

# Pre-trade Information in the Corporate Bond Market

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## Abstract

Dealer quoting is one of the primary sources for pre-trade price (“quoted price”) and size (“quoted size”) information (“pre-trade information”) in the corporate bond market. Using dealer quotes on corporate bond ATSS, this paper studies the availability of pre-trade information across public and Rule 144A corporate bonds and examines various cross-sectional characteristics of bonds, for which dealers provide more quotes. This paper also documents the amount of pre-trade information on corporate bond ATSS and reports the amount of incremental pricing information that dealer quotes on ATSS provide in addition to post-trade information disseminated via TRACE. Furthermore, this paper examines the types of dealers who are more likely to provide quotes on ATSS.

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## 1. Introduction

The usage of electronic venues in corporate bond trading have become more prevalent in recent years, and ATSs<sup>2</sup> represent one type of electronic venue that host corporate bond trading. The descriptive statistics and accompanying analyses on pre-trade information<sup>3</sup> may serve as a resource to Commission staff, academic researchers, policy commentators, and investors who are interested in the corporate bond market. Furthermore, assessing dealer quoting behavior on electronic platforms could inform future policy decisions regarding transparency in the corporate bond market.

Post-trade information<sup>4</sup> for public corporate bonds<sup>5</sup> has been available to the public since the initiation of TRACE reporting in July 2002. The dissemination of post-trade information on publicly traded corporate bonds via TRACE was phased in by the end of 2005. For Rule 144A corporate bonds, TRACE dissemination commenced on June 30<sup>th</sup>, 2014. Existing research suggests that post-trade transparency generally reduces transaction costs and price dispersion by mitigating information asymmetries among traders.<sup>6</sup>

In addition to post-trade information (disseminated via TRACE), pre-trade information could provide important pricing information for corporate bonds, particularly because post-trade information could be “stale” or even unavailable for infrequently traded corporate bonds. In the

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<sup>2</sup> Generally, an ATS is defined as any organization, association, person, group of persons, or system that meets the definition of “exchange” within the meaning of Section 3(a)(1) of the Exchange Act and Rule 3b-16 thereunder, but does not: (a) set rules governing the conduct of subscribers other than the conduct of such subscribers trading on the ATS; or (b) discipline subscribers other than by exclusion from trading. An ATS that complies with Regulation ATS, which includes, among other things, registering as a broker-dealer and filing a Form ATS with the Commission, is not required to register as a national securities exchange under Section 5 of the Exchange Act.

<sup>3</sup> This terminology is consistent with a previous SEC white paper that also used the term ‘pre-trade information’ when analyzing dealer quotes on ATSs for municipal bonds. See Craig, Kim, and Woo (2018), “Pre-trade Information in the Municipal Bond Market,” available at [https://www.sec.gov/dera/staff-papers/dera\\_wp\\_pre-trade\\_information\\_in\\_the\\_municipal\\_bond\\_market](https://www.sec.gov/dera/staff-papers/dera_wp_pre-trade_information_in_the_municipal_bond_market). Dealers on ATS provide quotes in the form of response to Request-for-Quotes and live quotes with the following information: side of the market (i.e., bid or offer), quote price (i.e., bid price or offer price), and quote size (i.e., bid size or offer size). In this paper, we focus on analyzing live dealer quotes on ATSs. Also, please see Section 2 for further descriptions on dealer quotes.

<sup>4</sup> Post-trade information refers to the information on price and quantity for each trade.

<sup>5</sup> In this paper, we use “public corporate bonds” to distinguish such corporate bonds from Rule 144A corporate bonds.

<sup>6</sup> Studies of post-trade transparency generally concluded that TRACE reporting led to lower transaction costs for corporate bonds (Bessembinder et al., 2006; Edwards et al., 2007; Goldstein et al., 2007). For example, Bessembinder et al. (2006) use the dataset of the National Association of Insurance Commissions (“NAIC”) to examine the effect of post-trade transparency of 439 bonds phased in on July 1, 2002. They estimate a reduction in the imputed transaction cost of these transparent bonds of about 5 to 10 bps as well as a decline in the concentration ratio of the largest dealers. However, the effects of post-trade transparency on transaction costs and trading activity are not universal. For most investment grade bonds, post-trade transparency clearly reduces transaction costs, but for thinly traded investment grade bonds and for high yield bonds, post-trade transparency reduces trading activity with little effect on transaction costs (e.g., Asquith et al. (2019)).

absence information about recent trades, pre-trade information could enhance and significantly contribute to price discovery of corporate bonds. Unlike corporate bond dealers, some institutional investors and retail investors may not have ready access to pre-trade information. Greater accessibility (e.g., public dissemination) to pre-trade information (e.g., live quotes, responses to Request-for-Quotes) could potentially reduce information asymmetry between dealers and customers and also reduce search costs resulting in lower transaction costs in the corporate bond market.

The section B.IV.C.4 of *Report to Congress: Access to Capital and Market Liquidity*<sup>7</sup> (“Report to Congress”) examines pre-trade information (i.e., dealer quotes) in the corporate bond market and provides transaction cost estimates (e.g., quoted spread, effective spread, price improvement) based on dealer quotes.<sup>8</sup> The analysis of pre-trade information in the Report to Congress is limited to the universe of public bonds and hence does not include Rule 144A corporate bonds. In general, Rule 144A corporate bonds are subject to lower disclosure requirements than those for registered corporate bonds.<sup>9</sup> Furthermore, Rule 144A bond issues are predominantly traded by institutional investors. In the presence of institutional investors who may transact in large amounts, dealers may be less likely to provide quotes for Rule 144A bonds on ATSS, from which market participants could make inference on the inventory positions of dealers. Thus, information environment for trading Rule 144A corporate bonds could be different from trading public bonds.

To the best of our knowledge, this paper is the first paper to document and compare dealer quoting activity for public and Rule 144A corporate bonds. In this paper, we examine and compare various aspects of pre-trade information available on ATSS between public and Rule 144A corporate bonds. More specifically, we characterize dealer quotes on ATSS, the types of corporate bonds with dealer quotes on ATSS, and the amount of pre-trade information (e.g., live price quotes)

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<sup>7</sup> See Report to Congress: Access to Capital and Market Liquidity, SEC Division of Economic and Risk Analysis staff, available at <https://www.sec.gov/files/access-to-capital-andmarket-liquidity-study-dera-2017.pdf>.

<sup>8</sup> Craig, Kim, and Woo (2018) examine pre-trade information in the municipal bond market and reports transaction cost estimates based on dealer quotes.

<sup>9</sup> Rule 144A issuances provide an opportunity for firms to raise capital without registering securities at issuance and satisfy disclosure requirements that are different from registered corporate bonds. For detailed information, see Securities Act Release No. 6862 (Apr. 23, 1990), available at <https://www.sec.gov/rules/final/1990/33-6862.pdf>.

disseminated on ATSS.<sup>10</sup> Furthermore, we examine the characteristics of dealers who post live quotes on ATSS.

We summarize our findings based on dealer quote data from two ATSS during a four month period in 2014:

- A larger portion of public corporate bonds have pre-trade information (as measured by dealer quotes on ATSS) compared to Rule 144A corporate bonds.
  - On a given day, over 50% of TRACE-eligible public bonds have dealer bid quotes. For TRACE-eligible Rule 144A bonds, approximately 15% of bonds have dealer offer quotes on a given day.
  - Approximately 35% of TRACE-eligible public bonds have both dealer bid and offer quotes, whereas less than 3% of TRACE-eligible Rule 144A bonds have both dealer bid and offer quotes on a given day.
- Corporate bonds with dealer quotes sent to ATSS tend to be larger in issue size, investment grade, and less complex.
  - For corporate bonds with issue size greater than \$500 million, on an average day, approximately 92% and 30% of TRACE-eligible public and Rule 144A bonds, respectively, have dealer quotes.
  - For investment grade bonds, approximately 78% and 20% of TRACE-eligible public and Rule 144A bonds, respectively, have dealer quotes on an average day.
- A larger portion of public bond customer trades have pre-trade information compared to Rule 144A bond customer trades.<sup>11</sup>
  - For public bonds, over 90% of customer trades had pre-trade pricing information at the time of trade execution. Approximately 26% of customer trades for Rule 144A bonds had pre-trade information.

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<sup>10</sup> We do not include corporate bond quotes on the New York Stock Exchange (NYSE) because available data fields in NYSE quote data are different from those of ATS quote data and hence unable to generate combined quote data appropriate for our analysis. Furthermore, NYSE quote data does not include submitting market participant identifiers (MPIDs) for quote messages. This makes it difficult to analyze the number of distinct quotes and the number of distinct dealers providing quotes. Our ATS quote data is comprehensive: from Table 1, over 16,000 TRACE-eligible public corporate bonds are quoted on ATSS during our sample period, whereas approximately 1,300 public corporate bond issues are quoted on the NYSE.

