# The Modern Bond Market*

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**Abstract**

The bond market is severely fragmented. We identify a simple innovation that counteracts this fragmentation: Traders can request quotes for many bonds simultaneously from the same set of dealers on modern bond platforms. Such List requests comprise 73% of all requests on the largest platform. We develop a model in which traders submit Lists in order to resolve price uncertainty and choose among substitute bonds. Using requests for high-yield corporate bonds on the largest platform, we document that (i) traders substitute among bonds within each List, (ii) the substitution is stronger for bonds with similar maturities or ratings, (iii) a large fraction of unfilled bonds in Lists are never filled, and (iv) a List contains more substitute bonds when their prices are more uncertain.

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# I Introduction

Most bonds do not trade on a given day, as the bond market is fragmented across numerous bond issues. In many markets, fragmentation has been resolved through standardization. Perhaps because bond issuers value discretion over details of bond attributes, the bond market still remains remarkably fragmented. How does the bond market overcome its fragmentation?

We identify a widespread innovation that alleviates fragmentation in the bond market: Rather than trading bonds one at a time as in existing models of trade, a bond trader simultaneously requests quotes for often dozens of bonds from the same set of dealers. The dealers may respond to all or some bonds, and the trader may accept some or even none of the quotes, possibly from different dealers.[1] We find that these *List* requests comprise 73% of requests and allow traders to simultaneously search over swaths of substitute bonds. Doing so, the trader learns the distribution of current bond prices, and trades the bonds with the most favorable prices among the substitutes.

In this paper, we show that search across substitute bonds and learning about the distribution of bond prices drive the use of Lists. Our approach is to develop a model of List requests that incorporates the desire for simultaneous search and learning, then test its predictions in the most fragmented part of the bond market—high-yield corporate bonds. Two frictions underlie our model: First, bonds are partly substitutable, some more with each other than others. Second, traders do not know the current bond prices until they receive quotes. In equilibrium, each trader includes close substitute bonds into her List, and more so when there is greater uncertainty over prices or if quoted spreads are likely to be high. The trader accepts the better-priced among the substitute bonds upon receiving her quotes. Our model yields sharp empirical predictions that we then test in the data. We document that indeed

[1] Note this is very different from co-called portfolio trades in which dealers have to submit quotes for all bonds and traders have to accept trading the whole portfolio with the same dealer.

(i) substitution takes place within Lists, (ii) substitution is more intense among bonds close in maturity or rating within a List, (iii) a large fraction of unfilled bonds in Lists are never filled, and (iv) a List contains more substitute bonds when their prices are more uncertain.

We present a two-stage model of trade with two key ingredients: substitutable bonds and price uncertainty. First, traders decide whether to request quotes for single bonds or in a List. Once they receive the quotes, they decide whether to trade a bond or a potentially imperfect substitute instead. We show that in equilibrium, a trader submits Lists without intending to trade all the bonds they ask for, even if there is a cost of requesting or rejecting each additional quote. The number of potential substitutes they include in the List increases in the uncertainty about the price. We also show that in Lists which include substitutes, the ranking of a bond's transaction cost within the List determine whether it will be traded, not simply its own transaction cost. The reason is that when trading off substitutes against each other, the trader only cares about the relative ranking of their transaction costs and not the transaction costs *per se*. Note that if traders knew all the prices they faced in advance they would simply choose to trade the bond that gives them the highest payoff given the joint cost of trading and substitution. Thus, in the absence of price uncertainty, there is no need to ask for quotes in Lists.

To test our hypotheses, we use data from MarketAxess, the largest multi-dealer platform for US corporate bond trading. We focus on high-yield corporate (HY) bonds, as price uncertainty is particularly high in this market segment. Our data covers every request made in 2021-2022, and contains identifiers that partition the individual requests for bonds into separate Lists, portfolio trades, or single-bond requests. We observe 1,457,885 individual requests over 125,517 Lists. A List can request quotes for as few as 2 and up to 50 bonds. Long Lists dominate the data; the average List length is 26.7. Given that on average only 63.6% of the requests made in Lists get filled, this means that on average there are quite a few bonds that

do not get traded and are yet included in a List. We find that a large fraction of the unfilled bond requests remain unfilled even through other channels. Thus, many bonds included in the List are not expected to be filled in the first place. We think of these bonds as ones that the trader substituted away from by trading other bonds instead.

The unique structure of the MarketAxess data means we have information on the alternatives the trader considered and how it decided among those alternatives. This is in contrast with traditional over-the-counter (OTC) bond markets, where there is no data about the bonds that the trader considered trading but ended up not choosing. In fact, such data is unique even compared to stock markets as we have no indication of what other options a trader considered before settling on trading a specific stock. While it is likely that even in traditional OTC markets traders verbally request quotes for more bonds than they plan to trade but this remains invisible and for this reason has not been studied.

Another advantage of our setting is the availability of a benchmark price (CP+) updated in real-time for almost all bonds, including the least liquid ones. We use the CP+ predicted bid and ask prices to compute the transaction cost implied by the best quote received from dealers. In our data, the average transaction cost implied by the best quotes is 51 basis points (bps) of the price and there is substantial uncertainty about the cost. Even for the same bond, the implied transaction costs' variation over time is large, the average standard deviation of transaction costs is 73 bps even within bonds, only shy of the 91 bps standard deviation in trading costs across all requests. Unsurprisingly, it is the bonds with the highest average transaction costs that face the highest uncertainty about the cost, the exact reason why we focus on HY bonds, which have high transaction costs.

That each List contains multiple bond requests allows us to include List-specific fixed effects. These effects flexibly control for all potential confounders particular to a List, notably time of submission, submitter identity, the set of chosen dealers, and the

joint distribution of bonds and quantities requested. Our model implies a "peer effect" that the relative ranking of quoted spreads within each List captures. Controlling for each bond's quoted spread, the relative ranking avoids the usual econometric problem of peer effects that one cannot include group fixed effects while measuring the effect of peers on a group member due to collinearity. Precisely, we first rank bonds within a List according to their best quoted spreads in an increasing order. Then we denote the rank within the List as increasing from 0 with the lowest transaction cost to 1 with that of the highest. We include the rank along with the transaction cost in our regressions as suggested by our theoretical model.

We show empirical evidence that bond substitution indeed happens within Lists. We run a regression explaining whether a request is filled—i.e., whether the trader accepted a quote provided by a dealer—on both the transaction cost of the requested bond and the ranking of its transaction cost within its List. Consistent with our hypothesis derived from the model, we show that even after controlling for the transaction cost of the bond and also List and bond fixed effects, the coefficient on the ranking of its cost within the List is highly negatively significant. In our main specification this means that—everything else equal—if the bond ends up being ranked to be the one with the lowest transaction cost, it is 21 percentage point more likely to be filled than if it is the last in the rank. We expect ranking to matter more within close substitutes, which we define as bonds that are quite similar in terms of risk and lie within one year in maturity and within one notch in credit rating. We show that indeed rank within close substitutes matters beyond overall rank in the List. All our results are robust to both linear and logistic specification and to including bond fixed effects.

We also test whether the price uncertainty affects the ex-ante composition of Lists as our model predicts. We find that bonds with more price uncertainty have significantly more substitutes included in the List, controlling for List, bond rating, and maturity fixed effects, consistent with our model's prediction.

