a_m}+\bar{a})\int_{2\overline{a_m}-a}^{\bar{a}}\left(\underbrace{\left|V^{E\prime\prime}(\frac{a+a'}{2})\right|}_{\text{constant}}\left|\frac{a-a'}{2}\right|\right)dF^E(a') \\
&\qquad + \mathbb{1}(2\overline{a_m}+\bar{a}<a<2|\overline{a_m}|-\bar{a})\int_{-\bar{a}}^{\bar{a}}\left(\underbrace{\left|V^{E\prime\prime}(\frac{a+a'}{2})\right|}_{\text{constant}}\left|\frac{a-a'}{2}\right|\right)dF^E(a') \\
&\qquad + \mathbb{1}(2|\overline{a_m}|-\bar{a}<a<\bar{a})\int_{-\bar{a}}^{2|\overline{a_m}|-a}\left(\underbrace{\left|V^{E\prime\prime}(\frac{a+a'}{2})\right|}_{\text{constant}}\left|\frac{a-a'}{2}\right|\right)dF^E(a') \\
&\qquad + \mathbb{1}(-\bar{a}<a<2\overline{a_m}+\bar{a})\Big|2V^E(\overline{a_m}) - V^E(a) - V^E(2\overline{a_m}-a)\Big| \\
&\qquad \left. - \mathbb{1}(2\overline{a_m}+\bar{a}<a<2|\overline{a_m}|-\bar{a})\Big|2V^E(|\overline{a_m}|) - V^E(a) - V^E(2|\overline{a_m}|-a)\Big|\right] + o(|\overline{a_m}+\bar{a}|) \\
&\leq B_{dV^E},
\end{aligned}
$$

where the second last inequality is obtained by Leibniz integral rule.

$$\left|\frac{d(T_2V^B)(a)}{da}\right| \tag{A28}$$

$$= \left|V^{B\prime}(a)(1-r-\delta) + \frac{\alpha^B}{2}\frac{d}{da}\left[\int_{|a'|>\bar{a}} S(a,a')dF^E(a')\right]\right|$$

$$= \left|V^{B\prime}(a)(1-r-\delta) + \frac{\alpha^B}{2}\frac{d}{da}\left[\underbrace{\int_{|a'|>\bar{a},\left|\frac{a+a'}{2}\right|>|\underline{a_m}|,a\times a'>0}\left(2V^B(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right)dF^E(a')}_{a,a' \text{ are on same side of bilateral voice venue}}\right.\right.$$

$$+ \underbrace{\int_{|a'|>\bar{a},\left|\frac{a+a'}{2}\right|>\bar{a},a\times a'<0}\left(2V^B(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right)dF^E(a')}_{a,a' \text{ are on different sides of bilateral voice venue, and both remain in bilateral venue after transaction}}$$

$$\left.\left. + \underbrace{\int_{|a'|>\bar{a},\left|\frac{a+a'}{2}\right|<\bar{a},a\times a'<0}\left(2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right)dF^E(a')}_{a,a' \text{ are on different sides of bilateral voice venue, and both enter electronic venue after transaction}}\right]\right| + o(|\underline{a_m}+\bar{a}|)$$

$$\leq \left|V^{B\prime}(a)(1-r-\delta)\right| + \left|\frac{\alpha^B}{2}\frac{d}{da}\left[\mathbb{1}(-A<a<2\underline{a_m}+\bar{a})\int_{-A}^{-\bar{a}}\left(2V^B(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right)dF^E(a')\right.\right.$$

$$+ \mathbb{1}(2\underline{a_m}+\bar{a}<a<-\bar{a})\int_{-A}^{2\underline{a_m}-a}\left(2V^B(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right)dF^E(a')$$

$$+ \mathbb{1}(\bar{a}<a<2|\underline{a_m}|-\bar{a})\int_{2|\underline{a_m}|-a}^{A}\left(2V^B(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right)dF^E(a')$$

$$+ \mathbb{1}(2|\underline{a_m}|-\bar{a}<a<-A)\int_{\bar{a}}^{A}\left(2V^B(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right)dF^E(a')$$

$$+ \mathbb{1}(-A<a<-3\bar{a})\mathbb{1}(A>3\bar{a})\int_{\bar{a}}^{-2\bar{a}-a}\left(2V^B(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right)dF^E(a')$$

$$+ \mathbb{1}(2\bar{a}-A<a<-\bar{a})\mathbb{1}(A>3\bar{a})\int_{2\bar{a}-a}^{A}\left(2V^B(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right)dF^E(a')$$

$$+ \mathbb{1}(\bar{a}<a<-2\bar{a}+A)\mathbb{1}(A>3\bar{a})\int_{-A}^{-2\bar{a}-a}\left(2V^B(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right)dF^E(a')$$

$$+ \mathbb{1}(3\bar{a}<a<A)\mathbb{1}(A>3\bar{a})\int_{2\bar{a}-a}^{-\bar{a}}\left(2V^B(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right)dF^E(a')$$

$$+ \mathbb{1}(A<3\bar{a})\mathbb{1}(-A<a<-\bar{a})\int_{\bar{a}}^{A}\left(2V^B(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right)dF^E(a')$$

$$+ \mathbb{1}(3\bar{a}<A<5\bar{a})\mathbb{1}(-A<a<-3\bar{a})\int_{-2\bar{a}-a}^{A}\left(2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right)dF^E(a')$$

$$+ \mathbb{1}(3\bar{a}<A<5\bar{a})\mathbb{1}(-3\bar{a}<a<2\bar{a}-A)\int_{\bar{a}}^{A}\left(2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right)dF^E(a')$$