<sup>11</sup> In this paper, we do not examine causal relationship: in particular, we do not test whether observing a quote on a bond results in more trading in that bond nor whether active trading in a bond results in more quoting activity in that bond.

- For customer trades without prior trade price information (via TRACE dissemination), approximately 90% and 20% of those customer trades for public and Rule 144A bonds, respectively, had pre-trade information at the time of trade execution.
- Large dealers, as defined as those in the highest 25% of trade volume and the number of bond issues traded, have a greater propensity to provide quotes on ATSS than smaller dealers.
- Public corporate bonds have more quote competition than Rule 144A bonds do.
  - On a given day, at least 50% of public bonds with dealer quote have 6 or more distinct dealer quotes on ATSS.
  - For Rule 144A bonds, on a given day, less than 50% of bonds with dealer quote have 2 or more distinct dealer quotes on ATSS.

## 2. Background

In this section, we provide a short description of types of ATS quotes and discuss potential differences in trading environment for Rule 144A bonds from public corporate bonds.

Traditionally, corporate bonds are traded via “voice” intermediation although the fraction of buy-side participants trading corporate bonds on electronic venues may have increased in recent years.<sup>12</sup> Furthermore, Harris (2015) indicates that corporate bond trading may be evolving toward a market structure where dealers increasingly engage in more agency or riskless principal based trading. To the extent that electronic trading could facilitate agency or riskless principal based trading, it is important to understand various aspects of electronic trading for corporate bonds and how electronic trading is different from voice intermediated trading. For instance, one difference between voice intermediated and electronic trading is the broader (vs. bilateral) availability of or greater ease of access to pre-trade information (e.g., quoted price, quoted size).<sup>13</sup>

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<sup>12</sup> See, e.g., Greenwich Associates (2015).

<sup>13</sup> Existing research on electronic trading venues is constrained by data availability. Mizrach (2015) relies on survey data from Greenwich Associates (2015) to show that electronic platforms play a significant role in facilitating trading of corporate bonds. The paper estimates that such electronic platforms were used for 80% of investment grade bonds and 43% of high yield bonds in 2014. Mizrach (2015) explains that, while most of these electronic platforms involve activities to facilitate trades, such as seeking or posting quotes, they do not provide direct electronic trading venues to corporate bond investors. Therefore, the paper suggests that fully automated electronic trading represents only 16% of volume weighted market share for investment grade bonds and 4% for high yield bonds. Using electronic auction data from MarketAxess, Hendershott and Madhavan (2015) compare transaction costs of electronic and voice trades

One form of pre-trade information generated in the corporate bond market consists of quotes posted on corporate bond ATSS. Corporate bond ATSS are electronic trading platforms where traders can post live quotes, request quotes (Request-for-Quotes), and execute trades.<sup>14</sup> Live quotes on ATSS are generally available to ATS participants as well as certain retail and institutional investors through quote consolidators or broker-dealers.<sup>15</sup> Thus, unlike in the equity market where the public can observe intra-day quote prices,<sup>16</sup> pre-trade price information in the corporate bond market may be available to more limited group of market participants.

The main providers of quotes on ATSS are dealers though these dealers vary in their activities. Some dealers may provide quotes and trade the same bonds; other dealers may use ATSS to trade or to obtain current price quotes but without providing quotes of their own.<sup>17</sup> We focus our study on live dealer quotes on ATSS.<sup>18</sup> Live quotes are often referred to as “continuous quotes.” Live quotes are generally anonymous and contain information on current quote price and size that are available and accessible by ATS subscribers. On the other hand, responses to Request-for-Quotes (RFQ quotes) on ATSS are available specifically to the submitter of RFQ and typically, only for the duration of the RFQ session, and hence not accessible by other ATS subscribers.

The trading environment for Rule 144A corporate bonds could be different from trading public (registered) bonds. In general, Rule 144A corporate bonds are subject to lower disclosure requirements than those for registered corporate bonds. Rule 144A issuances provide an

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for 4.6 million customer-to-dealer corporate bond trades between January 2010 and April 2011. The paper finds that electronic trading is concentrated in bonds we expect ex ante to be more liquid, but reduces transaction costs after accounting for endogenous venue selection. Harris (2015) uses data for the period of December 15, 2014 to March 31, 2015 and finds that retail investors incur substantially higher transaction costs than institutional investors: the paper estimates average transaction costs of 85 bps for retail, versus 52 bps for institutional trades. The paper also explores the incidence of trade-throughs (trades executed at a price above the best standing ask or at a price below the best standing bid) and riskless principal trades (RPTs), in which dealers offset a customer trade with an interdealer trade and carry no inventory risk (defined as pairs of sequentially adjacent trades of the same size for which one trade is a customer trade). Harris (2015) documents that the trade-through rate is 43%, the RPT rate is 42%, and 41% of the trade-throughs are RPTs during the sample period (April 2014 through March 2015).

<sup>14</sup> Quotes are either firm or indicative. We do not differentiate whether quotes are firm or indicative because not every quote in our data has an indication for a firm or an indicative quotes, and therefore it is unclear to separate them in our analysis. Furthermore, Harris (2015) discusses that the quoted and indicated corporate bond prices are largely actionable and firm.

<sup>15</sup> There are quote consolidators (or aggregators) in the fixed income electronic markets. Quote consolidators receive quotes from ATSS or various dealer platforms, and provide quotes to their clients, institutional and retail investors.

<sup>16</sup> In equities markets, quotes are free with a fifteen-minute lag and are available in real time for a fee.

<sup>17</sup> In sections below, we describe the characteristics of dealers who provide quotes to ATSS, and present statistics regarding the number of securities and the characteristics of securities for which dealers provide quotes during the sample period.

<sup>18</sup> Although the main providers of quotes on ATSS are dealers, dealer quotes may represent customer orders. To minimize the potential misspecification, we dropped quotes that are clearly not dealer quotes.

opportunity for firms to raise capital without registering securities at issuance and satisfy disclosure requirements unlike for registered corporate bonds. Furthermore, Rule 144A limits the sale of 144A securities to qualified institutional buyers (QIBs). Investment funds with more than \$100 million in assets-under-management (AUM) qualify for the QIB designation, but few retail investors would meet this threshold. Thus, market participants in the secondary market trading for Rule 144A corporate bonds are primarily institutional investor.

Display of trading intention (via live quoting on ATSS) could potentially be costly in trading Rule 144A bonds where trading is dominated by institutional investors. In the presence of institutional investors who may transact in large amounts, dealers may be less likely to post live quotes for Rule 144A corporate bonds on ATS, from which market participants could infer the inventory positions of dealers. For this reason, in this paper, we separate out Rule 144A bonds from public corporate bonds in conducting analysis on pre-trade information in the corporate bond market.

### 3. Description of Data

We obtained dealer quotes from two ATSS, KCG and TMC, that support corporate bond trading through Commission data requests. We construct our live dealer quote sample using ATS quote data between August 1, 2014 and November 28, 2014 (82<sup>19</sup> business days). Our quote data include the following information: bond identifier (CUSIP), quoted price, quoted size, an indicator that specifies whether a quote is a bid or an offer, a broker-dealer identifier (MPID), date of quote, time stamps for quote messages, and messages (e.g., quote cancellation and modification).

For corporate bond transaction data, we use a regulatory version of TRACE that includes a broker-dealer identifier (i.e., market participant ID (MPID)), unmasked trade sizes, an indicator that identifies whether a trade is buy or sell, a trade identifier that classifies whether a trade is an interdealer or a customer trade, a broker-dealer capacity indicator that reports whether a trade is a principal trade or an agency trade for a reporting broker-dealer, and a credit quality code for investment grade and high yield bonds. TRACE data also includes issuer and issue information for TRACE-eligible bond issues updated daily. We merge these transaction data with bond

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<sup>19</sup> There are a total of 84 business days during our sample period, from August 1, 2014 to November 28, 2014. We drop two business days, August 29, 2014 and November 26, 2014, from our analysis because we do not have a complete list of TRACE-eligible bonds for those two days due to system error.

characteristics provided by the Mergent Fixed Income Securities Database (FISD). The FISD database includes issue date, issue size, maturity date, and various bond features (e.g., convertible, puttable, redeemable, pay-in-kind, variable rate, sinking fund). We construct our corporate bond transaction data sample as follows. First, we exclude all primary market trades (i.e., “P1” trades in TRACE) from our analysis to isolate secondary market trades. Second, we eliminate bonds that are not covered in the FISD.<sup>20</sup>

#### 4. Descriptive Statistics for Live Dealer Quotes on ATSS

In this section, we discuss our dealer quote sample collected from two ATSS. We present the following summary statistics on dealer quotes for public bonds and Rule 144A bonds: the number of dealer quotes, the number of bond issues (CUSIPs) with dealer quotes, the number of days with dealer quotes, quoted time length, and quote size. We observe that a significantly larger portion of public corporate bonds have live dealer quotes compared to Rule 144A bonds on a given day.