There could be alternative reasons why traders ask for quotes in Lists, but none of them invalidate our main results, they simply complement it. First, traders could simply ask for Lists because of convenience. While this might be a factor behind longer Lists, in itself it cannot explain our results. Second, traders might have non-public information about bonds and might try to hide this by requesting longer Lists. While we find evidence of future information not incorporated in CP+ prices at the time of the request influencing the choice of filling trades, even controlling for this does not overturn our results. Third, traders might ask for longer Lists in order to increase bidding competition between dealers for the bonds in the List. While possible, this also relies on our basic mechanism of bond substitutability and price uncertainty.

Overall, our paper has implications for both future empirical and theoretical work on over the counter markets and multi-dealer platforms. We show that traders simultaneously search across substitute bonds, counteracting the intense fragmentation of the bond market and lowering trading costs for assets where substitution is easier.

The rest of the paper is structured as follows. Section II presents an overview of relevant literature and discusses how our results are related. Then in Section III we present a simple theoretical model at the end of which we formulate our empirical hypotheses. We describe our data in Section IV and present the empirical tests of the hypotheses in Section V. In Section VI, we explore the robustness of our results, while Section VII concludes. Proofs not included in the text are relegated to Appendix A, while tables for the robustness tests can be found in Appendix B.

# II Related Literature

Modeling trades in bond markets has mostly relied on search models, an approach pioneered by Duffie, Gârleanu and Pedersen (2005), in which traders search for a single asset. This approach becomes technically challenging when allowing traders to search

for multiple assets. Vayanos and Weill (2008) extend the above approach to two assets with identical cash flows to show that one of the two assets endogenously becomes more liquid. Sambalaibat (2022) uses the search framework to model non-directed search in CDS and bond markets to show that spillovers from the CDS market make the bond market more liquid. Milbradt (2017) extends the search model to allow for a continuum of bonds with different attributes to show firms might prefer issuing fragmented bonds. Oehmke and Zawadowski (2015) and Oehmke and Zawadowski (2017) take a different approach to modeling substitution between bonds and CDS with identical cash-flows and show that bond fragmentation drives trading in the more liquid CDS market. While all the above models exhibit liquidity spillovers between substitutable assets, none of the models incorporate the aspect of substitutability between multiple assets in the way we do.

Some recent papers model the theoretical aspects of multi-dealer platforms such as MarketAxess. Glebkin, Yueshen and Shen (2023) model traders interested in trading one single asset but facing multiple dealers to show that it is not worth asking for quotes from too many dealers. Wang (2023) also considers trading one single asset on such platforms and shows that traders want to restrict competition between dealers. Baldauf and Mollner (2024) consider the potential for information leakage from contacting many dealers. In fact if traders want to limit the number of dealers they want to contact, they will prefer OTC markets over multi-dealer platforms. Our focus is different, as we are interested in how many bonds the traders include in their Lists.

There is also a growing empirical literature on multi-dealer platforms. Allen and Wittwer (2023) show that even if bond traders can trade on a multi-dealer platform, many still choose to trade OTC because of strong relationship discounts they receive from dealers. There are also other papers specifically using data from the MarketAxess platform. Hendershott and Madhavan (2015) examine request for quotes on the MarketAxess platform using data from 2010-11 to understand what factors determine

whether traders prefer to use the platform or contact a dealer directly. O'Hara and Zhou (2021) provides a follow-up paper using data 2010-17 to show that transaction costs have decreased over time due to multi-dealer platforms. Kargar, Lester, Plante and Weill (2023) uses a version of the data with both customer and dealer identities. They show that rejected quotes are filled 40% of the time up to several days later for about 10 basis points better prices, which is in line with our findings. Hendershott, Livdan and Schürhoff (2021) analyses the impact of open trading platform in which not only dealers can submit quotes but other market participants as well.

In a recent paper, Chaudhary, Fu and Li (2023) find that ignoring the impacts of a demand shock to a bond on the prices of its substitutes understates the shock's price impact. No prior work studies Lists and their use to substitute among similar bonds, despite their dominance on bond platforms. A complementary literature examines portfolio trading, a restrictive form of Lists which comprise 6% of requests in our sample. Meli and Todorova (2023) develops an algorithm to identify portfolio trades in the Trace data.[2] Li, O'Hara, Rapp and Zhou (2023) find that portfolio trading increases bond market liquidity.

# III Model and Empirical Hypotheses

We first model how lists can be built to facilitate bond substitution. We concentrate on the choices of the trader and take the strategies of the dealers as given. The bonds have unit value and traders always want to trade (buy or sell) one unit of a bond. Traders face an information friction that they do not know the transaction costs of the bonds, these are only revealed to them when they request a quote. Bond $i$ has a transaction cost $c_i$ that is distributed independently and exponentially according to $f(c_i) \sim \frac{1}{\bar{c}} \exp^{-c_i/\bar{c}}$ for $c_i \geq 0$. Thus, $\bar{c}$ measures both the expectation and the standard deviation of the transaction cost $c_i$.[3] In reality, traders can get multiple

[2]Note that this approach might also pick up List RFQs alongside portfolio trades.

[3]In our data the mean and standard deviation of transaction costs are indeed related one-to-one.

responses from different dealers for a single bond, here the transaction cost refers to the transaction cost of the best offer with the lowest associated transaction cost.

Traders can request quotes for $n$ different unit bonds in a list, even if they only want to trade one unit. Once the costs are revealed, the trader chooses one bond to trade and rejects the other offers. There is a small reputation cost $\eta > 0$ of rejecting an offer for a bond. We assume that traders in principle want to trade bond $i = 1$ but can substitute other bonds at a cost $s > 0$, which is an additional cost to the transaction cost. Thus, the trader chooses to trade bond $i$ if $c_i + s_i \leq c_j + s_j$ for all $j \neq i$, where $s_j = s$ if $j \neq 1$, and $s_1 = 0$. The trader's optimization problem is described in the following Lemma. All proofs are relegated to Appendix A.

**Lemma 1.** *The trader chooses the list length $n$ in order to minimize the expected trading and substitution cost* $\min\{c_1, c_2 + s, c_3 + s, \ldots, c_n + s\}$ *of the accepted quote plus the cost of rejecting the other $n - 1$ quotes:*

$$\min_n \bar{c} - \frac{n-1}{n} e^{-\frac{s}{\bar{c}}} \bar{c} + (n-1)\eta \tag{1}$$

Setting aside the integer constraint, the first order constraint of (1) yields optimal list length of

$$n^* = e^{-\frac{s}{2\bar{c}}} \sqrt{\frac{\bar{c}}{\eta}}. \tag{2}$$

Taking the partial derivatives establishes the following Proposition.

**Proposition 1.** *The number of substitutes requested in the list for a bond increases in the expectation and standard deviation of the quoted transaction cost of a bond ($\bar{c}$), and increases in the bond's substitutability ($1/s$).*

Note that the probability of acceptance of a quote is $1/n^*$ in equilibrium, thus the probability of acceptance is decreasing both in the expectation and standard deviation of the quoted transaction cost of a bond ($\bar{c}$) and in the bond's substitutability ($1/s$).