$$
\begin{aligned}
&+ \mathbb{1}(3\bar{a} < A < 5\bar{a})\mathbb{1}(2\bar{a} - A < a < -\bar{a}) \int_{\bar{a}}^{2\bar{a}-a} \left(2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right) dF^E(a') \\
&+ \mathbb{1}(A > 5\bar{a})\mathbb{1}(-A < a < 2\bar{a} - A) \int_{-2\bar{a}-a}^{A} \left(2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right) dF^E(a') \\
&+ \mathbb{1}(A > 5\bar{a})\mathbb{1}(2\bar{a} - A < a < -3\bar{a}) \int_{-2\bar{a}-a}^{2\bar{a}-a} \left(2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right) dF^E(a') \\
&+ \mathbb{1}(A > 5\bar{a})\mathbb{1}(-3\bar{a} < a < -\bar{a}) \int_{\bar{a}}^{2\bar{a}-a} \left(2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right) dF^E(a') \\
&+ \mathbb{1}(A < 3\bar{a})\mathbb{1}(\bar{a} < a < A) \int_{-A}^{-\bar{a}} \left(2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right) dF^E(a') \\
&+ \mathbb{1}(3\bar{a} < A < 5\bar{a})\mathbb{1}(\bar{a} < a < A - 2\bar{a}) \int_{-2\bar{a}-a}^{-\bar{a}} \left(2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right) dF^E(a') \\
&+ \mathbb{1}(3\bar{a} < A < 5\bar{a})\mathbb{1}(A - 2\bar{a} < a < 3\bar{a}) \int_{-A}^{-\bar{a}} \left(2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right) dF^E(a') \\
&+ \mathbb{1}(3\bar{a} < A < 5\bar{a})\mathbb{1}(3\bar{a} < a < A) \int_{-A}^{2\bar{a}-a} \left(2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right) dF^E(a') \\
&+ \mathbb{1}(A > 5\bar{a})\mathbb{1}(\bar{a} < a < 3\bar{a}) \int_{-2\bar{a}-a}^{-\bar{a}} \left(2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right) dF^E(a') \\
&+ \mathbb{1}(A > 5\bar{a})\mathbb{1}(3\bar{a} < a < A - 2\bar{a}) \int_{-2\bar{a}-a}^{2\bar{a}-a} \left(2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right) dF^E(a') \\
&+ \mathbb{1}(A > 5\bar{a})\mathbb{1}(A - 2\bar{a} < a < A) \int_{-A}^{2\bar{a}-a} \left(2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')\right) dF^E(a') \Bigg] \Bigg| + o(|\underline{a_m} + \bar{a}|) \\
&\leq B_{dV^B},
\end{aligned}
$$

where the second last inequality is obtained by Leibniz integral rule. Specifically, all lower and upper bounds of integral are either not related to a or linear functions of a. For both integrands, $2V^B(\frac{a+a'}{2}) - V^B(a) - V^B(a')$ and $2V^E(\frac{a+a'}{2}) - V^B(a) - V^B(a')$, their absolute values are bounded if we plug in upper and/or lower bounds of integral. For derivatives of both integrands, $V^{B'}(\frac{a+a'}{2}) - V^{B'}(a)$ and $V^{E'}(\frac{a+a'}{2}) - V^{B'}(a)$, their absolute values are also bounded, because the first derivative of both value functions are continuous on $a \in [-A, A]$.

$$
\begin{aligned}
&\left|\frac{d(T_3 f^E)(a)}{da}\right| \qquad \text{(A29)} \\
&= \Bigg|(1-\delta)f^{E'}(a) + \delta g'(a) - \alpha^E f^{E'}(a) \int_{|a_j| \leq \bar{a}} f^E(a_j) da_j \\
&+ \alpha^E \left[\mathbb{1}(\overline{a_m} < a < 0)\frac{d}{da}\int_{-\bar{a}}^{2a+\bar{a}} f(a_i) f(2a - a_i) da_i + \mathbb{1}(0 < a < |\overline{a_m}|)\frac{d}{da}\int_{2a-\bar{a}}^{\bar{a}} f(a_i) f(2a - a_i) da_i\right] \\
&+ \alpha^B \left[\mathbb{1}(-\bar{a} < a < 0)\frac{d}{da}\int_{-A}^{2a-\bar{a}} f(a_i) f(2a - a_i) da_i + \mathbb{1}(0 < a < \bar{a})\frac{d}{da}\int_{2a-A}^{2a-\bar{a}} f(a_i) f(2a - a_i) da_i\right] \\
&+ \alpha^B \left[\mathbb{1}(-\bar{a} < a < 0)\frac{d}{da}\int_{\bar{a}}^{2a+A} f(a_i) f(2a - a_i) da_i + \mathbb{1}(0 < a < \bar{a})\frac{d}{da}\int_{2a+\bar{a}}^{A} f(a_i) f(2a - a_i) da_i\right] \Bigg|
\end{aligned}
$$

$$
\begin{aligned}
&+ o(|\overline{a_m} + \bar{a}|) \\
&\leq (1-\delta)\left|f^{E\prime}(a)\right| + \delta\left|g'(a)\right| + \alpha^E \int_{|a_j|\leq \bar{a}} f^E(a_j)da_j \left|f^{E\prime}(a)\right| \\
&+ \alpha^E \mathbb{1}(\overline{a_m} < a < 0)\left[\left|2f(2a+\bar{a})f(-\bar{a})\right| + \left|\int_{-\bar{a}}^{2a+\bar{a}} f(a_i) \times 2f'(2a-a_i)da_i\right|\right] \\
&+ \alpha^E \mathbb{1}(0 < a < |\overline{a_m}|)\left[\left|(-2) \times f(2a-\bar{a})f(\bar{a})\right| + \left|\int_{2a-\bar{a}}^{\bar{a}} f(a_i)2f'(2a-a_i)da_i\right|\right] \\
&+ \alpha^B \mathbb{1}(-\bar{a} < a < 0)\left[\left|2f(2a-\bar{a})f(\bar{a})\right| + \left|\int_{-A}^{2a-\bar{a}} f(a_i)2f'(2a-a_i)da_i\right|\right] \\
&+ \alpha^B \mathbb{1}(0 < a < \bar{a})\left[\left|2f(2a-\bar{a})f(\bar{a}) - 2f(2a-A)f(A)\right| + \left|\int_{2a-A}^{2a-\bar{a}} f(a_i)2f'(2a-a_i)da_i\right|\right] \\
&+ \alpha^B \mathbb{1}(-\bar{a} < a < 0)\left[\left|2f(2a+A)f(-A)\right| + \left|\int_{\bar{a}}^{2a+A} f(a_i)2f'(2a-a_i)da_i\right|\right] \\
&+ \alpha^B \mathbb{1}(0 < a < \bar{a})\left[\left|(-2) \times f(2a+\bar{a})f(\bar{a})\right| + \left|\int_{2a+\bar{a}}^{A} f(a_i)2f'(2a-a_i)da_i\right|\right] \\
&+ o(|\overline{a_m} + \bar{a}|) \\
&\leq B_{df^E},
\end{aligned}
$$

where the second last inequality is obtained by Leibniz integral rule and the last inequality is by the boundness of density functions and their first derivatives.