We identify dealers that post live quotes on ATSS using MPIDs. We count the number of live dealer quotes in the following way: on a given day, we count the number of unique MPID-CUSIP pairs. Table 1 reports the number of dealer quotes and the number of bonds quoted broken out by quoted side, offer or bid, for public bonds and Rule 144A bonds. From Table 1, we note that most dealer quotes is on public bonds. We observe approximately 9.4 million dealer quotes on 16,717 distinct public bond issues (CUSIPs) over 82 business days from August 1 to November 28, 2014. In contrast to public bonds, for Rule 144A bonds, we only observe approximately 105 thousand dealer quotes on 1,453 distinct bond issues (CUSIPs) during the same period. There are approximately 3.2 million dealer offer quotes for 13,740 distinct public bond issues (CUSIPs). On the other hand, we observe a substantially larger number of dealer bid quotes than dealer offer quotes: there are 16,461 distinct public bond issues (CUSIPs) with over 6.1 million dealer bid quotes.

Panel A of Table 2 shows the distribution for the number of TRACE-eligible bond issues (CUSIPs) per day and the portion of TRACE-eligible bond issues (CUSIPs) quoted per day broken out by public bonds and Rule 144A bonds. The median number of TRACE-eligible public and

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<sup>20</sup> We provide more detailed discussion of the corporate bond transaction data sample construction in Appendix A.

Rule 144A bond issues on a given day is approximately 28,000 and 5,000, respectively. We note that a significantly larger portion of TRACE-eligible public bond issues have live dealer quotes compared to TRACE-eligible Rule 144A bond issues. Approximately 35% of TRACE-eligible public bonds have both live dealer bids and offers, whereas the portion of TRACE-eligible Rule 144A bonds with both live dealer bids and offers is only 2.9% on a given day. Furthermore, on an average day, over 50% of TRACE-eligible public bond issues has live dealer bid quotes.

Panel B of Table 2 reports the distributional statistics for the number of live dealer quotes per day for public bonds and Rule 144A bonds. The median number of live dealer quotes (bid or offer) for public bonds is over 116,000 per day, whereas the median number of live dealer quotes (bid or offer) for Rule 144A bonds is only around 1,300 per day. For public bonds, the median number of live dealer bid and offer quotes per day is over 75,000 and 39,000, respectively, and on a given day, we observe twice as many live dealer bid quotes as offer quotes. On the other hand, for Rule 144A bonds, we observe larger number of live dealer offer quotes than bid quotes: on a median day, we observe approximately 300 live dealer bid quotes and 1,000 offer quotes.

Table 2 Panel C shows the distribution for the number of days quoted per bond issue (CUSIP) for public bonds and Rule 144A bonds. We include only TRACE-eligible bond issues with at least one live dealer quote during the sample period in deriving the distribution for the number of days with dealer quotes per bond issue (CUSIP) in Table 2 Panel C. We observe that at least 75% of TRACE-eligible public bond issues quoted during the sample period have either live dealer bid or offer quotes every day during the sample period (82 business days). At least one half of Rule 144A TRACE-eligible bond issues quoted during the sample period (82 business days) have live dealer bid or offer quote for 55 days or more.

Panel D of Table 2 reports the distributional statistics on quote duration<sup>21</sup> and quote size for public bonds and Rule 144A bonds. ATS business hours for our sample are from 8 a.m. to 5:15 p.m., for a total length of time of 9.25 hours. For public bonds, we observe that the median quote duration for live dealer bid or offer quote is 9.25 hours per day, so the majority of live quotes are available for an entire trading day. We also note that 90% of live dealer quotes on public bond issues are posted for at least 8 hours per day. The majority live continuous quotes on a Rule 144A bond issues have the quote duration of more than 8 hours per day. From the lower section of Table

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<sup>21</sup> We measure quotes duration as the duration (in hours) for which a dealer provides live quotes for a bond issue on a given day.

2 Panel D, the median quote size for public bond issues is larger for live dealer bid than for offer quotes (\$250,000 versus \$130,000). On the other hand, for Rule 144A bonds, the median quote size for live dealer bid quotes is smaller than that for dealer offer quotes (\$250,000 versus \$438,000).

## 5. Live Dealer Quotes and Bond Characteristics

In this section, we report the types of corporate bonds that have live dealer quotes and also examine the types of corporate bonds with two-sided (both bid and offer vs. only one-side bid or offer) dealer quotes on a given day. To this end, we examine the cross-sectional distributions of various bond characteristics for public bonds and Rule 144A bonds quoted on ATS. We consider the following five bond characteristics: issue size, credit quality, age (time since issuance), original maturity, and complexity features. We find that corporate bonds with live dealer quotes tend to be larger in issue size, investment grade, and less complex.

Table 3 Panel A.1 reports the distribution of issue size for TRACE-eligible public bonds and Rule 144A bonds that are quoted and not quoted on ATS. From Table 3 Panel A, dealer quoting activity is concentrated in bond issues with larger issue size. We observe that the average issue size (\$464 million) for TRACE-eligible Rule 144A bonds is significantly larger than that for TRACE-eligible public bonds (\$221 million). For public bonds, on a given day, we note that the average issue size (\$358 million) for bonds quoted on ATSS is larger than the average issue size (\$221 million) of TRACE-eligible bond issues. The average issue size (\$358 million) for public bonds quoted on ATSS is substantially larger than the average issue size (\$56 million) for public bonds that are not quoted on ATSS on a given day. Similarly, on a given day, the average issue size (\$711 million) of Rule 144A bonds that are quoted on ATS is significantly larger than the average issue size (\$464 million) of TRACE-eligible Rule 144A bonds.

In Panel A.2 of Table 3, we report the average daily portion of public and Rule 144A corporate bonds with live quotes broken out by issue size. We note that larger bond issues are more likely to have live quotes on ATSS. For corporate bonds with issue size greater than \$500 million, on an average day, approximately 92% and 30% TRACE-eligible public and Rule 144A bonds, respectively, have at least one live quote.

In Table 3 Panel B.1, we show the distribution of credit quality for bonds with quotes and without quote broken out by public bonds and Rule 144A bonds. From Table 3 Panel B, we observe

that at least 50% of TRACE-eligible public bonds are investment grade bonds and at least 90% of TRACE-eligible Rule 144A bonds are high yield bonds. For public bonds, at least 75% of corporate bonds with live dealer quotes on ATSS have an investment grade credit rating, whereas at least 50% of corporate bonds that are not quoted on ATSS on a given day are high yield bonds. Furthermore, we note that over 75% of Rule 144A bonds that have live dealer quotes on ATSS are high yield bonds.

In Panel B.2 of Table 3, we report the average daily portion of public and Rule 144A corporate bonds with live quotes broken out by credit quality. We note that investment grade corporate bonds are more likely to have live quotes on ATSS than high yield bonds. For public corporate bonds, on an average day, over 78% of investment grade TRACE-eligible public bonds have at least one live quote, whereas only 24% of high yield public bonds have at least one live quote. Furthermore, for Rule 144A corporate bonds, approximately 20% and 15% of investment grade and high yield Rule 144A TRACE-eligible bonds, respectively, have live quotes on an average day.

Table 3 Panel C and Panel D report the distribution of age (time since issuance) and original maturity, respectively, for public bonds and Rule 144A bonds that are quoted and not quoted on ATSS. In Panel D.1 of Table 3, we observe that the average original maturity (14.3 years) of public bonds quoted is longer than that (8.5 years) of public bonds not quoted on ATSS on a given day. While public bond issues quoted on ATSS have longer original maturity than those not quoted on ATSS, we note little difference in the average age (time since issuance) between the two groups of public bonds (although the median age for public bonds that are quoted is slightly older than those not quoted on ATSS (3.3 years for public bonds quoted vs. 1.7 years for public bonds not quoted), the difference in the median age is small). From Table 3 Panel D.1, on a given day, we observe that the average original maturity for Rule 144A bonds quoted (10.8 years) and not quoted (12 years) on ATSS are similar. On the other hand, on a given day, Rule 144A bonds that are quoted on ATSS are younger (3 years) than the average age (6.1 years) of those not quoted on ATSS. Furthermore, for public and Rule 144A bonds with live dealer quotes on ATSS, we observe that the average age of Rule 144A bonds is younger than that of public bonds (3 years for Rule 144A bonds vs. 5.1 years for public bonds).

Corporate bonds quoted on ATSS are less likely to be complex than bonds that are not quoted.<sup>22</sup> From Table 3 Panel E.1, at least 10% of public bonds quoted have two or more complexity features whereas at least 25% of public bonds that are not quoted on ATSS on a given day have two or more complexity features. Similarly, on a given day, at least 5% of Rule 144A bonds quoted have two or more complexity features whereas at least 25% of Rules 144A bonds not quoted on ATSS have two or more complexity features.