For further analysis assume, for simplicity, that the lists can be at most the length of two, and the two bonds requested are indexed as $i \in \{1, 2\}$. Assume furthermore that there are two types of traders submitting such lists of length two. A $\nu \in [0, 1]$ fraction of traders submit two bonds which are perfect substitutes ($s = 0$) just as the above with $n^* = 2$. These traders want to trade only one of two bonds, the one that has the lower transaction cost. Denote by $f_i$ the probability that the quote for bond $i$ at transaction cost $c_i$ is accepted by the trader. The trader will accept the offer for bond $i$ if $c_i < c_j$ resulting in $f_i = 1$ and $f_j = 0$ ($j \neq i$). $1 - \nu$ portion of the lists are submitted by traders as lists due to pure lazyness, there is no substitution between the bonds, the trader has independent downward sloping demand for both bonds. Thus the probability of accepting the quote for bond $i$ (and thus the request being filled) is $f_i = 1 - \lambda_i \cdot c_i$ where $\lambda_i \geq 0$.

Define the rank within the list as $rank_i = 1$ and $rank_j = 0$ if $c_i < c_j$. Also denote the lists as $l$. We can then show the following Proposition.

**Proposition 2.** *Running the following regression with list fixed effects:*

$$f_{i,l} = \alpha + \beta \cdot rank_{i,l} + \gamma \cdot c_{i,l} + \delta_l + \epsilon_{i,l} \tag{3}$$

*the coefficient on within list rank is $\beta = -\nu$ and the coefficient on the quoted transaction cost is $\gamma = -(1 - \nu) \cdot \overline{\lambda}$ where $\overline{\lambda}$ is the average $\lambda_i$.*

The above model is deliberately stylized to show the basic mechanisms. In practice lists, in which requests for quotes are made, are much longer than two. Also the two forces of submitting together for convenience and to be able to substitute are mixed within lists. In fact one can think of longer lists being composed of sublists, i.e., lists are requests for several unrelated bonds together, each of them potentially having their own list of substitutes which we call a sublist. Based on the above results we derive the following empirical hypothesis that we then test in the data. Hypotheses 1 and 2 follow from Proposition 2, while Hypothesis 3 follows from Proposition 1. We

first define within list rank generally.

**Definition 1. Within list rank.** *In a list of length $n$, rank the bonds by their quoted transaction price in increasing order. Define $rank_i = \frac{i-1}{n-1}$ as the rank of the $i$'th bond in this ordered list. Thus, the bond with the lowest transaction cost has $rank_i = 0$, while that with the highest has $rank_i = 1$.*

**Hypothesis 1. Rank within list.** *Whether a bond quote is accepted is related negatively to its rank within the whole list, even after controlling for the transaction cost.*

**Hypothesis 2. Rank within close substitutes.** *Whether a bond quote is accepted is related negatively to its rank within the sublist of its close substitutes, even after controlling for the transaction cost.*

**Hypothesis 3. Number of close substitutes.** *The number of close substitutes requested within a list increases with the uncertainty about the transaction cost.*

# IV Data

Our data is from MarketAxess, the leading electronic platform for US corporate bond trading. About 20% of all US corporate bond trades registered on Trace are done through MarketAxess. The platform allows any trader to ask for quotes from multiple dealers for a specific amount of a given bond and then can decide whether or not to trade on the quotes received. The process is called Request for Quotes (RFQ). The dealers have a given timeframe to respond—typically few minutes—and it is important to note that dealers see trader identity, just like in traditional OTC market. However, dealers do not see which other dealers have been approached by the trader through the platform.

There are three types of trading protocols available on the platform. The first is the single RFQ where the trader asks for a quote for a single bond. The second is

Portfolio Trade (PT) in which the trader requests quotes for a list of bonds. In a PT, the dealers have to give a quote for all the bonds on the list if they choose to respond. Then the trader can choose one dealer and transact the whole list with that one dealer or forego trading any of the bonds altogether.

However, our focus is on a third, lesser known protocol called list RFQ. In this case the trader asks for quotes for a list of bonds. Dealers can give a quote for one or multiple bonds in the list, they are not obliged to give quotes for all—unlike in a PT request. After seeing all the quotes, the trader decides for each bond separately whether to accept the best quote or reject all quotes and thus forego the trade altogether.

Our raw data includes all requests for US bonds in 2021 and 2022. Overall $7,853,104$ individual requests are made in $616,821$ list RFQ's, while $1,703,358$ requests are made in single RFQ's, and $243,754$ requests in $2,542$ PT lists. This shows that about 80% of bond requests are made in list RFQ's making it the most important request type on the platform.

The main fields for each list include an exact timestamp of request, the trader type (but not trader ID), the number of dealers contacted, and the time frame for the dealers to respond. MarketAxess categorizes traders into one of three categories: "Asset Manager", "Dealer", and "Other". The exact categorization procedure has not been shared with us but hedge funds are be categorized as "Other", while mutual funds as "Asset Manager".

The main fields for each bond request include the following: The exact CUSIP and quantity of bond requested. The direction of request, i.e., whether it is buy or sell. All the quotes from the dealers, both quantity and price. The decision by trader, i.e., whether to accept the best quote or reject all. Beyond this, the data includes the benchmark CP+ price which is generated by a machine-learning algorithm based on a proprietary algorithm of the data vendor. The algorithm uses both the public data source of Trace and the proprietary data generated by requests, quotes and trades on

the MarketAxess trading platform. The benchmark CP+ prices are updated every 15 seconds even for the most illiquid bonds. While both bid and ask prices are reported, we only use the midprice because bid and ask prices are not a good predictor of the quoted prices.[4] The trading platform thus can be viewed as a vehicle to gather data for the CP+ price algorithm.

In our sample, we focus on requests for High-Yield (HY) bonds only. Investment Grade (IG) bonds are highly liquid, get many response from traders and the quotes are almost always accepted, for this reason we exclude them from our sample. About 20% of requests are made in mixed lists of HY and IG bonds, in these cases we only consider the HY portion of the list. Prices and quotes are measured in percentage of par for HY bonds. We also exclude requests made by broker-dealers in our baseline analysis, since brokers are likely much better informed about prices and also use the platform in a very different way than clients. Our baseline sample includes $1,457,885$ requests made in $125,517$ lists. We complement this with the enhanced version of Trace which in principle includes all trades for US corporate bonds for which Rule 144A does not apply.

Our main variables are defined in Table 1 and the summary statistics of variables are reported in Table 2. The average bond is included in a list RFQ of the length 30.9 but the average length of a list RFQ is lower. While in most cases the trader does not technically invite all the dealers, they invite 33.6 on average, which means in practice almost all dealers are invited. About 54% of bond requests are made by "Asset Managers", the rest by "Other" traders—dealers are excluded from our baseline sample. The par value of the average quantity requested is 446 thousand USD and 45% of the requests are for buying. Note that almost all lists are pure sell or pure buy lists. 63.6% of requests end up being filled, in 33.0% of the cases the offers get rejected, while 3.5% of requests do not receive any responses from dealers. Even including the latter, requests on average receive 5.88 responses from dealers.

[4]The algorithm seems to be optimized to predict bid ask quotes for Asset Managers but only is at least three quotes are received.

The average transaction cost implied by the best quote is 51 bps but there is quite a bit of variation across requests with standard deviation of 91 bps. In fact there is substantial time-series uncertainty in transaction costs, even for a given bond, the standard deviation best offers over time is 74 bps, meaning there is substantial uncertainty about the transaction cost.

To check whether we correctly identify filled trades we search for a match in the Trace database and find 27.9% of the requests. Of the bond eligible for reporting in Trace, we find 94.8% of filled trades reported in Trace within 10 minutes. The missing $63.6\% - 27.9\% = 35.5\%$ of requests cannot be found in Trace because 58% of the requests are made for private placement bonds where rule 144A applies and thus they do not have to report to Trace.This also highlights the importance of the platform in the market segment of corporate bonds with the least transparency. In fact the CP+ price is reported by the platform for 98% of the requests, meaning that the platform can indeed help gather information in this market segment.