$$
\begin{aligned}
&\left|\frac{d(T_4 f^B)(a)}{da}\right| \qquad \text{(A30)} \\
&= \Bigg|(1-\delta)f^{B\prime}(a) + \delta g'(a) - \alpha^B f^{B\prime}(a)\int_{|a_j|\leq\bar{a}} f^B(a_j)da_j \\
&+ \alpha^B\Bigg[\mathbb{1}(A > \bar{a} - 2\underline{a_m})\mathbb{1}(\frac{\bar{a}-A}{2} < a < \underline{a_m})\frac{d}{da}\int_{\bar{a}}^{2a+A} f(a_i)f(2a-a_i)da_i \\
&\qquad + \mathbb{1}(A > \bar{a} - 2\underline{a_m})\mathbb{1}(\frac{\bar{a}-A}{2} < a < \underline{a_m})\frac{d}{da}\int_{-A}^{2a-\bar{a}} f(a_i)f(2a-a_i)da_i\Bigg] \\
&+ \alpha^B\Bigg[\mathbb{1}(-A-\bar{a} > 2\underline{a_m})\frac{d}{da}\int_{-A}^{2a+A} f(a_i)f(2a-a_i)da_i\Bigg] \\
&+\alpha^B\Bigg[\mathbb{1}(-A-\bar{a} < 2\underline{a_m})\mathbb{1}(a > \frac{-A-\bar{a}}{2})\frac{d}{da}\int_{2a+\bar{a}}^{-\bar{a}} f(a_i)f(2a-a_i)da_i \\
&\qquad +\mathbb{1}(-A-\bar{a} < 2\underline{a_m})\mathbb{1}(a < \frac{-A-\bar{a}}{2})\frac{d}{da}\int_{-A}^{2a+A} f(a_i)f(2a-a_i)da_i\Bigg]\Bigg| \\
&+ o(|\underline{a_m} + \bar{a}|) \\
&\leq (1-\delta)\left|f^{B\prime}(a)\right| + \delta\left|g'(a)\right| + \alpha^B\left|f^{B\prime}(a)\right|\int_{|a_j|\leq\bar{a}} f^B(a_j)da_j \\
&+ \alpha^B\Bigg[\mathbb{1}(A > \bar{a} - 2\underline{a_m})\mathbb{1}(\frac{\bar{a}-A}{2} < a < \underline{a_m})\Bigg(|2f(2a+A)f(A)| + \left|\int_{\bar{a}}^{2a+A} f(a_i)2f'(2a-a_i)da_i\right|\Bigg)
\end{aligned}
$$

$$
\begin{aligned}
&+ \mathbb{1}(A > \bar{a} - 2\underline{a_m})\mathbb{1}(\frac{\bar{a}-A}{2} < a < \underline{a_m})\left(|2f(2a-\bar{a})f(\bar{a})| + \left|\int_{-A}^{2a-\bar{a}} f(a_i)2f'(2a-a_i)da_i\right|\right)\Bigg] \\
&+ \alpha^B\Bigg[\mathbb{1}(-A-\bar{a} > 2\underline{a_m})\left(|f(2a+A)f(-A)| + \left|\int_{-A}^{2a+A} f(a_i)2f'(2a-a_i)da_i\right|\right)\Bigg] \\
&+\alpha^B\Bigg[\mathbb{1}(-A-\bar{a} < 2\underline{a_m})\mathbb{1}(a > \frac{-A-\bar{a}}{2})\left(|(-2)f(2a+\bar{a})f(-\bar{a})| + \left|\int_{2a+\bar{a}}^{-\bar{a}} f(a_i)2f'(2a-a_i)da_i\right|\right) \\
&\quad +\mathbb{1}(-A-\bar{a} < 2\underline{a_m})\mathbb{1}(a < \frac{-A-\bar{a}}{2})\left(|2f(2a+A)f(-A)| + \left|\int_{-A}^{2a+A} f(a_i)2f'(2a-a_i)da_i\right|\right)\Bigg]\Bigg| \\
&+ o(|\underline{a_m} + \bar{a}|) \\
&\leq B_{df^B}
\end{aligned}
$$

where the second last inequality is obtained by Leibniz integral rule and the last inequality is by the boundness of density functions and their first derivatives.

Step-2: we prove that any sequence of vector of functions in the new normed linear space $T_1(V_S^E) \times T_2(V_S^B) \times T_3(F^E) \times T_4(F^B)$ is equicontinuous by definition. For $\forall a \in [-\bar{a}, \bar{a}]$, given $\forall \epsilon > 0$, we can always choose small enough $\hat{a} = \frac{\epsilon}{4 \times max\left\{B_{dV^E}, B_{dV^B}, B_{df^E}, B_{df^B}\right\}} > 0$, such that,

$$
\left\|[V^E(a+\hat{a}) \quad V^B(a+\hat{a}) \quad f^E(a+\hat{a}) \quad f^B(a+\hat{a})]^T - [V^E(a) \quad V^B(a) \quad f^E(a) \quad f^B(a)]^T\right\|_\infty \tag{A31}
$$