In Panel E.2 of Table 3, we report the average daily portion of public and Rule 144A corporate bonds with live quotes broken out by the number of complexity features. For public corporate bonds, approximately 60% and 39% of TRACE-eligible public bonds with zero or one complexity feature and bonds with two or more complexity features, respectively, have live quotes on an average day. Furthermore, for Rule 144A corporate bonds, on an average day, approximately 22% of TRACE-eligible Rule 144A bonds with zero or one complexity feature have at least one live quote, whereas only 4% of bonds with two or more complexity features have at least one live quote.

## 6. Amount of Pre-trade information for Customer Trades

In this section, we examine the amount of pre-trade information prior to customer trades. In measuring the amount of pre-trade information, we examine whether a live dealer quote (i.e., price quote) exists and is observable on the ATS prior to the trade. We use dealer quote data from August 1, 2014 to November 28, 2014 and customer trades from the regulatory version of TRACE for the same period. We match quoted prices with trades to evaluate whether the quoted price had been available around the time of trade execution. In matching quoted prices with trades, we require the quoted price to stand for at least 30 minutes prior to the time of trade execution to ensure that dealers have had the time to observe the quoted price.

Table 4<sup>23</sup> reports the number of customer trades with pre-trade information at the time of trade execution broken out for public and Rule 144A bonds and the distributional statistics for five

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<sup>22</sup> This finding supports the notion that bonds that are quoted have a broader potential investor base compared to bonds that are not quoted.

<sup>23</sup> Our analysis reported in Table 4 includes only corporate bond trades between 8:30 a.m. and 5:15 p.m. because we require quoted price to stand for at least 30 minutes prior to the time of trade execution (the earliest time a dealer can post a quote is 8:00 a.m., and the latest time that a dealer can post a quote on an ATS is 5:15 p.m.). The total number of customer trades for public and Rule 144A bonds between August 1, 2014 and November 28, 2014 is 1,695,341 and 141,918, respectively. For public bonds, of the 1,695,341 customer trades, 52,422 (approximately 3.1% of 1,695,341)

bond characteristics (issue size, credit quality, age (time since issuance), original maturity, and complexity features). The number of customer trades (not reported in Table 4) between 8:30 a.m. and 5:15 p.m. from August 1, 2014 to November 28, 2014 is approximately 1.4 million and 140 thousand for public bonds and Rule 144A bonds, respectively.

The amount of pre-trade information varies significantly across public and Rule 144A bonds: from Table 4, for public bonds, over 90% of customer trades had pre-trade information at the time of trade execution, whereas only 25% of customer trades for Rule 144A bonds had pre-trade information during the sample period. For both public and Rule 144A bonds, we find that bonds with pre-trade information tend to be larger issues and less complex bonds. At least one half of public and Rule 144A bond customer trades that had pre-trade information have issue size greater than or equal to \$750 million. We observe that most of the corporate bonds with pre-trade information have zero or one complexity feature. Furthermore, at least 25% of public bond customer trades that had pre-trade information are high yield bonds and at least 50% of Rule 144A bond customer trades that had pre-trade information are high yield bonds. Furthermore, we also note that the average age of Rule 144A bond trades with pre-trade information is younger than that of public bond trades (1.6 years for Rule 144A bond customer trades vs. 3.8 years for public bond customer trades).

As discussed above, the dissemination of corporate bond transaction prices via TRACE was phased in for publicly traded bonds by the end of 2005. Transaction price dissemination via TRACE for Rule 144A bonds commenced on June 30<sup>th</sup>, 2014, which is prior to our sample period. Post-trade information provides valuable pricing information to investors when negotiating trade prices. If a customer trade takes place subsequent to a trade in the same or similar bond, then customer could use the information from the earlier trade to determine the price at which she/he may be willing to transact. Thus, in our analysis, we consider the availability of trade prices (i.e., post-trade information) prior to a customer trade. Because bonds do not trade every day and trade prices may become stale over time, we limit our attention to post-trade information from the same day for a customer trade. We examine the amount of incremental pricing information that live dealer quotes provide in addition to prior trade price information disseminated via TRACE.

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customer trades are executed either before 8:30 a.m. or after 5:15 p.m. Furthermore, 5,258 customer trades (approximately 3.7% of 141,918) for Rule 144A bonds are executed either before 8:30 a.m. or after 5:15 p.m.

For each customer trade, we identify whether there is any prior trade for the same bond at least 30 minutes prior to the trade on a given day. This procedure produces four groups of customer trades: trades with both prior trade price information (i.e., post-trade information) and pre-trade information, trades with prior trade price information but without pre-trade information, trades without prior trade price information but with pre-trade information, and trades with neither prior trade price information nor pre-trade information.

Table 5<sup>24</sup> reports the number of customer trades with pre-trade and prior trade price information (i.e., post-trade information) at the time of trade execution and the distributional statistics for five bond characteristics (issue size, credit quality, age (time since issuance), original maturity, and complexity features) for corporate bonds with pre-trade information. Panel A and Panel B of Table 5 show distributional statistics for public bonds and Rule 144A bonds, respectively.

During our sample period, we document that there is significant amount of pricing information prior to customer trades in the corporate bond market. From Table 5 Panel A, approximately 77%<sup>25</sup> of customer trades for public bonds had prior trade price information at least 30 minutes prior to the trades. Of the customer trades without prior trade price information, over 90%<sup>26</sup> of those trades for public bonds had pre-trade information. This leaves only a small fraction, less than 2%,<sup>27</sup> of customer trades for public bonds without prior trade price information and pre-trade information prior to trade execution.

Public corporate bonds with pre-trade information but without prior trade price information tend to be larger in issue size, higher credit quality, older, longer maturity, and more complex. For customer trades without prior trade price information, the median and average issue size for public bonds that had pre-trade information is approximately \$500 million and \$703 million (versus \$250 million and \$312 million), respectively, which are significantly larger than those for public bonds with no pre-trade information. Furthermore, we observe that the median and average bond age is

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<sup>24</sup> Our analysis reported in Table 5 includes only corporate bond trades between 8:30 a.m. and 5:15 p.m. because we require quoted price to stand for at least 30 minutes prior to the time of trade execution (the earliest time a dealer can post a quote is 8:00 a.m., and the latest time that a dealer can post a quote on an ATS is 5:15 p.m.). The total number of customer trades for public and Rule 144A bonds between August 1, 2014 and November 28, 2014 is 1,695,341 and 141,918, respectively. For public bonds, of the 1,695,341 customer trades, 52,422 (approximately 3.1% of 1,695,341) customer trades are executed either before 8:30 a.m. or after 5:15 p.m. Furthermore, 5,258 customer trades (approximately 3.7% of 141,918) for Rule 144A bonds are executed either before 8:30 a.m. or after 5:15 p.m.

<sup>25</sup> Approximately 1.3 million (1,245,837 + 53,874) trades out of 1.7 million total customer trades for public bonds.

<sup>26</sup> Approximately 317 thousand trades out of 343 thousand (316,667 + 26,541) customer trades.

<sup>27</sup> Approximately 27 thousand trades out of 1.7 million total customer trades for public bonds.

approximately 3 and 4.2 years (versus 1.4 and 2.5 years), respectively, which are somewhat older than those for public bonds with no pre-trade information.

During our sample period, we find that pricing information for Rule 144A bonds is more scarce compared to public corporate bonds. For Rule 144A bonds, from Panel B of Table 5, we infer that approximately 60%<sup>28</sup> of customer trades had prior trade price information at least 30 minutes before the trades. Approximately 23%<sup>29</sup> of customer Rule 144A bond trades without prior trade price information had pre-trade information at the time of trade execution during the sample period. In our estimation, for Rule 144A bonds, approximately 29%<sup>30</sup> of all customer trades did not have prior trade price information nor pre-trade information at least 30 minutes before the trade execution. We also observe that Rule 144A bonds with pre-trade information but without prior trade price information tend to be larger in issue size. In Table 5 Panel B.1, for customer trades with no prior trade price information, the median issue size (\$750 million) for Rule 144A bonds that had pre-trade information is larger than that of bonds with no pre-trade information (\$500 million).

## 7. Dealer Quoting Activities on ATSS

This section provides descriptive statistics on dealers' quoting activity and discusses dealer concentration in quote provision on ATSS for public and Rule 144A corporate bonds. We examine dealer quoting propensity, the number of bond issues (CUSIPs) quoted by each dealer, the number of dealers quoting each bond issue (CUSIP), and the number of dealers providing two-sided quotes on bond issues (CUSIPs). Throughout this section, we limit our analyses to a sample of corporate bond issues that have at least one valid dealer quote each day.<sup>31</sup>

First, we examine how dealer size is related to quote availability. We obtain all valid trades<sup>32</sup> from TRACE and combine them with ATS quote data. For each dealer, we construct two measures of dealer size: the total par volume traded and the number of bond issues (CUSIPs) traded over one-year period prior to our sample period (from August 1, 2014 to November 28, 2014). We then divide dealers into four groups based on the two measures of dealer size. For each dealer in

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<sup>28</sup> Approximately 83 thousand (60,100 + 23,088) trades out of 140 thousand total customer trades for Rule 144A bonds.