An important question is whether MarketAxess is the primary platform for filling these requests. It is possible that requests not filled on the platform can be filled easily through other venues. To check for this, in case of unfilled trades we search the Trace database for the same quantity being traded in the next 5 days.[5] We find a match for 5.28% of all requests. Comparing this to the 27.9% of requests that were filled on MarketAxess and found in Trace we see that less than 16% of trades that were requested on the platform were eventually filled outside of the platform. When conditioning on bonds reported in Trace and that received offers on MarketAxess, we find 42.7% of these filled outside the platform. Note that while our measure is noisy since we do not observe trader indentities it is similar to the 40% reported by Kargar et al. (2023). Thus, the offers that were rejected on the platform do not end up being traded more than half of the time. This is in line with our model that shows certain requests might be substituted by other requests and are eventually left unfilled.

[5] Hendershott and Madhavan (2015) also look for trades later in Trace for requests that were unsuccessful on MarketAxess in a similar fashion.

# V Empirical Analysis

We now turn to the empirical analysis of our hypotheses. We first test Hypothesis 1 that bonds are substituted within lists by using the following empirical specification:

$$\text{filled}_{i,l} = \alpha + \beta \cdot \text{within_list_rank}_{i,l} + \gamma \cdot \text{transaction_cost}_{i,l} + \delta_l + \delta_i + \epsilon_{i,l}. \quad (4)$$

The left hand side variable $filled_{i,l}$ indicates whether the bond $i$ requested in list $l$ has been filled. The quoted cost of bond $i$ requested in list $l$ is measured by $transaction_cost_{i,l}$ while its rank in terms of cost within the list is $within_list_rank_{i,l}$. We run the regression conditional on getting a response for the request for quote, otherwise the transaction cost is not available. Importantly, we add list fixed effects $\delta_l$ as it is important to control both for the trader identity and the time at which the request is made. In fact, the list fixed effects are stronger than adding both fixed effects separately as they act as interactive fixed effects controlling for the trader identity at the exact time when the request is made. In certain specifications we also add bond fixed effects $\delta_i$. There is a trade-off between using linear versus logistic regressions. While linear regressions do not properly capture that the variable *filled* can only take to values 0 and 1, the logistic regression produces marginals that are biased in shorter lists with fixed effects (Fernández-Val, 2009). We use both specifications in our analysis. Our results are presented in Table 3.

In all specifications Hypothesis 1 holds, the coefficient on *within_list_rank* is negative and statistically significant even after controlling for the *transaction_cost*. We expect demand to be downward sloping and thus the coefficient on *transaction_cost* to be significantly negative, which is indeed the case in all specifications. The results are also economically significant. Focusing on the linear regression with both bond and list fixed effects in column (4), the coefficient of $-12.1$ on *transaction_cost* means that a one standard deviation increase in *transaction_cost* implies a 11 percentage point

decrease ($-12.1 * 0.00912$) in the likelihood of the request being filled. Meanwhile the coefficient of $-0.21$ on *within_list_rank* means that if the bond's relative position within the list drops from being the one with lowest transcation cost ($rank = 0$) to that with the highest ($rank = 1$) results in a 21 percentage point decrease in the probability of being filled, even if the transaction cost itself is unchanged.

We further refine our theory of substitutability by exploiting that there is heterogeneity in the substitutability of bonds within a list. We define close substitutes of a bond by those within one rating notch and one year in maturity. These are more likely to be considered as substitutes since they have similar characteristics in terms of both credit risk and interest rate risk. We then compute the average transaction cost of these close substitutes and also the bond's ranking within this sublist of close substitutes. When there is no closest substitute, we set the rank of the bond and the transaction cost of the closest substitutes to zero. We run the specification defined in equation (4) including the two above variables. We expect Hypothesis 2 to hold and the coefficient on the rank within close substitutes to be negative and significant.

The results presented in Table 4 are in line with Hypothesis 2, the coefficient on the variable *rank_within_closest* is negative and statistically significant. We focus on the linear specification with both bond and list fixed effects presented in column (3). The coefficient on *rank_within_closest* is $-0.023$, meaning that if the ranking within close substitutes is changed from best ($rank = 0$) to worst ($rank = 1$), then the probability of being filled decreases by 2.3 percentage points and this effect comes on top of any effect due to a change in overall rank within the whole list.

Our model also has implications for the composition of the lists. Hypothesis 3 states that for bonds with large and uncertain transaction costs, traders find it optimal to include more substitutes in the list they request quotes for. We use the time series standard deviation of quoted transaction costs (*stdev of trans. cost.*) of a given bond as a measure of price uncertainty the trader faces when requesting that bond. Note that the model also implies that the number of substitutes included in a

request also increases with how easy the bond is to substitute. Since we do not have a good measure of how easily bonds can be substituted it is important that we control for this as well as possible. Since *stdev of trans. cost.* is a fixed characteristic of the bond we cannot include bond fixed effects, so we include detailed fixed effects for ratings (by notch) and remaining maturity (by year until 10 and then every 5 years). To strengthen our analysis we also include these fixed effects in interactive way, i.e., having a separate fixed effect for all rating and maturity buckets $\delta_{maturity*rating}$. Thus, in our most stringent specification we run the regression:

$$\text{number_of_close_bonds}_{i,l} = \alpha + \beta \cdot \text{stdev_of_trans_cost}_{i,l} + \delta_l + \delta_{maturity*rating} + \epsilon_{i,l}. \quad (5)$$

Our results in Table 5 lend strong support for Hypothesis 3. Even in column (3) with the interactive fixed effects for bond maturity and rating, we find that the coefficient on the *stdev of trans. cost.*, our measure of price uncertainty, is positive and statistically significant. This means that a one standard deviation increase in price uncertainty of a bond increases the number of substitutes included in an average list by $3.24 * 0.0043 = 0.014$. While this is not very large, it is still economically significant given the number of close substitutes on average is 2.3 and we are already controlling for most bond and list characteristics.

# VI Robustness

In this Section, we briefly discuss our robustness checks. All tables are in Appendix B. In Tables 6 and 7 we show that our results on substitution are unchanged even taking into account that some requests are filled later even if rejected on the platform. In our further robustness checks we split our sample by trader type, this time including "Broker-Dealers". We also look separately at buy and sell requests, and do all specifications in linear and logistic setups. Table 8 shows the summary statistics by trader type. The main difference emerges between dealers and non-dealers. Dealers

receive less responses, worse prices, and reject quotes more often, their average fill rate for requests is only 0.08. This reinforces our choice to exclude dealers from our baseline specification since they use the platform in a very different way compared to non-dealers. The main results on within list rank are the same across all groups as shown in Table 9. The only difference is that the coefficient on the transaction price for dealers becomes slightly positive but only in the linear specification. The reason for this "flip" in sign is likely to be that the linear specification does not work well in lists where only a small fraction of requests are filled. Thus, there are many more 0's than 1's in *filled* for broker-dealers. The logistic regression can better account for this and indeed the coefficient is significantly negative for this group using the logistic approach.