$$
\begin{aligned}
&= \sqrt{(\max_{-A\leq a\leq A}|V^E(a+\hat{a}) - V^E(a)|)^2 + (\max_{-A\leq a\leq A}|V^B(a+\hat{a}) - V^B(a)|)^2 + ...} \\
&\quad \sqrt{..... + (\max_{-A\leq a\leq A}|f^E(a+\hat{a}) - f^E(a)|)^2 + (\max_{-A\leq a\leq A}|f^B(a+\hat{a}) - f^B(a)|)^2} \\
&= \sqrt{\left(\max_{-A\leq a\leq A}\left|\frac{d(T_1V^E)(a)}{da}\hat{a} + o(|\hat{a}|)\right|\right)^2 + \left(\max_{-A\leq a\leq A}\left|\frac{d(T_2V^B)(a)}{da}\hat{a} + o(|\hat{a}|)\right|\right)^2 + ...} \\
&\quad \sqrt{..... + \left(\max_{-A\leq a\leq A}\left|\frac{d(T_3f^E)(a)}{da}\hat{a} + o(|\hat{a}|)\right|\right)^2 + \left(\max_{-A\leq a\leq A}\left|\frac{d(T_4f^B)(a)}{da}\hat{a} + o(|\hat{a}|)\right|\right)^2} \\
&\leq \sqrt{\left(2 \times \hat{a} \times B_{dV^E}\right)^2 + \left(2 \times \hat{a} \times B_{dV^B}\right)^2 + \left(2 \times \hat{a} \times B_{f^E}\right)^2 + \left(2 \times \hat{a} \times B_{f^B}\right)^2} \\
&\leq \sqrt{4 \times 4 \times \left(\frac{\epsilon}{4 \times max\left\{B_{dV^E}, B_{dV^B}, B_{df^E}, B_{df^B}\right\}}\right)^2 \times \left(max\left\{B_{dV^E}, B_{dV^B}, B_{df^E}, B_{df^B}\right\}\right)^2} \\
&= \epsilon
\end{aligned}
$$

Since $\hat{a}$ does not relate to specific value of a, then any sequence of vector of functions $[V^E(a) \quad V^B(a) \quad f^E(a) \quad f^B(a)]^T$ in normed linear space $T_1(V_S^E) \times T_2(V_S^B) \times T_3(F^E) \times T_4(F^B)$ is uniform equicontinuous.

Existance of fixed point By **boundedness** and **equicontinuity** above, and refer to Arzelà-Ascoli theorem in Arzelà (1895), we obtain that every sequence in $T_1(V_S^E) \times T_2(V_S^B) \times T_3(F^E) \times T_4(F^B)$ has a uniformly convergent subsequence, then $T_1(V_S^E) \times T_2(V_S^B) \times T_3(F^E) \times T_4(F^B)$ is a sequentially compact space. Therefore, the continuous mapping T maps $V_S^E \times V_S^B \times F^E \times F^B$ to $T_1(V_S^E) \times T_2(V_S^B) \times T_3(F^E) \times T_4(F^B)$, which is a compact subspace of the previous one. By Schauder's fixed point theorem, T: $V_S^E \times V_S^B \times F^E \times F^B \longrightarrow T_1(V_S^E) \times T_2(V_S^B) \times T_3(F^E) \times T_4(F^B)$ has a fixed point which satisfies,

$$T \begin{bmatrix} \overline{V^E}(a) \\ \overline{V^B}(a) \\ \overline{f^E}(a) \\ \overline{f^B}(a) \end{bmatrix} = \begin{bmatrix} T_1(\overline{V^E}(a)) \\ T_2(\overline{V^B}(a)) \\ T_3(\overline{f^E}(a)) \\ T_4(\overline{f^B}(a)) \end{bmatrix} = \begin{bmatrix} \overline{V^E}(a) \\ \overline{V^B}(a) \\ \overline{f^E}(a) \\ \overline{f^B}(a) \end{bmatrix}. \tag{A32}$$

□

C Identification of round-trip trades

C.1 Identifying principal trades

In this paper, to identify principal trades that require traders' capital commitment, I firstly identify agency trades, among which traders behave as match-makers to pre-arrange transactions between buyers and sellers, and do not hold bonds in their inventories. Then I exclude the identified agency trades from the sample and regard the remaining sample as principal trades.

Each pair of agency trades has the same bond price and volume in opposite directions, and happen at very close or exactly the same execution time(s). I apply two approaches to identify agency trades: **(1)** in the data, I refer to the variable *Buyer/Seller Capacity*. Agency trades are the observations with this variable labelled as "Agency"; and **(2)** to further identify other pre-arranged trades that are not directly labelled in the data, I look for pairs of two trades in a given bond with the same volume by the same trader but in opposite directions, and take place within 15 minutes of each other. As FINRA requires that reports need to be submitted within 15 minutes after the transactions, this approach will identify those pairs with one buy and one sell transactions which do not have exactly the same execution time. The difference in execution time could be due to reporting errors, so that it is still very likely that the traders conducting the matched buy and sell transactions do not take any inventory risk.

C.2 Identifying round-trip trades

In the identified principal trades, I choose the following three types of trades to identify round-trip trades (RTT): (i) non-member firm sells to member firm, denoted as *C2D*; (ii) member firm sells to non-member firm, denoted as *D2C*; and (iii) member firm sells to another member firm, denoted as *D2D*. For C2D trades, I denote $V_{s^{C2D}}$ as trading volume, $T_{s^{C2D}}$ as execution time (round to seconds), $D_{s^{C2D}}$ as the ID of the member firm (i.e., the trader), where transaction $s^{C2D} \in S^{C2D}$, and S^{C2D} is the collection of all C2D trades. Similarly, for the other two types $k = D2C, D2D$, I denote V_{s^k} as trading volume, T_{s^k} as execution time, D_{s^k} as the ID of the *selling* member firm (i.e., the trader who sells the bond to others), where transaction $s^k \in S^k$, and S^k is the collection of all type k trades. Then I apply the following four rounds of matching to construct RTT *for each bond*:

Round 1 For each trade s^{C2D}, I search for D2C trade s^{D2C}, which happens closest to trade s^{C2D} and satisfies the following criteria:

- The two trades are completed by same trader: $D_{s^{C2D}} = D_{s^{D2C}}$;
- $T_{s^{C2D}} < T_{s^{D2C}}$, $V_{s^{C2D}} \geq V_{s^{D2C}}$;
- The time gap between the two trades is at least 15 minutes (900 seconds) and at most one week (604,800 seconds): $900 \leq |T_{s^{D2C}} - T_{s^{C2D}}| \leq 604,800$.

I denote the matched RTT in Round 1 as RTT^1_{CDC}.