<sup>29</sup> Approximately 12 thousand trades out of 53 thousand (40,987 + 12,485) customer trades.

<sup>30</sup> Approximately 41 thousand trades out of 140 thousand total customer trades for Rule 144A bonds.

<sup>31</sup> We report statistics based on the universe of TRACE-eligible bond issues.

<sup>32</sup> We define valid trades using the methodology described in Appendix A.

each dealer size group, we construct propensity to provide quotes. For dealers to be included in our analyses, we require dealers to have at least one trade during the sample period and also over the one-year period prior to the sample period. Furthermore, we only include the bond issues with at least one trade during the sample period. Then, we construct an indicator variable by assigning 1 if a dealer provides at least one quote (bid or offer) on a given day and 0 otherwise. We generate the mean propensity to quote for each dealer size group by taking the average of the indicator variable over all days and dealers. We analyze public bonds and Rule 144A bonds separately.

For both public and Rule 144A bonds, we find that larger dealers tend to quote more than smaller dealers. Table 6 presents how dealer size is related to dealer's propensity to quote. When we use total par volume as a measure of dealer size, we observe that for public bonds, the mean propensity for the dealers in the top quartile to provide quotes is 31%, whereas the mean propensity for the dealers in the bottom quartile to provide quotes is less than 1%. Furthermore, for Rule 144A bonds, the mean propensity for dealers in the top quartile to provide quotes is 16%, whereas the mean propensity for dealers in the bottom quartile to provide quotes is less than 1%<sup>33</sup>. We find similar patterns for dealers' propensity to quote when we use the number of issues (CUSIPs) traded as a measure of dealer size.

Next, we examine whether dealers provide bids and offers differently depending on the bond issue to be public or a Rule 144A bond. Table 7<sup>34</sup> reports the number of bond issues that each dealer quotes per day separately for public bonds and Rule 144A bonds. We find that dealers provide more bids than offers for public bonds, whereas dealers provide more offers than bids for 144A bonds. For public bonds, at the median, a dealer provides either bid or offer quote for 78 bond issues, bid for 135 bond issues, and offer for 47 bond issues on a given day. For Rule 144A bonds, at the median, a dealer provides quote for 8 bond issues, bid for 4 bond issues, and offer for 6 bond issues on a given day. We note that there is a large variation in the number of bond issues that each dealer quotes per day. For example, at the 95<sup>th</sup> percentile, we observe that a dealer provides quotes on 2948 public bonds and on 62 Rule 144A bond issues.

We also examine whether the number of dealers providing quotes is associated with a bond issue to be public or a Rule 144A bond. In Table 8<sup>35</sup>, we present the number of dealers providing

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<sup>33</sup> Of the 244 dealers in the bottom quartile only one dealer provided quotes for Rule 144A bonds. This dealer provided quotes 5 days out of 82 days.

<sup>34</sup> For Table 7, we only include bond issues that have quote on a given day.

<sup>35</sup> For Table 8, we only include bond issues that have quote on a given day.

quotes for each bond issue separately for public and Rule 144A bonds. We find that more dealers provide quotes for public bonds than Rule 144A bond issues. In Table 8, we observe that a median number of 6 dealers provide quotes (bid or offer quotes) for a public bond on a given day. For Rule 144A bonds, a median number of 1 dealer provide quotes (bid or offer quotes) on a given day. Thus, the findings in Table 8 suggests that on a given day, for quoted corporate bonds, there is more quote competition in public bonds than in Rule 144A bonds.

We conduct additional analysis on dealers quoting activity by analyzing whether dealers' quoting activity varies across bonds with varying trading activity. For each bond issue, we rank public bonds and Rule 144A bonds by the total number of trades summed over the sample period and divide bonds into five groups. Group 1 in Table 9 includes bonds that ranked in the top 20% in terms of the total number of trades. We examine the number of dealers that provide two-sided quotes for each bond issue in each group.

We find that more actively traded public bonds have more dealers providing two-sided quotes, suggesting that there is more quote competition in frequently traded public bond issues. In Table 9, we present the daily distribution for the number of dealers providing two-sided quotes for each group of bond issues. The median number of dealers that provide two-sided quotes for public bonds in the top two groups in terms of trading activity is 9 and 6, respectively. As a contrast, for Rule 144A bond issues, we find that at least 25% of bond issues in any group do not have two-side quotes.

In summary, for both public and Rule 144A bonds, larger dealers are more likely to provide quotes on a given day than smaller dealers. We also document that more actively traded bond issues have more dealers providing two-sided quotes. Finally, there is more quote competition in frequently traded public bond issues.

## 8. Conclusion

In this paper, we examine and compare various aspects of pre-trade information (as measured by dealer quotes on ATSS) between public and Rule 144A corporate bonds. We document that a larger portion of public corporate bonds have pre-trade information compared to Rule 144A bonds on a given day. Furthermore, corporate bonds with pre-trade information tend to be larger in issue size, investment grade, and less complex.

As discussed above, academic research finds that in general, public dissemination of post-trade information results in lower transaction costs benefitting investors. In this paper, we document that there is a significant amount of pricing information from prior trades disseminated via TRACE in the corporate bond market. During our sample period, we estimate that 77% and 60% of customer trades for public and Rule 144A bonds, respectively, had prior trade price information.

The analyses in this paper show that there is a substantial amount of pre-trade pricing information in the corporate bond market. In our estimation, approximately 90% and 25% of customer trades for public and Rule 144A bonds, respectively, had pre-trade pricing information at the time of trade execution. Furthermore, we document the amount of incremental pricing information from pre-trade information (i.e., live dealer quote) in addition to prior trade price information (i.e., post-trade information) provided by TRACE. For the customer trades without prior trade price information, approximately 90% and 23% of those customer trades for public and Rule 144A bonds, respectively, had pre-trade pricing information at the time of trade execution. In the absence of post-trade information, pre-trade information could enhance and significantly contribute to price discovery of corporate bonds.

Lastly, unlike corporate bond dealers, some institutional investors and retail investors may not have ready access to pre-trade information. Public dissemination of pre-trade information, for example, would improve accessibility. Pre-trade information (e.g., live quotes, responses to Request-for-Quotes) could enable investors to better assess the quality of trade execution and transaction costs.

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**Table 1. Number of live dealer quotes and corporate bond issues quoted**

Table 1 presents the number of live dealer quotes and the number of TRACE-eligible corporate bond issues (CUSIPs) quoted on corporate bond ATs for the duration of our sample period: from August 1, 2014 to November 28, 2014 (82 business days) broken out by public and Rule 144A bonds. We identify dealers who provide live quotes on ATs using MPIDs. In counting the number of live dealer quotes on ATs, we count the number of unique CUSIP-MPID pairs on a given day.

	Number of Quotes (in thousands)	Number of TRACE-eligible bond issues (CUSIPs)
Quote (bid or offer)		
Public bonds	9,356	16,717
Rule 144A bonds	105	1,453
Bid		
Public bonds	6,129	16,461
Rule 144A bonds	27	809
Offer		
Public bonds	3,227	13,740
Rule 144A bonds	78	1,347

Source: DERA analysis

**Table 2. Corporate bond issues quoted per day and the number of dealer quotes per day**

Panel A reports the daily distribution for the number of TRACE-eligible corporate bonds and the percentage of TRACE-eligible bonds quoted. Panel B presents the distribution for the number of bond issues quoted and live dealer quotes per day. Panel C reports the number of days quoted per bond issue (CUSIP) conditional on a bond having at least one quote during the sample period: from August 1, 2014 and November 28, 2014 (82 business days). Panel D presents the distribution of quote duration in hours per bond issue and quote size conditional on a bond having at least one quote on a given day.