Table 8 and 10 also include future returns on the bonds that are being requested. It shows that traders do have some additional information that is not incorporated in the CP+ price, so they are more likely to accept quotes for buying if the price of the bond later increases and a more likely to accept quotes when selling if the price is more likely to decrease. The coefficients on are main variable of interest are unchanged with the inclusion of this measure of information meaning that even if there is some informational trading, our main channels outlined in our hypotheses still work. In Table 10 we confirm our results in longer lists of length of at least 10, in which the marginal effects from the logistic regressions are less likely to be biased (Fernández-Val, 2009). The main results are similar as the baseline results discussed above. Table 11 confirms that our results on the rank within close substitutes also hold in all subsamples. Table 12 confirms the same for our price uncertainty results.

# VII Conclusion

In this paper, we show that requesting Lists instead of individual bonds arises endogenously on multi-dealer platforms. Using a simple model, we show that the driving

force behind the emergence of Lists is the uncertainty about prices and the ability to substitute between bonds. Empirically we show that Lists are prevalent on the largest multi-dealer platform and substitution does happen within lists. We also show empirical evidence in line with the model showing that Lists emerge due to price uncertainty. Our results imply that substitution between bonds needs to be seriously considered in future theoretical and empirical work.

# References


Allen, J., Wittwer, M., 2023. Centralizing over-the-counter markets? Journal of Political Economy 131, 3310–3351.

Baldauf, M., Mollner, J., 2024. Competition and information leakage. Journal of Political Economy 132, 1603–1641.

Chaudhary, M., Fu, Z., Li, J., 2023. Corporate bond multipliers: Substitutes matter. working paper .

Duffie, D., Gârleanu, N., Pedersen, L.H., 2005. Over-the-counter markets. Econometrica 73, 1815–1847.

Fernández-Val, I., 2009. Fixed effects estimation of structural parameters and marginal effects in panel probit models. Journal of Econometrics 150, 71–85.

Glebkin, S., Yueshen, B.Z., Shen, J., 2023. Simultaneous multilateral search. The Review of Financial Studies 36, 571–614.

Hendershott, T., Livdan, D., Schürhoff, N., 2021. All-to-all liquidity in corporate bonds. Swiss Finance Institute Research Paper .

Hendershott, T., Madhavan, A., 2015. Click or call? auction versus search in the over-the-counter market. The Journal of Finance 70, 419–447.

Kargar, M., Lester, B., Plante, S., Weill, P.O., 2023. Sequential search for corporate bonds. Technical Report. National Bureau of Economic Research.

Li, J.S., O'Hara, M., Rapp, A.C., Zhou, X.A., 2023. Bond market illiquidity: Is portfolio trading the solution? working paper .

Meli, J., Todorova, Z., 2023. Portfolio trading in corporate bond markets. working paper .

Milbradt, K., 2017. Asset heterogeneity in over-the-counter markets. working paper .

Oehmke, M., Zawadowski, A., 2015. Synthetic or real? the equilibrium effects of credit default swaps on bond markets. Review of Financial Studies 28, 3303–3337.

Oehmke, M., Zawadowski, A., 2017. The anatomy of the cds market. Review of Financial Studies 30, 80–119.

O'Hara, M., Zhou, X.A., 2021. The electronic evolution of corporate bond dealers. Journal of Financial Economics 140, 368–390.

Sambalaibat, B., 2022. A theory of liquidity spillover between bond and cds markets. The Review of Financial Studies 35, 2525–2569.

Vayanos, D., Weill, P.O., 2008. A search-based theory of the on-the-run phenomenon. The Journal of Finance 63, 1361–1398.

Wang, C., 2023. The limits of multi-dealer platforms. Journal of Financial Economics 149, 434–450.

# Appendix A: Proofs

**Proof of Lemma 1:** *Define* $Y = \min\{c_1, c_2 + s, c_3 + s, \ldots, c_n + s\}$. *To be able to determine* $E[Y]$ *we first need to find the distribution of* $Y$. *Note that there are two regions:*

1. *For any* $s > y$ *we have* $x_i + s \geq s > y$ *so the only contribution to the event* $Y \leq y$ *comes from* $x_1$, *thus* $P(Y > y) = P(x_1 > y) = e^{-\frac{1}{\bar{c}}y}$.

2. *For any* $y \geq s$ *both* $x_1$ *and* $x_i + s$ *for* $i \geq 2$ *contribute. Since the variables are independent and* $P(x_i + s > y) = e^{-\frac{1}{\bar{c}}(y-s)}$, *we get*

$$P(Y > y) = P(x_1 > y) \prod_{i=2}^{n} P(x_i + s > y) = e^{-\frac{1}{\bar{c}}y - (n-1)\frac{1}{\bar{c}}(y-s)}. \tag{6}$$

*Using integration by parts, the expectation can be obtained using the formula*

$$E[Y] = \int_0^\infty P(Y > y)\, dy = \int_0^s e^{-\frac{1}{\bar{c}}y}\, dy + \int_s^\infty e^{-\frac{1}{\bar{c}}y - (n-1)\frac{1}{\bar{c}}(y-s)}\, dy \tag{7}$$

*yielding:*

$$E[Y] = \frac{1 - e^{-s/\bar{c}}}{1/\bar{c}} + \frac{e^{-s/\bar{c}}}{n/\bar{c}} = \bar{c} - \frac{n-1}{n} e^{-\frac{s}{\bar{c}}} \bar{c} \tag{8}$$

*The equation in the lemma adds the cost of the other* $n - 1$ *rejected quotes to the above.* □

**Proof of Proposition 1:** *The relevant partial derivatives are:*

$$\frac{\partial n^*}{\partial c} = \frac{e^{-\frac{s}{2c}}(c + s)}{2c^{3/2}\sqrt{\eta}} > 0 \tag{9}$$

$$\frac{\partial n^*}{\partial s} = -\frac{e^{-\frac{s}{2c}}}{2\sqrt{c\eta}} < 0 \tag{10}$$

*The insights for partials extend even for integer choices of* $n^*$. □

**Proof of Proposition 2:**

$$f_{i,l} = \nu \cdot (1 - rank_{i,l}) + (1 - \nu) \cdot (1 - \lambda_i \cdot c_i) = 1 - \nu \cdot rank_{i,l} - (1 - \nu) \cdot \lambda_i \cdot c_i \tag{11}$$

*which yields the coefficients in Proposition.* □

**Table 1:** Variable definitions

| **Name** | **Variable definition** |
|---|---|
| *list-level variables:* | |
| list length | the number of different bonds requested in a list |
| all invited | indicator of inviting all dealers to bid |
| dealers invited | number of dealers invited to bid |
| asset manager | indicator if trader is asset manager |
| *bond-level variables:* | |
| quantity requested | par value of bonds requested in millions of USD |
| buy | indicator of 1 if buy, 0 if sell |
| num. of responses | number of responses for a request |
| no responses | indicator of getting no responses for a request |
| transaction cost | in case of a response, difference between offer price and midprice |
| | as a percentage of the midprice (times $-1$ for sell) |
| within list rank | ranking of bonds by trans. costs within a list, see Definition 1 |
| filled | indicator whether the request was eventually filled |
| quote rejected | conditional on getting offers, indicator |
| | whether all offers were rejected |
| filled & in Trace | indicator whether a filled trade is registered in Trace within 10 mins |
| filled outside | if the bond is not *filled*, indicator whether a trade of the same quantity is |
| | registered as a trade in Trace within 5 days |
| time to maturity | the remaining time to maturity in years |
| median rating | the median rating in notches of the bond requested, |
| | where $BB+ = 11$ increasing to $D = 22$ |
| Rule 144A | indicator whether the 144A rule applies to the bond |
| | and transactions do not have to be reported in Trace |
| CP+ available | indicator whether a CP+ price is available for the bond |
| 7-day CP+ return | return on the bond from the end of the |
| | trading day it was requested to 7 days after |
| stdev. of trans. cost | bond-level measure of the standard deviation of |
| | offered transaction costs over time (for at least 10 requests) |
| number of close bonds | number of bonds in a list within |
| | one year of maturity and one rating notch |
| trans. cost of closest | average transaction cost of bonds within |
| | one year of maturity and one rating notch |
| rank within closest | rank by transaction cost within sublist of bonds within |
| | one year of maturity and one rating notch |