Round 2 For each trade s^{C2D}, I search for D2C trade s^{D2C}, which happens closest to trade s^{C2D} and satisfies the following criteria:

- The two trades are completed by same trader: $D_{s^{C2D}} = D_{s^{D2C}}$;
- $T_{s^{C2D}} < T_{s^{D2C}}$, $V_{s^{C2D}} < V_{s^{D2C}}$;
- The time gap between the two trades is at least 15 minutes (900 seconds) and at most one week (604,800 seconds): $900 \leq |T_{s^{D2C}} - T_{s^{C2D}}| \leq 604,800$.

I denote the matched RTT in Round 2 as RTT^2_{CDC}.

Round 3 For each trade s^{C2D}, I search for D2C trade s^{D2D}, which happens closest to trade s^{C2D} and satisfies the following criteria:

- The buying trader in s^{C2D} is same as the selling trader in s^{D2D}: $D_{s^{C2D}} = D_{s^{D2D}}$;
- $T_{s^{C2D}} < T_{s^{D2D}}$, $V_{s^{C2D}} \geq V_{s^{D2D}}$;
- The time gap between the two trades is at least 15 minutes (900 seconds) and at most one week (604,800 seconds): $900 \leq |T_{s^{D2D}} - T_{s^{C2D}}| \leq 604,800$.

I denote the matched RTT in Round 3 as RTT^3_{CDD}.

Round 4 For each trade s^{C2D}, I search for D2C trade s^{D2D}, which happens closest to trade s^{C2D} and satisfies the following criteria:

- The buying trader in s^{C2D} is same as the selling trader in s^{D2D}: $D_{s^{C2D}} = D_{s^{D2D}}$;
- $T_{s^{C2D}} < T_{s^{D2D}}$, $V_{s^{C2D}} < V_{s^{D2D}}$;
- The time gap between the two trades is at least 15 minutes (900 seconds) and at most one week (604,800 seconds): $900 \leq |T_{s^{D2D}} - T_{s^{C2D}}| \leq 604,800$.

I denote the matched RTT in Round 4 as RTT^4_{CDD}.

The difference between Round 1 (Round 3) and Round 2 (Round 4) is the requirement on the relationship between the first leg and second leg trading volumes in the matched RTT.

Tables

Table A1: Robustness by controllling different effects: core dealers' weekly choice of bilateral voice venue

	bilateral voice (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	3.55***		3.50***		4.19***		4.20***	
	(1.04)		(1.04)		(1.22)		(1.22)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		0.78		0.75		−0.88		−1.02
		(0.90)		(0.89)		(0.79)		(0.78)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
week FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*week FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.42	0.35	0.43	0.36	0.54	0.48	0.55	0.49
Adjusted R^2	0.41	0.34	0.42	0.34	0.46	0.39	0.46	0.39
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table A2: Robustness by controllling different effects: core dealers' weekly choice of core-core voice venue

	core-core voice (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	1.25***		1.13***		0.78**		0.57	
	(0.33)		(0.31)		(0.38)		(0.35)	
abs bond inv, $\|inv_{i,j,t}\|$		4.29***		4.32***		3.70***		3.83***
		(0.59)		(0.61)		(0.66)		(0.75)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
week FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*week FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.23	0.14	0.24	0.15	0.40	0.31	0.41	0.32
Adjusted R^2	0.21	0.12	0.21	0.12	0.29	0.19	0.29	0.20

Note: *p<0.1; **p<0.05; ***p<0.01

Table A3: Core dealers' daily share of transactions in different venues

	bilateral voice (%)		electronic (%)		voice core-core (%)		voice core-noncore (%)	
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	3.78***		−3.78***		1.30***		2.48**	
	(1.05)		(1.05)		(0.30)		(1.10)	
abs bond inv, $\lvert inv_{i,j,t} \rvert$		0.52		−0.52		4.19***		−3.63***
		(0.80)		(0.80)		(0.62)		(0.99)
bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer*day FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	529,483	525,103	529,483	525,103	529,483	525,103	529,483	525,103
R^2	0.40	0.34	0.40	0.34	0.20	0.14	0.32	0.27
Adjusted R^2	0.38	0.32	0.38	0.32	0.18	0.11	0.30	0.25
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table A4: Robustness by controllling different effects: core dealers' daily choice of bilateral voice venue

	bilateral voice (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	3.75***		3.78***		4.55***		4.61***	
	(1.05)		(1.05)		(1.32)		(1.33)	
abs bond inv, $\lvert inv_{i,j,t} \rvert$		0.61		0.52		−1.75**		−1.98**
		(0.79)		(0.80)		(0.82)		(0.80)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
day FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*day FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	529,483	525,103	529,483	525,103	529,483	525,103	529,483	525,103
R^2	0.38	0.32	0.40	0.34	0.48	0.42	0.49	0.44
Adjusted R^2	0.37	0.31	0.38	0.32	0.42	0.36	0.42	0.37

Note: *p<0.1; **p<0.05; ***p<0.01

Table A5: Robustness by controllling different effects: core dealers' daily choice of core-core voice venue

	core-core voice (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	1.41***		1.30***		0.93**		0.75**	
	(0.30)		(0.30)		(0.35)		(0.34)	
abs bond inv, $\|inv_{i,j,t}\|$		4.22***		4.19***		3.46***		3.55***
		(0.60)		(0.62)		(0.75)		(0.84)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
day FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*day FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	529,483	525,103	529,483	525,103	529,483	525,103	529,483	525,103
R^2	0.18	0.11	0.20	0.14	0.31	0.24	0.33	0.26
Adjusted R^2	0.17	0.10	0.18	0.11	0.23	0.16	0.24	0.17
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table A6: Core dealers' daily share of trading with top-10 connected partners through bilateral voice venue

	bilateral voice with top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	0.92***		0.81***		0.97***		0.67*	
	(0.30)		(0.29)		(0.35)		(0.35)	
abs bond inv, $\|inv_{i,j,t}\|$		3.39***		3.39***		3.29***		3.46***
		(0.63)		(0.64)		(0.63)		(0.68)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
day FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*day FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	529,483	525,103	529,483	525,103	529,483	525,103	529,483	525,103
R^2	0.18	0.13	0.21	0.15	0.33	0.28	0.36	0.30
Adjusted R^2	0.17	0.11	0.19	0.13	0.26	0.20	0.27	0.21