**Panel A: Number of TRACE-eligible corporate bonds and percentage of bonds quoted per day**

		Distribution							
		Mean	5th percentile	10th percentile	25th percentile	Median	75th percentile	90th percentile	95th percentile
Number of TRACE-eligible bonds (CUSIPs)	Public bonds	28,066	27,781	27,794	27,848	28,069	28,244	28,350	28,381
	Rule 144A bonds	5,007	4,971	4,973	4,980	5,009	5,032	5,049	5,054
		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
TRACE-eligible bonds with bid	Public bonds	53.9	53.1	53.2	53.6	54.1	54.5	54.6	54.6
	Rule 144A bonds	5.4	4.1	4.2	4.9	5.5	6.0	6.8	7.1
TRACE-eligible bonds with offer	Public bonds	35.7	35.2	35.3	35.5	35.8	36.1	36.4	36.4
	Rule 144A bonds	14.8	13.8	14.1	14.3	14.8	15.4	15.8	16.0
TRACE-eligible bonds with both bid & offer	Public bonds	35.0	34.5	34.6	34.9	35.1	35.4	35.7	35.7
	Rule 144A bonds	3.0	2.0	2.3	2.6	2.9	3.4	4.1	4.4

Source: DERA analysis

**Panel B: Number of dealer quotes per day**

		Distribution							
		Mean	5th percentile	10th percentile	25th percentile	Median	75th percentile	90th percentile	95th percentile
Number of quotes	Public bonds	114,097.6	103,551	105,509	113,646	116,022	119,892	122,159	122,253
	Rule 144A bonds	1,284.2	1,168	1,209	1,242	1,279	1,347	1,413	1,440
Bid	Public bonds	74,748	65,341	67,009	72,892	75,776	80,284	81,822	82,693
	Rule 144A bonds	333	243	256	296	334	369	424	446
Offer	Public bonds	39,349	36,732	37,075	38,736	39,942	41,173	41,815	42,175
	Rule 144A bonds	951	870	883	902	966	1,010	1,036	1,050

Source: DERA analysis

**Panel C: Number of days quoted per corporate bond issue**

		Distribution							
		Mean	5th percentile	10th percentile	25th percentile	Median	75th percentile	90th percentile	95th percentile
Number of days quoted per bond (CUSIP)	Public bonds	75.2	18	55	82	82	82	82	82
	Rule 144A bonds	48.4	1	3	18	55	80	82	82
Bid	Public bonds	75.3	23	57	81	82	82	82	82
	Rule 144A bonds	27.3	1	1	4	19	44	75	79
Offer	Public bonds	59.8	3	8	35	80	82	82	82
	Rule 144A bonds	45.0	1	3	14	48	79	82	82

Source: DERA analysis

**Panel D: Quote duration and quote size**

			Distribution							
			Mean	5th percentile	10th percentile	25th percentile	Median	75th percentile	90th percentile	95th percentile
Quote duration (in hour)	Bid	Public bonds	9.1	8.49	8.89	9.20	9.25	9.25	9.25	9.25
		Rule 144A bonds	8.1	2.53	5.35	8.25	9.00	9.25	9.25	9.25
	Offer	Public bonds	8.9	7.38	8.58	9.00	9.25	9.25	9.25	9.25
		Rule 144A bonds	8.3	5.02	7.08	8.27	8.66	9.04	9.25	9.25
Quote size (in thousand)	Both bid & offer	Public bonds	8.8	6.96	8.41	8.95	9.25	9.25	9.25	9.25
		Rule 144A bonds	7.5	1.38	3.41	7.08	8.63	9.02	9.25	9.25
	Bid	Public bonds	NM	25	50	100	250	250	300	500
		Rule 144A bonds	NM	50	70	125	250	750	1,000	1,000
Offer	Public bonds	NM	6	14	65	130	250	500	825	
	Rule 144A bonds	NM	25	50	150	438	800	1,154	2,007	

NM: Not meaningful.<sup>36</sup>

Source: DERA analysis

<sup>36</sup> We do not report the means for quote size because the mean values are influenced by extreme outliers, which are believed to be errors.

**Table 3. Bond characteristics of corporate bonds quoted on ATs**

Table 3 presents the distribution of bond characteristic for public and Rule 144A TRACE-eligible corporate bonds quoted and not quoted on ATs. Panels A through E tabulates the distribution of issue size, credit quality, age, maturity, and complexity, respectively.

**Panel A.1: Issue Size**

		Distribution							
		Mean	5th percentile	10th percentile	25th percentile	Median	75th percentile	90th percentile	95th percentile
Public TRACE-eligible bonds		221.0	0.3	0.7	2.0	10	300	700	1000
Not quoted		56.1	0.2	0.4	1.1	3.1	13.7	150	300
Quoted		358.2	0.6	1.2	5.4	200	500	1000	1250
Issue Size (in \$million)	Quoted	71.5	0.3	0.5	1.3	4.5	30	250	400
	One-side	518.6	2.9	7	142	385	700	1200	1500
	Two-side								
	Quoted								
Rule 144A TRACE-eligible bonds		464.1	10	25	125	325	600	1,000	1,400
Not quoted		413.0	10	20	100	300	500	1,000	1,250
Quoted		711.5	150	250	350	550	930	1,300	1,750
Quoted		676.3	167	250	350	500	850	1,250	1,600
One-side		875.9	150	300	499	700	1,100	1,500	2,000
Two-side									

Source: DERA analysis

**Panel A.2: Issue Size, the mean percentage of bonds with quotes by issue size**

		Public	Rule 144A	
		TRACE-eligible bonds	TRACE-eligible bonds	
Number of Bonds		17,585	985	
Issue Size	Less than \$100M	(%)	(%)	
		Not quoted	62.1	98.0
	Quoted	37.9	2.0	
	Quoted	One-side	24.9	1.5
		Two-side	13.0	0.5
	Number of Bonds		6,867	2,551
Issue Size	Between \$100M and \$500M	(%)	(%)	
		Not quoted	22.4	84.4
	Quoted	77.6	15.6	
	Quoted	One-side	14.5	13.6
		Two-side	63.1	2.1
	Number of Bonds		3,613	1,471
Issue Size	Greater than \$500M	(%)	(%)	
		Not quoted	7.7	70.1
	Quoted	92.3	29.9	
	Quoted	One-side	3.6	23.5
Two-side		88.7	6.4	

Source: DERA analysis

### Panel B.1: Credit Quality

			Distribution							
			Mean	5th percentile	10th percentile	25th percentile	Median	75th percentile	90th percentile	95th percentile
Public TRACE-eligible bonds			NM	HY	HY	HY	IG	IG	IG	IG
Not quoted			NM	HY	HY	HY	HY	IG	IG	IG
Quoted			NM	HY	HY	IG	IG	IG	IG	IG
Credit Quality	Quoted	One-side	NM	HY	HY	IG	IG	IG	IG	IG
		Two-side	NM	HY	IG	IG	IG	IG	IG	IG
	Rule 144A TRACE-eligible bonds		NM	HY	HY	HY	HY	HY	HY	IG
	Not quoted		NM	HY	HY	HY	HY	HY	HY	HY
Quoted		NM	HY	HY	HY	HY	HY	IG	IG	
Quoted	One-side	NM	HY	HY	HY	HY	HY	IG	IG	
	Two-side	NM	HY	HY	HY	HY	IG	IG	IG	

NM: Not meaningful.

Source: DERA analysis

### Panel B.2: Credit quality, the mean percentage of bonds with quotes by credit quality

			Public TRACE-eligible bonds	Rule 144A TRACE-eligible bonds
Number of Bonds			15,816	2,235
			(%)	(%)
Investment Grade	Not quoted		21.8	79.8
	Quoted		78.2	20.2
	Quoted	One-side	28.2	15.6
		Two-side	50.0	4.6
Credit Quality	Number of Bonds		12,250	2,772
			(%)	(%)
	Not quoted		75.9	85.3
	Quoted		24.2	14.7
High Yield	Quoted	One-side	8.4	12.9
		Two-side	15.7	1.8

Source: DERA analysis

### Panel C.1: Age

		Distribution								
		Mean	5th percentile	10th percentile	25th percentile	Median	75th percentile	90th percentile	95th percentile	
Age (in years)	Public TRACE-eligible bonds	4.9	0.2	0.4	1.0	2.6	7.0	13.0	17.8	
	Not quoted	4.6	0.1	0.2	0.7	1.7	6.8	14.2	19.2	
	Quoted	5.1	0.4	0.7	1.6	3.3	7.1	11.7	17.3	
	Quoted	One-side	5.4	0.4	0.6	1.5	3.1	7.9	14.9	18.5
		Two-side	5.0	0.4	0.7	1.7	3.4	6.8	11.2	16.6
	Rule 144A TRACE-eligible bonds	5.5	0.2	0.5	1.5	3.8	8.0	13.6	17.3	
	Not quoted	6.1	0.3	0.6	1.7	4.2	8.5	14.6	17.9	
	Quoted	3.0	0.2	0.3	0.8	2.0	3.9	7.1	9.5	
	Quoted	One-side	2.8	0.2	0.3	0.8	2.0	3.7	6.4	9.1
		Two-side	3.7	0.1	0.2	0.8	2.1	5.0	9.0	12.7