**Table 2:** Summary statistics

*Notes.* The table presents the summary statistics for our baseline sample. The first column is the mean, the second the standard deviation, while the third contains the number of observations for that specific variable. For variable definitions, see Table 1.

| | mean | sd | count |
|---|---|---|---|
| list length | 26.73 | 16.91 | 1,457,885 |
| all invited | 0.0408 | 0.198 | 1,457,885 |
| dealers invited | 33.60 | 11.19 | 1,398,396 |
| asset manager | 0.538 | 0.499 | 1,457,885 |
| quantity requested | 0.446 | 1.008 | 1,457,885 |
| buy | 0.454 | 0.498 | 1,457,885 |
| num. of responses | 5.881 | 3.498 | 1,457,885 |
| no responses | 0.0346 | 0.183 | 1,457,885 |
| transaction cost | 0.00509 | 0.00912 | 1,386,780 |
| within list rank | 0.500 | 0.321 | 1,446,729 |
| filled | 0.636 | 0.481 | 1,457,885 |
| quote rejected | 0.330 | 0.470 | 1,457,885 |
| filled & in Trace | 0.279 | 0.449 | 1,457,885 |
| outside match | 0.0528 | 0.224 | 1,457,885 |
| time to maturity | 6.268 | 3.724 | 1,411,998 |
| median rating | 13.28 | 2.063 | 1,351,278 |
| Rule 144A | 0.581 | 0.493 | 1,457,885 |
| CP+ available | 0.980 | 0.139 | 1,457,885 |
| 7-day CP+ return | -0.00211 | 0.0153 | 1,086,176 |
| number of close bonds | 2.302 | 2.823 | 1,457,885 |
| stdev of trans. cost | 0.00735 | 0.00431 | 1,439,236 |

**Table 3:** Trader's decision whether to accept the offer

*Notes.* Left hand side variable is *filled*, indicating whether a bond trade request gets filled on not, conditional on getting at least one offer. The empirical specification is given in Equation (4). For variable definitions, see Table 1. Column (1) only includes *transaction_cost* with both list and bond fixed effects. Columns (2)-(4) include the *within_list_rank* variable first without and then with bond fixed effects and finally controlling for the size of the request. Column (5) shows the logistic regression without bond fixed effects. Robust standard errors are clustered by list and date and indicated in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% level, respectively.

| | **linear** | | | | **logit** |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| transaction cost | -17.7*** | -12.0*** | -12.1*** | -12.1*** | -15.9*** |
| | (0.23) | (0.17) | (0.17) | (0.17) | (0.15) |
| within list rank | | -0.22*** | -0.21*** | -0.21*** | -0.33*** |
| | | (0.0042) | (0.0043) | (0.0043) | (0.0017) |
| quantity requested | | | | -0.029*** | |
| | | | | (0.0015) | |
| List FE | Yes | Yes | Yes | Yes | Yes |
| Bond FE | Yes | No | Yes | Yes | No |
| R2 | 0.562 | 0.569 | 0.574 | 0.574 | |
| Within R2 | 0.126 | 0.167 | 0.149 | 0.149 | |
| Number of Lists | 121,304 | 121,400 | 121,304 | 121,304 | |
| Number of Obs. | 1,373,889 | 1,374,398 | 1,373,889 | 1,373,889 | 958,438 |

**Table 4:** Ranking within close substitutes

*Notes.* Left hand side variable is *filled*, indicating whether a bond trade request gets filled on not, conditional on getting at least one offer. For variable definitions, see Table 1. The variable *trans. cost of closest* is the average transaction cost of all other bonds within one year of maturity and within one rating notch. The variable *rank within closest* ranking of bonds by increasing transaction costs among the closest bonds within one year of maturity and within one rating notch, the bond with the lowest cost gets 0, increasing linearly to 1. For other variable definitions, see Table 1. Columns (1)-(3) are linear regressions. Column (1) includes only list fixed effects, column (2) adds bond fixed effects while column (3) additional controls. Column (4) is a logistic regression with list fixed effects. Robust standard errors are clustered by list and date and indicated in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% level, respectively.

| | **linear** | | | **logit** |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| transaction cost | -12.0*** | -12.1*** | -12.1*** | -15.7*** |
| | (0.18) | (0.17) | (0.17) | (0.15) |
| within list rank | -0.21*** | -0.20*** | -0.20*** | -0.32*** |
| | (0.0038) | (0.0039) | (0.0039) | (0.0019) |
| trans. cost of closest | 0.081 | -0.42** | -0.44** | 1.25*** |
| | (0.18) | (0.18) | (0.18) | (0.22) |
| rank within closest | -0.016*** | -0.023*** | -0.023*** | -0.011*** |
| | (0.0014) | (0.0014) | (0.0014) | (0.0013) |
| quantity requested | | | -0.029*** | |
| | | | (0.0015) | |
| List FE | Yes | Yes | Yes | Yes |
| Bond FE | No | Yes | Yes | No |
| Overall R2 | 0.569 | 0.574 | 0.574 | |
| Within R2 | 0.167 | 0.149 | 0.150 | |
| Number of Lists | 121,400 | 121,304 | 121,304 | |
| Number of Obs. | 1,374,398 | 1,373,889 | 1,373,889 | 958,438 |

**Table 5:** Number of substitutes in lists

*Notes.* Left hand side variable is *number of close bonds*, the number of bonds in the list within one year of maturity and within one rating notch using the specification in Equation (5). For variable definitions, see Table 1. All specifications are linear and include list fixed effects. Column (1) and (2) include separate fixed effects for rating and maturity buckets, while column (3) includes interactive fixed effects of rating and maturity buckets. Robust standard errors are clustered by list and date and indicated in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% level, respectively.

| | (1) | (2) | (3) |
|---|---|---|---|
| stdev of trans. cost | 3.94*** | 3.99*** | 3.24*** |
| | (0.76) | (0.76) | (0.83) |
| quantity requested | | 0.0090 | 0.014 |
| | | (0.0074) | (0.0087) |
| List FE | Yes | Yes | Yes |
| Bond FE | No | No | No |
| Rating FE | Yes | Yes | No |
| Maturity FE | Yes | Yes | No |
| Rating*Maturity FE | No | No | Yes |
| Overall R2 | 0.578 | 0.578 | 0.553 |
| Within R2 | 0.000 | 0.000 | 0.277 |
| Number of Lists | 121,824 | 121,824 | 49,534 |
| Number of Obs. | 1,385,025 | 1,385,025 | 1,083,218 |