Note: *p<0.1; **p<0.05; ***p<0.01

Table A7: Core dealers' daily share of trading with non top-10 connected partners through bilateral voice venue

	bilateral voice with non top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	0.61*		0.54		0.13		0.07	
	(0.34)		(0.34)		(0.26)		(0.26)	
abs bond inv, $\|inv_{i,j,t}\|$		2.21**		2.23**		0.91		1.04
		(0.85)		(0.86)		(0.86)		(0.90)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
day FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*day FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	529,483	525,103	529,483	525,103	529,483	525,103	529,483	525,103
R^2	0.11	0.11	0.14	0.13	0.26	0.24	0.27	0.26
Adjusted R^2	0.10	0.10	0.11	0.11	0.17	0.16	0.18	0.16

Note: *p<0.1; **p<0.05; ***p<0.01

Table A8: Core dealers' daily share of trading with top-10 connected partners through bilateral voice venue and the sign of the average bond-specific inventory of the top-10 partners

	bilateral voice with top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	1.53***		1.48***		1.98***		1.85***	
	(0.48)		(0.48)		(0.58)		(0.60)	
$inv_{i,j,t}\times$	58.35***		58.37***		75.01***		74.84***	
$\mathbb{1}\{Top10_AveInv < 0\}$	(13.87)		(14.09)		(21.50)		(21.83)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		-0.98		-0.73		-1.07		-1.02
		(0.81)		(0.79)		(0.94)		(0.96)
$\lvert inv_{i,j,t}\rvert\times$		90.62***		92.92***		113.8***		115.0***
$\mathbb{1}\{Top10_AveInv \geq 0\}$		(10.61)		(10.85)		(13.45)		(13.65)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
day FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*day FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.23	0.26	0.25	0.29	0.37	0.40	0.39	0.41
Adjusted R^2	0.22	0.25	0.23	0.27	0.30	0.33	0.31	0.34

Note: *p<0.1; **p<0.05; ***p<0.01

Table A9: Core dealers' daily share of sell/buy trading through bilateral voice venue when they have positive/negative inventory positions

	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	11.31***		11.41***		14.22***		14.40***	
	(0.88)		(0.89)		(1.31)		(1.38)	
abs bond inv, $\|inv_{i,j,t}\|$		14.80***		14.68***		22.93***		22.96***
		(0.76)		(0.78)		(1.13)		(1.23)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
day FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*day FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	529,483	525,103	529,483	525,103	529,483	525,103	529,483	525,103
R^2	0.17	0.14	0.20	0.16	0.29	0.26	0.31	0.28
Adjusted R^2	0.16	0.13	0.18	0.14	0.21	0.18	0.23	0.19
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table A10: Core dealers' daily share of buy/sell trading through bilateral voice venue when they have positive/negative inventory positions

	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	-7.54^{***}		-7.61^{***}		-9.66^{***}		-9.79^{***}	
	(0.62)		(0.63)		(0.87)		(0.93)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		-14.20^{***}		-14.17^{***}		-24.83^{***}		-25.09^{***}
		(0.99)		(0.98)		(1.45)		(1.53)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
day FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*day FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	529,483	525,103	529,483	525,103	529,483	525,103	529,483	525,103
R^2	0.20	0.15	0.22	0.18	0.30	0.27	0.32	0.29
Adjusted R^2	0.19	0.14	0.20	0.16	0.22	0.19	0.23	0.20

Note: *p<0.1; **p<0.05; ***p<0.01

Table A11: Core dealers' monthly share of transactions in different venues

	bilateral voice (%)		electronic (%)		voice core-core (%)		voice core-noncore (%)	
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	2.47**		−2.59**		1.12***		1.46	
	(0.96)		(0.85)		(0.31)		(0.86)	
abs bond inv, $\lvert inv_{i,j,t} \rvert$		0.12		−0.14		3.44***		−3.32**
		(0.98)		(0.90)		(0.51)		(1.06)
bond FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer*month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	164,124	155,110	164,124	155,110	164,124	155,110	164,124	155,110
R^2	0.50	0.42	0.51	0.43	0.34	0.20	0.41	0.35
Adjusted R^2	0.48	0.39	0.49	0.40	0.31	0.16	0.38	0.31
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table A12: Robustness by controllling different effects: core dealers' monthly choice of bilateral voice venue

	bilateral voice (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	2.65**		2.47**		3.30***		3.28***	
	(0.86)		(0.96)		(1.01)		(1.01)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		0.19		0.12		−0.51		−0.67
		(0.91)		(0.98)		(0.92)		(0.88)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
month FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*month FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	164,124	155,110	164,124	155,110	164,124	155,110	164,124	155,110
R^2	0.51	0.42	0.50	0.42	0.69	0.63	0.70	0.63
Adjusted R^2	0.48	0.39	0.48	0.39	0.56	0.47	0.56	0.48

Note: *p<0.1; **p<0.05; ***p<0.01

Table A13: Robustness by controllling different effects: core dealers' monthly choice of core-core voice venue

	core-core voice (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	1.21***		1.12***		0.84*		0.62	
	(0.32)		(0.31)		(0.43)		(0.40)	
abs bond inv, $\|inv_{i,j,t}\|$		3.46***		3.44***		2.62***		2.70***
		(0.50)		(0.51)		(0.55)		(0.60)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
month FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*month FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	164,124	155,110	164,124	155,110	164,124	155,110	164,124	155,110
R^2	0.34	0.20	0.34	0.20	0.60	0.49	0.60	0.50
Adjusted R^2	0.30	0.16	0.31	0.16	0.42	0.28	0.42	0.28
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table A14: Core dealers' monthly share of trading with top-10 connected partners through bilateral voice venue

	bilateral voice with top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	0.67*		0.58		0.87**		0.51	
	(0.35)		(0.34)		(0.36)		(0.35)	
abs bond inv, $\|inv_{i,j,t}\|$		3.08***		3.11***		2.66***		2.82***
		(0.54)		(0.55)		(0.56)		(0.58)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
month FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*month FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	164,124	155,110	164,124	155,110	164,124	155,110	164,124	155,110
R^2	0.31	0.20	0.32	0.21	0.60	0.51	0.60	0.52
Adjusted R^2	0.28	0.16	0.29	0.17	0.42	0.30	0.42	0.31
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table A15: Core dealers' monthly share of trading with non top-10 connected partners through bilateral voice venue