Source: DERA analysis

### Panel C.2: Age, the mean percentage of bonds with quotes by age

		Public	Rule 144A	
		TRACE-eligible bonds	TRACE-eligible bonds	
Age (in years)	Number of Bonds		11,602	1,600
			(%)	(%)
	Less than 2 years	Not quoted	58.6	73.0
		Quoted	41.4	27.1
	Quoted	One-side	15.7	22.5
		Two-side	25.7	4.6
	Number of Bonds		7,684	1,444
			(%)	(%)
	Between 2 and 5 years	Not quoted	28.1	80.3
		Quoted	72.0	19.8
Quoted	One-side	25.4	17.0	
	Two-side	46.6	2.8	
Number of Bonds		8,638	1,954	
		(%)	(%)	
Greater than 5 years	Not quoted	42.3	92.9	
	Quoted	57.7	7.1	
Quoted	One-side	19.9	5.2	
	Two-side	37.8	2.0	

Source: DERA analysis

### Panel D.1: Maturity

			Distribution							
			Mean	5th percentile	10th percentile	25th percentile	Median	75th percentile	90th percentile	95th percentile
Maturity (in years)	Public TRACE-eligible bonds		11.7	1.5	2.0	5.1	9.5	15.2	30.4	30.5
	Not quoted		8.5	1.1	1.5	2.0	5.1	10.2	20.3	30.4
		Quoted	14.3	4.1	5.1	7.1	10.2	20.3	30.5	30.5
	Quoted	One-side	13.7	4.0	5.1	7.1	10.2	18.3	30.4	30.5
		Two-side	14.6	4.1	5.1	7.2	10.2	20.3	30.5	30.5
	Rule 144A TRACE-eligible bonds		11.8	3.0	4.1	5.1	8.3	12.2	30.4	30.5
	Not quoted		12.0	2.0	3.2	5.1	9.2	15.2	30.4	30.5
		Quoted	10.8	3.1	5.1	5.2	8.2	10.2	30.4	30.5
	Quoted	One-side	10.3	3.1	5.1	5.2	8.1	10.2	30.3	30.5
		Two-side	13.3	3.1	5.1	5.2	10.2	10.4	30.5	40.6

Source: DERA analysis

### Panel D.2: Maturity, the mean percentage of bonds with quotes by maturity

			Public TRACE-eligible bonds	Rule 144A TRACE-eligible bonds
Number of Bonds			6,883	551
			(%)	(%)
Less than 5 years	Not quoted		84.5	88.9
		Quoted	15.5	11.1
	Quoted	One-side	6.6	8.6
		Two-side	9.0	2.5
Number of Bonds			15,461	3,389
			(%)	(%)
Maturity (in years) Between 5 and 20 years	Not quoted		34.0	79.9
		Quoted	66.0	20.1
	Quoted	One-side	24.0	17.1
		Two-side	42.0	3.0
Number of Bonds			5,702	1,023
			(%)	(%)
Greater than 20 years	Not quoted		29.2	89.9
		Quoted	70.9	10.1
	Quoted	One-side	23.3	7.6
	Two-side	47.6	2.6	

Source: DERA analysis

### Panel E.1: Complexity

			Distribution							
			Mean	5th percentile	10th percentile	25th percentile	Median	75th percentile	90th percentile	95th percentile
Complexity	Public TRACE-eligible bonds		NM	0	0	0	0	1	1	1
	Not quoted		NM	0	0	0	0	1	1	1
	Quoted		NM	0	0	0	0	1	1	1
	Quoted	One-side	NM	0	0	0	0	1	1	1
		Two-side	NM	0	0	0	0	1	1	1
	Rule 144A TRACE-eligible bonds		NM	0	0	0	0	1	1	1
	Not quoted		NM	0	0	0	0	1	1	1
	Quoted		NM	0	0	0	0	0	0	1
	Quoted	One-side	NM	0	0	0	0	0	0	0
		Two-side	NM	0	0	0	0	0	1	1

NM: Not meaningful.

Note: The value 0 for the complexity variable indicates that a corporate bond issue has zero or one complexity feature and the value 1 for the complexity variable indicates that a corporate bond issue has two or more complexity features.

Source: DERA analysis

### Panel E.2: Complexity, the mean percentage of bonds with quotes by the number of complexity features

			Public TRACE-eligible bonds	Rule 144A TRACE-eligible bonds
Number of Bonds			20,326	3,746
			(%)	(%)
Complexity 0 or 1	Not quoted		39.6	78.5
	Quoted		60.4	21.5
Complexity	Quoted	One-side	18.0	17.9
		Two-side	42.4	3.6
Number of Bonds			7,739	1,261
			(%)	(%)
Complexity more than 1	Not quoted		60.7	95.9
	Quoted		39.3	4.1
Quoted	Quoted	One-side	23.7	2.7
		Two-side	15.6	1.4

Source: DERA analysis

**Table 4. Amount of pre-trade information for customer trades**

Table 4 reports the availability of pre-trade information for customer trades during the sample period, from August 1, 2014 to November 28, 2014, for public and Rule 144A corporate bonds broken out by the following bond characteristics: issue size, credit quality, age, maturity, and complexity. In determining the availability of pre-trade information, for each customer trade, we match a live dealer offer standing for at least thirty minutes with customer-buy trade, or a live dealer bid standing for at least thirty minutes with customer-sell trade.

			Distribution								
			Number of	Mean	5th	10th	25th	Median	75th	90th	95th
			Trades		percentile	percentile	percentile		percentile	percentile	percentile
Issue size (in \$million)	Public bonds	Without quote	80,415	377.3	1.7	3.6	22	250	500	1,000	1,250
		With quote	1,562,504	1,052.7	69	250	450	750	1,339	2,250	2,750
	Rule 144A bonds	Without quote	101,087	778.6	200	260	400	600	1,000	1,500	2,000
		With quote	35,573	1,127.2	300	360	500	800	1,384	2,250	3,000
Credit quality	Public bonds	Without quote	80,411	NM	HY	HY	HY	HY	IG	IG	IG
		With quote	1,562,493	NM	HY	HY	HY	IG	IG	IG	IG
	Rule 144A bonds	Without quote	101,087	NM	HY	HY	HY	HY	IG	IG	IG
		With quote	35,573	NM	HY	HY	HY	HY	IG	IG	IG
Age (in years)	Public bonds	Without quote	80,402	2.2	0.0	0.0	0.3	1.1	2.6	5.6	8.7
		With quote	1,562,474	3.8	0.2	0.4	1.3	2.7	4.8	8.1	11.4
	Rule 144A bonds	Without quote	101,087	1.4	0.0	0.0	0.2	0.8	2.0	3.7	4.6
		With quote	35,573	1.6	0.1	0.1	0.4	1.0	2.2	3.8	4.9
Maturity (in years)	Public bonds	Without quote	80,087	10.1	1.5	3.0	4.0	6.5	12.0	28.0	30.0
		With quote	1,561,278	12.1	4.4	5.0	6.6	10.0	10.2	30.0	30.1
	Rule 144A bonds	Without quote	100,051	8.6	3.5	5.0	5.0	7.1	10.0	10.2	29.8
		With quote	35,018	9.5	4.4	5.0	6.0	8.0	10.0	10.5	30.0
Complexity	Public bonds	Without quote	80,415	NM	0	0	0	0	1	1	1
		With quote	1,562,504	NM	0	0	0	0	0	0	1
	Rule 144A bonds	Without quote	101,087	NM	0	0	0	0	0	0	1
		With quote	35,573	NM	0	0	0	0	0	0	0

NM: Not meaningful.

Note: The value 0 for the complexity variable indicates that a corporate bond issue has zero or one complexity feature and the value 1 for the complexity variable indicates that a corporate bond issue has two or more complexity features.

Source: DERA analysis

**Table 5. Amount of prior trade price information (i.e., post-trade information) and pre-trade information for customer trades**

Table 5 reports the availability of pre-trade information for customer trades during the sample period, from August 1, 2014 to November 28, 2014, for public and Rule 144A corporate bonds broken out by the following bond characteristics: issue size, credit quality, age, maturity, and complexity. To assess the availability of prior trade price information (i.e., post-trade information), for each customer trade, we screen for any previous trade for the same bond at least thirty minutes prior to the trade. In determining the availability of pre-trade information, for each customer trade, we match a live dealer offer standing for at least thirty minutes with customer-buy trade, or a live dealer bid standing for at least thirty minutes with customer-sell trade.