# Appendix B: Robustness

**Table 6:** Trader's decision whether to accept the offer including fills later

*Notes.* Left hand side variable is *filled* + *outside_match*, indicating whether a bond trade request eventually gets filled on not, conditional on getting at least one offer. The empirical specification is given in Equation (4). For variable definitions, see Table 1. Column (1) only includes *transaction_cost* with both list and bond fixed effects. Columns (2)-(4) include the *within_list_rank* variable first without and then with bond fixed effects and finally controlling for the size of the request. Column (5) shows the logistic regression without bond fixed effects. Robust standard errors are clustered by list and date and indicated in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% level, respectively.

| | **linear** | | | | **logit** |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| transaction cost | -17.4*** | -12.0*** | -12.1*** | -12.1*** | -14.8*** |
| | (0.22) | (0.17) | (0.17) | (0.16) | (0.14) |
| within list rank | | -0.21*** | -0.20*** | -0.20*** | -0.33*** |
| | | (0.0042) | (0.0042) | (0.0042) | (0.0016) |
| quantity requested | | | | -0.021*** | |
| | | | | (0.0015) | |
| List FE | Yes | Yes | Yes | Yes | Yes |
| Bond FE | Yes | No | Yes | Yes | No |
| R2 | 0.555 | 0.560 | 0.565 | 0.566 | |
| Within R2 | 0.122 | 0.161 | 0.143 | 0.143 | |
| Number of Lists | 121,304 | 121,400 | 121,304 | 121,304 | |
| Number of Obs. | 1,373,889 | 1,374,398 | 1,373,889 | 1,373,889 | 961,444 |

**Table 7:** Ranking within close substitutes including later fills

*Notes.* Left hand side variable is *filled + outside_match*, indicating whether a bond trade request eventually gets filled on not, conditional on getting at least one offer. For variable definitions, see Table 1. The variable *trans. cost of closest* is the average transaction cost of all other bonds within one year of maturity and within one rating notch. The variable *rank within closest* ranking of bonds by increasing transaction costs among the closest bonds within one year of maturity and within one rating notch, the bond with the lowest cost gets 0, increasing linearly to 1. For other variable definitions, see Table 1. Columns (1)-(3) are linear regressions. Column (1) includes only list fixed effects, column (2) adds bond fixed effects while column (3) additional controls. Column (4) is a logistic regression with list fixed effects. Robust standard errors are clustered by list and date and indicated in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% level, respectively.

| | **linear** | | | **logit** |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| transaction cost | -12.0*** | -12.1*** | -12.1*** | -14.6*** |
| | (0.17) | (0.17) | (0.17) | (0.14) |
| within list rank | -0.20*** | -0.19*** | -0.19*** | -0.32*** |
| | (0.0037) | (0.0038) | (0.0038) | (0.0019) |
| trans. cost of closest | -0.10 | -0.42** | -0.43** | 0.89*** |
| | (0.18) | (0.18) | (0.18) | (0.22) |
| rank within closest | -0.019*** | -0.023*** | -0.023*** | -0.015*** |
| | (0.0014) | (0.0014) | (0.0014) | (0.0013) |
| quantity requested | | | -0.021*** | |
| | | | (0.0015) | |
| List FE | Yes | Yes | Yes | Yes |
| Bond FE | No | Yes | Yes | No |
| Overall R2 | 0.560 | 0.566 | 0.566 | |
| Within R2 | 0.161 | 0.144 | 0.144 | |
| Number of Lists | 121,400 | 121,304 | 121,304 | |
| Number of Obs. | 1,374,398 | 1,373,889 | 1,373,889 | 961,444 |

**Table 8:** Summary statistics by trader type

*Notes.* The table presents the summary statistics in three groups based on trader type. For variable definitions, see Table 1.

| | ***Asset manager*** | | ***Other*** | | ***Broker-dealer*** | |
|---|---|---|---|---|---|---|
| | Mean | Std.Dev. | Mean | Std.Dev. | Mean | Std.Dev. |
| list length | 18.7 | 13.8 | 36.1 | 15.3 | 38.1 | 12.9 |
| all invited | 0.059 | 0.24 | 0.019 | 0.14 | 1 | 0 |
| dealers invited | 35.1 | 10.9 | 32.0 | 11.2 | . | . |
| quantity requested | 0.34 | 1.27 | 0.57 | 0.53 | 0.81 | 0.53 |
| buy | 0.43 | 0.50 | 0.48 | 0.50 | 0.49 | 0.50 |
| num. of responses | 6.97 | 3.57 | 4.62 | 2.95 | 1.50 | 1.54 |
| no responses | 0.021 | 0.14 | 0.051 | 0.22 | 0.31 | 0.46 |
| transaction cost | 0.0031 | 0.0068 | 0.0074 | 0.011 | 0.011 | 0.014 |
| within list rank | 0.50 | 0.33 | 0.50 | 0.31 | 0.50 | 0.30 |
| filled | 0.76 | 0.43 | 0.50 | 0.50 | 0.080 | 0.27 |
| quote rejected | 0.22 | 0.42 | 0.45 | 0.50 | 0.61 | 0.49 |
| filled & in Trace | 0.36 | 0.48 | 0.18 | 0.38 | 0.028 | 0.16 |
| filled outside | 0.021 | 0.14 | 0.034 | 0.18 | 0.012 | 0.11 |
| time to maturity | 6.20 | 3.75 | 6.35 | 3.70 | 6.35 | 3.28 |
| median rating | 13.1 | 2.02 | 13.4 | 2.10 | 13.5 | 2.01 |
| Rule 144A | 0.53 | 0.50 | 0.64 | 0.48 | 0.70 | 0.46 |
| CP+ available | 0.98 | 0.14 | 0.98 | 0.13 | 0.99 | 0.11 |
| 7-day CP+ return | -0.0014 | 0.014 | -0.0029 | 0.017 | -0.0031 | 0.017 |
| number of close bonds | 1.67 | 2.28 | 3.04 | 3.19 | 1.69 | 2.38 |
| stdev of trans. cost | 0.0057 | 0.0035 | 0.0093 | 0.0043 | 0.013 | 0.0038 |
| Observations | 783691 | | 674194 | | 855257 | |

**Table 9:** Traders' decision about accepting the offer

*Notes.* Left hand side variable is *filled*, indicating whether a bond trade request gets filled on not, conditional on getting at least one offer. The columns report results separately for buys and sells, and also by the type of trader. *Panel A* shows the marginal results for a logistic regression, while *Panel B* is for a linear regression. For variable definitions, see Table 1. Robust standard errors are clustered by list and date and indicated in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% level, respectively.

**Panel A:** Logistic regressions

| | **buy** | | | **sell** | | |
|---|---|---|---|---|---|---|
| | AM | other | broker | AM | other | broker |
| transaction cost | -36.5*** | -10.3*** | -24.8*** | -35.8*** | -9.26*** | -24.9*** |
| | (0.65) | (0.26) | (0.53) | (0.64) | (0.21) | (0.52) |
| within list rank | -0.21*** | -0.39*** | -0.23*** | -0.22*** | -0.43*** | -0.28*** |
| | (0.0053) | (0.0034) | (0.0075) | (0.0054) | (0.0026) | (0.0069) |
| 7-day CP+ return | 2.47*** | 1.72*** | 1.93*** | -2.42*** | -2.12*** | -2.77*** |
| | (0.14) | (0.079) | (0.11) | (0.14) | (0.076) | (0.10) |
| List FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Bond FE | No | No | No | No | No | No |
| Number of Obs. | 155,896 | 171,504 | 132,329 | 152,278 | 216,352 | 173,335 |