	bilateral voice with non top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	0.44		0.41		−0.06		−0.10	
	(0.42)		(0.41)		(0.37)		(0.36)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		0.94		0.95		−0.08		0.02
		(0.58)		(0.58)		(0.57)		(0.61)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
month FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*month FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	164,124	155,110	164,124	155,110	164,124	155,110	164,124	155,110
R^2	0.21	0.18	0.21	0.18	0.53	0.48	0.53	0.49
Adjusted R^2	0.17	0.14	0.18	0.14	0.32	0.26	0.33	0.27
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table A16: Core dealers' monthly share of trading with top-10 connected partners through bilateral voice venue and the sign of the average bond-specific inventory of the top-10 partners

	bilateral voice with top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	1.21***		1.14***		1.03**		0.84*	
	(0.33)		(0.33)		(0.35)		(0.38)	
$inv_{i,j,t}\times$	23.07***		22.95***		27.32***		26.98***	
$\mathbb{1}\{Top10_AveInv < 0\}$	(3.65)		(3.61)		(5.36)		(5.25)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		0.82		0.83		-0.02		0.09
		(0.51)		(0.67)		(0.71)		(0.72)
$\lvert inv_{i,j,t}\rvert\times$		40.6***		40.51***		44.99***		44.90***
$\mathbb{1}\{Top10_AveInv \geq 0\}$		(4.07)		(4.08)		(4.72)		(4.72)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
month FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*month FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.35	0.29	0.36	0.30	0.62	0.56	0.62	0.56
Adjusted R^2	0.32	0.26	0.33	0.26	0.45	0.37	0.45	0.37

Note: *p<0.1; **p<0.05; ***p<0.01

Table A17: Core dealers' monthly share of sell/buy trading through bilateral voice venue when they have positive/negative inventory positions

	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	10.13***		10.08***		10.61***		10.63***	
	(0.54)		(0.54)		(0.74)		(0.77)	
abs bond inv, $\|inv_{i,j,t}\|$		10.34***		10.36***		12.97***		13.17***
		(0.62)		(0.63)		(0.87)		(0.88)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
month FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*month FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	164,124	155,110	164,124	155,110	164,124	155,110	164,124	155,110
R^2	0.25	0.21	0.25	0.22	0.53	0.49	0.54	0.49
Adjusted R^2	0.21	0.17	0.22	0.18	0.32	0.28	0.33	0.28
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table A18: Core dealers' monthly share of buy/sell trading through bilateral voice venue when they have positive/negative inventory positions

	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	-7.54^{***}		-7.54^{***}		-7.42^{***}		-7.48^{***}	
	(0.57)		(0.57)		(0.50)		(0.53)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		-10.14^{***}		-10.20^{***}		-13.77^{***}		-14.13^{***}
		(0.72)		(0.71)		(1.03)		(1.04)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
month FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*month FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	164,124	155,110	164,124	155,110	164,124	155,110	164,124	155,110
R^2	0.29	0.21	0.30	0.22	0.54	0.48	0.54	0.49
Adjusted R^2	0.26	0.17	0.26	0.18	0.34	0.26	0.34	0.27
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table A19: Core dealers' weekly share of trading with top-10 connected partners through core-core voice venue

	core-core voice with top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	1.17***		1.05***		0.96***		0.74***	
	(0.26)		(0.25)		(0.27)		(0.26)	
abs bond inv, $\|inv_{i,j,t}\|$		3.59***		3.59***		3.39***		3.49***
		(0.29)		(0.30)		(0.41)		(0.44)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
week FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*week FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.22	0.13	0.23	0.14	0.41	0.31	0.42	0.32
Adjusted R^2	0.21	0.11	0.21	0.11	0.30	0.19	0.30	0.19
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table A20: Core dealers' weekly share of trading with non top-10 connected partners through core-core voice venue

	core-core voice with non top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	0.07		0.06		−0.18		−0.18	
	(0.22)		(0.22)		(0.26)		(0.27)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		0.69		0.73		0.30		0.34
		(0.48)		(0.49)		(0.47)		(0.49)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
week FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*week FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.09	0.08	0.10	0.09	0.28	0.25	0.29	0.26
Adjusted R^2	0.07	0.05	0.07	0.06	0.15	0.12	0.16	0.13

Note: *p<0.1; **p<0.05; ***p<0.01

Table A21: Core dealers' weekly share of sell/buy trading through core-core venue when they have positive/negative inventory positions

	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	2.43***		2.39***		2.15***		2.09***	
	(0.28)		(0.29)		(0.31)		(0.30)	
abs bond inv, $\|inv_{i,j,t}\|$		5.84***		5.84***		6.64***		6.78***
		(0.59)		(0.60)		(0.70)		(0.77)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
week FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*week FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.13	0.09	0.14	0.10	0.34	0.28	0.35	0.29
Adjusted R^2	0.11	0.07	0.11	0.07	0.22	0.16	0.22	0.17
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table A22: Core dealers' weekly share of buy/sell trading through core-core voice venue when they have positive/negative inventory positions

	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	-1.18^{***}		-1.26^{***}		-1.39^{***}		-1.55^{***}	
	(0.19)		(0.21)		(0.21)		(0.26)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		-1.53^{***}		-1.50^{***}		-2.97^{***}		-2.98^{***}
		(0.24)		(0.23)		(0.39)		(0.38)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
week FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*week FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342,247	330,797	342,247	330,797	342,247	330,797	342,247	330,797
R^2	0.14	0.08	0.15	0.09	0.32	0.25	0.33	0.26
Adjusted R^2	0.12	0.06	0.13	0.07	0.19	0.12	0.20	0.12
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table A23: Core dealers' daily share of trading with top-10 connected partners through core-core voice venue

	core-core voice with top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	1.16***		1.07***		1.13***		0.96***	
	(0.24)		(0.24)		(0.27)		(0.27)	
abs bond inv, $\|inv_{i,j,t}\|$		3.36***		3.33***		3.21***		3.28***
		(0.34)		(0.36)		(0.41)		(0.46)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
day FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*day FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	529,483	525,103	529,483	525,103	529,483	525,103	529,483	525,103
R^2	0.18	0.10	0.20	0.13	0.32	0.24	0.34	0.26
Adjusted R^2	0.17	0.09	0.18	0.10	0.24	0.16	0.25	0.17