**Panel A: Public Bonds**

	Pre-trade	Post-trade	Number of Trades	Mean	Distribution						
					5th percentile	10th percentile	25th percentile	Median	75th percentile	90th percentile	95th percentile
Issue size (in \$million)	Without quote	Without post-trade	26,541	312.0	1	3	13	250	450	750	1,000
		With post-trade	53,874	409.4	2	4	23	250	550	1,141	1,500
	With quote	Without post-trade	316,667	702.7	13	40	300	500	1,000	1,500	2,000
		With post-trade	1,245,837	1,141.6	175	300	500	900	1,500	2,500	3,000
Credit quality	Without quote	Without post-trade	26,539	NM	HY	HY	HY	HY	IG	IG	IG
		With post-trade	53,872	NM	HY	HY	HY	HY	IG	IG	IG
	With quote	Without post-trade	316,656	NM	HY	HY	IG	IG	IG	IG	IG
		With post-trade	1,245,837	NM	HY	HY	HY	IG	IG	IG	IG
Age (in years)	Without quote	Without post-trade	26,539	2.5	0.1	0.2	0.6	1.4	2.9	6.3	9.1
		With post-trade	53,863	2.1	0.0	0.0	0.2	1.0	2.4	5.1	8.5
	With quote	Without post-trade	316,649	4.2	0.3	0.6	1.5	3.0	5.5	9.2	12.8
		With post-trade	1,245,825	3.7	0.2	0.4	1.3	2.6	4.7	7.9	11.0
Maturity (in years)	Without quote	Without post-trade	26,520	9.5	1.5	2.0	3.8	6.0	10.1	29.0	30.0
		With post-trade	53,567	10.4	1.6	3.0	4.6	7.0	15.0	25.1	30.0
	With quote	Without post-trade	316,537	13.0	3.0	5.0	6.3	10.0	13.1	30.0	30.1
		With post-trade	1,244,741	11.8	4.8	5.0	6.6	10.0	10.1	30.0	30.1
Complexity	Without quote	Without post-trade	26,541	NM	0	0	0	0	1	1	1
		With post-trade	53,874	NM	0	0	0	0	1	1	1
	With quote	Without post-trade	316,667	NM	0	0	0	0	0	0	1
		With post-trade	1,245,837	NM	0	0	0	0	0	0	0

NM: Not meaningful.

## Panel B: Rule 144A Bonds

	Pre-trade	Post-trade	Number of Trades	Mean	Distribution						
					5th percentile	10th percentile	25th percentile	Median	75th percentile	90th percentile	95th percentile
Issue size (in \$million)	Without quote	Without post-trade	40,987	667.3	175	250	350	500	850	1,250	1,500
		With post-trade	60,100	854.5	225	300	439	700	1,000	1,600	2,250
	With quote	Without post-trade	12,485	884.5	250	325	500	750	1,000	1,600	2,000
		With post-trade	23,088	1,258.5	300	400	600	900	1,500	2,500	4,000
Credit quality	Without quote	Without post-trade	40,987	NM	HY	HY	HY	HY	IG	IG	IG
		With post-trade	60,100	NM	HY	HY	HY	HY	HY	IG	IG
	With quote	Without post-trade	12,485	NM	HY	HY	HY	HY	IG	IG	IG
		With post-trade	23,088	NM	HY	HY	HY	HY	IG	IG	IG
Age (in years)	Without quote	Without post-trade	40,987	1.8	0.1	0.2	0.4	1.2	2.6	4.1	5.0
		With post-trade	60,100	1.2	0.0	0.0	0.1	0.6	1.6	3.3	4.0
	With quote	Without post-trade	12,485	2.0	0.1	0.2	0.5	1.3	2.7	4.6	6.0
		With post-trade	23,088	1.4	0.0	0.1	0.3	0.8	2.0	3.4	4.3
Maturity (in years)	Without quote	Without post-trade	40,613	8.7	3.0	5.0	5.0	7.1	10.0	10.4	30.0
		With post-trade	59,438	8.5	5.0	5.0	5.1	7.1	10.0	10.2	20.0
	With quote	Without post-trade	12,275	9.7	3.0	5.0	5.1	8.0	10.0	10.6	30.0
		With post-trade	22,743	9.4	5.0	5.0	6.2	8.1	10.0	10.5	30.0
Complexity	Without quote	Without post-trade	40,987	NM	0	0	0	0	0	0	1
		With post-trade	60,100	NM	0	0	0	0	0	0	1
	With quote	Without post-trade	12,485	NM	0	0	0	0	0	0	0
		With post-trade	23,088	NM	0	0	0	0	0	0	0

NM: Not meaningful.

Source: DERA analysis

**Table 6. Dealer size and dealers' quoting propensity**

Table 6 presents how dealer size is related to dealers' quoting propensity on ATs on a given day. We divide dealers into four quartiles for each measure of dealer size, total par volume traded and the number of bond issues traded, and assess how the propensity that a dealer provides quotes differs across the four groups. Conditional on a dealer trading on a bond during the sample period and the prior one year, for each day and each MPID, we identify all bonds that have at least one trade during the sample period and assign an indicator equal to 1 if a dealer provides at least one quote per day.

Dealer size	Number of observations (MPIDs)	Mean propensity	
		Public bonds	Rule 144A bonds
Total par volume			
Top 25%	276	0.31	0.16
2nd quartile	276	0.12	0.01
3rd quartile	276	0.01	0.00
Bottom 25%	277	0.00	0.00
Number of issues (CUSIPs)			
Top 25%	276	0.37	0.17
2nd quartile	276	0.05	0.01
3rd quartile	267	0.02	0.00
Bottom 25%	286	0.00	0.00

Source: DERA analysis

**Table 7. Number of bond issues quoted by a dealer per day**

Table 7 reports the distribution for number of bond issues that each dealer quotes per day, when there is at least one issue quote on a given day. For Table 7, we only include bond issues that have quote on a given day.

		Distribution							
		Mean	5th percentile	10th percentile	25th percentile	Median	75th percentile	90th percentile	95th percentile
Bid or offer	Public bonds	653.1	1	1	5	78	528	2,077	2,948
	Rule 144A bonds	22.6	1	1	2	8	23	45	62
Bid	Public bonds	728.1	1	1	8	135	646	2,030	3,190
	Rule 144A bonds	9.4	1	1	1	4	13	23	34
Offer	Public bonds	329.7	1	1	7	47	317	793	1,479
	Rule 144A bonds	20.7	1	1	2	6	19	34	46

Source: DERA analysis

**Table 8. Number of dealers providing quotes per quoted bond issue**

Table 8 presents the distribution for the number of dealers quoting each bond issue on a given day. For Table 8, we only include bond issues that have quote on a given day.

		Distribution							
		Mean	5th percentile	10th percentile	25th percentile	Median	75th percentile	90th percentile	95th percentile
Bid or offer	Public bonds	6.4	1	2	3	6	9	12	14
	Rule 144A bonds	1.4	1	1	1	1	2	2	3
Bid	Public bonds	7.3	2	3	5	7	9	12	14
	Rule 144A bonds	0.6	0	0	0	0	1	2	2
Offer	Public bonds	6.1	0	1	3	5	9	12	15
	Rule 144A bonds	1.4	0	1	1	1	2	3	3

Source: DERA analysis

**Table 9. Number of dealers providing two-sided quotes by trading activity**

Table 9 presents the distribution for the number of dealers providing two-sided quotes for each group of bond issues (by trading activity) on a given day. We divide bond issues into five groups based on the total number of trades over the sample period. Group 1 includes the top 20% of actively traded bonds during the sample period.

			Distribution							
			Mean	5th percentile	10th percentile	25th percentile	Median	75th percentile	90th percentile	95th percentile
Top 20%	1	Public bonds	9.5	1	4	7	9	12	16	18
		Rule 144A bonds	1.1	0	0	0	1	2	2	3
	2	Public bonds	6.0	0	2	4	6	8	10	11
		Rule 144A bonds	0.9	0	0	0	1	1	2	3
	3	Public bonds	3.9	0	1	2	4	6	7	8
		Rule 144A bonds	0.8	0	0	0	1	1	2	2
4	Public bonds	2.5	0	0	1	2	4	5	6	
	Rule 144A bonds	0.7	0	0	0	1	1	2	2	
Bottom 20%	5	Public bonds	1.4	0	0	0	1	2	3	4
		Rule 144A bonds	0.6	0	0	0	1	1	1	2

Source: DERA analysis

## Appendix A: TRACE dataset sample construction

Our TRACE dataset is created from the regulatory version of TRACE, over the period of August 1 to November 28, 2014. This dataset is then merged with bond characteristics from the Mergent Fixed Income Securities Database (FISD). The FISD database includes issuance date, issue size, original maturity date, and instrument complexity features (i.e., variable rate, non-standard interest payment frequencies, pay-in-kind, redeemable, convertible, unconventional day count basis for accrued interests, and sinking fund).

We then remove observations from the trade report based on the following criteria:

- trade reports that were subsequently corrected or canceled.
- duplicate interdealer trade reports.
- primary market corporate bond trades (“P1” trades).
- trade reports that are missing any of the following information: the security identifier (CUSIP), executing dealer identifier, contra-party identifier, buy or sell indicator, dealer capacity code, trade execution date, trade execution time, price, and par volume.
- trade reports with zero or negative price.
- trade reports with zero, negative, or non-integer par volume.
- trades executed on holidays and weekends.
- bonds that are not covered by the FISD database and bonds with missing issue size in the FISD database.
- trade reports for which the trade execution date is prior to the issuance date of the bond.
- trade reports for which the trade execution date falls after the original maturity date of the bond.
- trade reports with par volume greater than one-half of its issue size.