**Panel B:** Linear regressions

| | **buy** | | | **sell** | | |
|---|---|---|---|---|---|---|
| | AM | other | broker | AM | other | broker |
| transaction cost | -16.4*** | -8.68*** | 1.11*** | -17.1*** | -9.16*** | 1.57*** |
| | (0.43) | (0.44) | (0.18) | (0.39) | (0.30) | (0.15) |
| within list rank | -0.17*** | -0.40*** | -0.41*** | -0.081*** | -0.41*** | -0.46*** |
| | (0.0061) | (0.018) | (0.0084) | (0.0046) | (0.016) | (0.0086) |
| 7-day CP+ return | 1.09*** | 1.52*** | 0.47*** | -0.70*** | -1.75*** | -1.00*** |
| | (0.15) | (0.13) | (0.095) | (0.089) | (0.11) | (0.078) |
| List FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Bond FE | No | No | No | No | No | No |
| R2 | 0.555 | 0.537 | 0.371 | 0.563 | 0.513 | 0.332 |
| Within list R2 | 0.145 | 0.201 | 0.118 | 0.141 | 0.203 | 0.126 |
| Number of Lists | 31,784 | 12,581 | 11,546 | 38,654 | 13,992 | 12,951 |
| Number of Obs. | 247,202 | 200,241 | 192,960 | 332,208 | 256,975 | 243,147 |

**Table 10:** Traders' decision whether to accept: lists with at least 10 requests

*Notes.* Regressions explaining the *filled* indicator: whether a bond request gets filled on not, conditional on getting at least one offer. *Panel A* shows the marginal results for a logistic regression, while *Panel B* is for a linear regression. For variable definitions, see Table 1. Robust standard errors are clustered by list and date and indicated in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% level, respectively.

**Panel A:** Logistic regressions

| | **buy** | | | **sell** | | |
|---|---|---|---|---|---|---|
| | AM | other | broker | AM | other | broker |
| transaction cost | -32.0*** | -8.75*** | -21.3*** | -30.6*** | -8.59*** | -22.5*** |
| | (0.81) | (0.24) | (0.54) | (0.76) | (0.20) | (0.52) |
| within list rank | -0.25*** | -0.41*** | -0.29*** | -0.28*** | -0.44*** | -0.32*** |
| | (0.0068) | (0.0032) | (0.0080) | (0.0065) | (0.0025) | (0.0072) |
| 7-day CP+ return | 2.28*** | 1.66*** | 1.76*** | -2.16*** | -2.09*** | -2.69*** |
| | (0.16) | (0.077) | (0.10) | (0.15) | (0.075) | (0.11) |
| List FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of Obs. | 111,680 | 162,822 | 125,221 | 116,925 | 208,823 | 166,089 |

**Panel B:** Linear regressions

| | **buy** | | | **sell** | | |
|---|---|---|---|---|---|---|
| | AM | other | broker | AM | other | broker |
| transaction cost | -15.7*** | -7.26*** | 1.40*** | -17.0*** | -8.11*** | 1.81*** |
| | (0.47) | (0.46) | (0.19) | (0.42) | (0.32) | (0.16) |
| within list rank | -0.19*** | -0.46*** | -0.42*** | -0.076*** | -0.47*** | -0.47*** |
| | (0.0090) | (0.020) | (0.0099) | (0.0059) | (0.017) | (0.0098) |
| 7-day CP+ return | 1.07*** | 1.60*** | 0.43*** | -0.61*** | -1.87*** | -0.98*** |
| | (0.15) | (0.14) | (0.097) | (0.089) | (0.11) | (0.079) |
| List FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Bond FE | No | No | No | No | No | No |
| R2 | 0.522 | 0.526 | 0.336 | 0.542 | 0.502 | 0.301 |
| Within list R2 | 0.144 | 0.210 | 0.115 | 0.140 | 0.210 | 0.123 |
| Number of Lists | 10,135 | 7,482 | 8,251 | 14,429 | 8,913 | 9,951 |
| Number of Obs. | 157,142 | 181,318 | 180,209 | 235,814 | 238,162 | 230,635 |

**Table 11:** Ranking within close substitutes by trader type

*Notes.* Left hand side variable is *filled*, indicating whether a bond trade request gets filled on not, conditional on getting at least one offer. The columns report results separately for buys and sells, and also by the type of trader. *Panel A* shows the marginal results for a logistic regression, while *Panel B* is for a linear regression. For variable definitions, see Table 1. The variable *trans. cost of closest* is the average transaction cost of all other bonds within one year of maturity and within one rating notch. The variable *rank within closest* ranking of bonds by increasing transaction costs among the closest bonds within one year of maturity and within one rating notch, the bond with the lowest cost gets 0, increasing linearly to 1. For other variable definitions, see Table 1. Robust standard errors are clustered by list and date and indicated in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% level, respectively.

| | **buy** | | | **sell** | | |
|---|---|---|---|---|---|---|
| | AM | other | broker | AM | other | broker |
| transaction cost | -14.8*** | -6.09*** | 1.89*** | -15.5*** | -7.86*** | 2.25*** |
| | (0.45) | (0.38) | (0.19) | (0.36) | (0.34) | (0.17) |
| within list rank | -0.16*** | -0.48*** | -0.42*** | -0.062*** | -0.45*** | -0.47*** |
| | (0.0095) | (0.019) | (0.010) | (0.0060) | (0.018) | (0.010) |
| trans. cost of closest | -0.019 | 0.089 | 1.38*** | 0.70 | 0.29 | 1.03*** |
| | (0.55) | (0.43) | (0.19) | (0.52) | (0.36) | (0.21) |
| rank within closest | -0.0075** | -0.014*** | -0.012*** | -0.0021 | -0.015*** | -0.0073*** |
| | (0.0033) | (0.0032) | (0.0026) | (0.0020) | (0.0037) | (0.0025) |
| List FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Bond FE | Yes | Yes | Yes | Yes | Yes | Yes |
| R2 | 0.558 | 0.535 | 0.330 | 0.567 | 0.520 | 0.308 |
| Within list R2 | 0.122 | 0.201 | 0.114 | 0.109 | 0.192 | 0.118 |
| Number of Lists | 11,720 | 9,638 | 10,921 | 16,166 | 10,011 | 11,922 |
| Number of Obs. | 148,505 | 225,947 | 197,006 | 215,569 | 245,469 | 225,960 |

**Table 12:** Number of substitutes in lists by trader type

*Notes.* Left hand side variable is *number of close bonds*, the number of bonds in the list within one year of maturity and within one rating notch. The columns report results separately for buys and sells, and also by the type of trader. For variable definitions, see Table 1. Robust standard errors are clustered by list and date and indicated in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% level, respectively.

| | **buy** | | | **sell** | | |
|---|---|---|---|---|---|---|
| | AM | other | broker | AM | other | broker |
| stdev of trans. cost | 6.79*** | 7.95*** | 15.3*** | 12.2*** | 8.43*** | 8.08*** |
| | (1.32) | (1.67) | (1.89) | (1.23) | (1.68) | (1.85) |
| List FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Bond FE | No | No | No | No | No | No |
| Rating FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Maturity FE | Yes | Yes | Yes | Yes | Yes | Yes |
| R2 | 0.605 | 0.586 | 0.524 | 0.558 | 0.526 | 0.519 |
| Within list R2 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Number of Lists | 37,915 | 16,465 | 15,511 | 46,495 | 16,902 | 16,163 |
| Number of Obs. | 299,033 | 286,911 | 260,438 | 398,211 | 309,259 | 295,586 |