Note: *p<0.1; **p<0.05; ***p<0.01

Table A24: Core dealers' daily share of trading with non top-10 connected partners through core-core voice venue

	core-core voice with non top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	0.25		0.22		−0.21		−0.20	
	(0.21)		(0.21)		(0.21)		(0.20)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		0.84*		0.85*		0.25		0.27
		(0.46)		(0.47)		(0.53)		(0.56)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
day FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*day FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	529,483	525,103	529,483	525,103	529,483	525,103	529,483	525,103
R^2	0.08	0.07	0.10	0.09	0.21	0.19	0.23	0.21
Adjusted R^2	0.07	0.06	0.08	0.07	0.12	0.10	0.13	0.11

Note: *p<0.1; **p<0.05; ***p<0.01

Table A25: Core dealers' daily share of sell/buy trading through core-core venue when they have positive/negative inventory positions

	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	2.66***		2.62***		2.54***		2.48***	
	(0.32)		(0.33)		(0.31)		(0.31)	
abs bond inv, $\|inv_{i,j,t}\|$		5.67***		5.57***		6.90***		7.03***
		(0.55)		(0.56)		(0.77)		(0.84)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
day FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*day FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	529,483	525,103	529,483	525,103	529,483	525,103	529,483	525,103
R^2	0.10	0.08	0.13	0.11	0.25	0.23	0.27	0.25
Adjusted R^2	0.09	0.07	0.10	0.08	0.16	0.14	0.17	0.15

Note: *p<0.1; **p<0.05; ***p<0.01

Table A26: Core dealers' daily share of buy/sell trading through core-core voice venue when they have positive/negative inventory positions

	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	-1.24^{***}		-1.31^{***}		-1.62^{***}		-1.73^{***}	
	(0.18)		(0.21)		(0.22)		(0.27)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		-1.42^{***}		-1.36^{***}		-3.45^{***}		-3.47^{***}
		(0.28)		(0.27)		(0.44)		(0.44)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
day FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*day FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	529,483	525,103	529,483	525,103	529,483	525,103	529,483	525,103
R^2	0.12	0.06	0.14	0.09	0.25	0.18	0.27	0.20
Adjusted R^2	0.10	0.05	0.12	0.06	0.16	0.09	0.17	0.10

Note: *p<0.1; **p<0.05; ***p<0.01

Table A27: Core dealers' monthly share of trading with top-10 connected partners through core-core voice venue

	core-core voice with top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	1.04***		0.96***		0.99***		0.77**	
	(0.26)		(0.26)		(0.27)		(0.28)	
abs bond inv, $\|inv_{i,j,t}\|$		3.13***		3.12***		2.53***		2.61***
		(0.35)		(0.36)		(0.42)		(0.43)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
month FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*month FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	164,124	155,110	164,124	155,110	164,124	155,110	164,124	155,110
R^2	0.33	0.18	0.33	0.19	0.60	0.49	0.60	0.49
Adjusted R^2	0.30	0.14	0.30	0.15	0.42	0.27	0.43	0.28

Note: *p<0.1; **p<0.05; ***p<0.01

Table A28: Core dealers' monthly share of trading with non top-10 connected partners through core-core voice venue

	core-core voice with non top-10 connected partners (%)							
	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv	pos inv	neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	0.16		0.14		−0.15		−0.15	
	(0.19)		(0.19)		(0.28)		(0.28)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		0.32		0.30		0.07		0.07
		(0.36)		(0.37)		(0.38)		(0.40)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
month FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*month FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	164,124	155,110	164,124	155,110	164,124	155,110	164,124	155,110
R^2	0.13	0.11	0.13	0.11	0.47	0.43	0.47	0.43
Adjusted R^2	0.09	0.06	0.09	0.07	0.23	0.19	0.24	0.19

Note: *p<0.1; **p<0.05; ***p<0.01

Table A29: Core dealers' monthly share of sell/buy trading through core-core venue when they have positive/negative inventory positions

	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv	sell (%) pos inv	buy (%) neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	2.36***		2.33***		1.92***		1.84***	
	(0.29)		(0.30)		(0.36)		(0.35)	
abs bond inv, $\|inv_{i,j,t}\|$		4.78***		4.78***		4.57***		4.70***
		(0.49)		(0.51)		(0.51)		(0.57)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
month FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*month FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	164,124	155,110	164,124	155,110	164,124	155,110	164,124	155,110
R^2	0.20	0.13	0.21	0.13	0.54	0.46	0.54	0.46
Adjusted R^2	0.16	0.08	0.17	0.09	0.33	0.23	0.34	0.23
Note:	*p<0.1; **p<0.05; ***p<0.01							

Table A30: Core dealers' monthly share of buy/sell trading through core-core voice venue when they have positive/negative inventory positions

	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv	buy (%) pos inv	sell (%) neg inv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bond inv, $inv_{i,j,t}$	-1.17^{***}		-1.23^{***}		-1.15^{***}		-1.29^{***}	
	(0.20)		(0.21)		(0.16)		(0.22)	
abs bond inv, $\lvert inv_{i,j,t}\rvert$		-1.30^{***}		-1.32^{***}		-2.01^{***}		-2.06^{***}
		(0.22)		(0.22)		(0.27)		(0.28)
bond FE	Yes	Yes	Yes	Yes	No	No	No	No
dealer FE	Yes	Yes	No	No	No	No	No	No
month FE	Yes	Yes	No	No	Yes	Yes	No	No
dealer*month FE	No	No	Yes	Yes	No	No	Yes	Yes
dealer*bond FE	No	No	No	No	Yes	Yes	Yes	Yes
lag dep var	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
bond char	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
dealer agg inv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	164,124	155,110	164,124	155,110	164,124	155,110	164,124	155,110
R^2	0.21	0.13	0.22	0.13	0.50	0.43	0.50	0.44
Adjusted R^2	0.18	0.08	0.18	0.09	0.28	0.19	0.28	0.20
Note:	*p<0.1; **p<0.05; ***p<0.01							