

Table 5. RFQ Quantities and Trade-to-Quote Ratio

RFQ Quantity	Number of RFQs	Percent of Total RFQs	Number of Trades	Trade-to-Quote Ratio
5	85,332	12.2%	16,357	19.2%
10	113,171	16.2%	28,896	25.5%
15	59,399	8.5%	15,508	26.1%
20	58,057	8.3%	16,375	28.2%
25	92,377	13.2%	26,855	29.1%
30	30,163	4.3%	8,442	28.0%
35	16,804	2.4%	4,675	27.8%
40	18,806	2.7%	5,257	28.0%
45	9,943	1.4%	2,512	25.2%
50	7,350	1.0%	1,670	24.7%
55	5,010	0.7%	1,472	24.3%
60	4,985	0.7%	1,819	24.8%
65	4,000	0.6%	1,217	22.9%
70	4,000	0.6%	1,213	22.9%
75	3,998	0.6%	2,764	22.9%
80	2,085	0.3%	219	708
85	2,085	0.3%	744	473
90	35,572	50.0%	89,374	161,280
95	626,789	89.1%	17	17
100	697,844	100.0%		
Total for Above RFQ Quantities	621,977			
All RFQs				
All RFQs with Responses				

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Further, when an RFQ received more responses, it became more likely to receive a trade. When examining the trade-to-quote ratios by the number of responses, the authors of this report found that 89.1 percent of the time an RFQ received only one response, 20.9 percent of the time an RFQ received two responses, 17.1 percent of the time an RFQ received three responses, 11.1 percent of the time an RFQ received four responses, 7.0 percent of the time an RFQ received five responses, 4.7 percent of the time an RFQ received six responses, 3.1 percent of the time an RFQ received seven responses, 2.1 percent of the time an RFQ received eight responses, 1.4 percent of the time an RFQ received nine responses, 0.9 percent of the time an RFQ received ten responses, 0.6 percent of the time an RFQ received eleven responses, 0.4 percent of the time an RFQ received twelve responses, 0.3 percent of the time an RFQ received thirteen responses, 0.2 percent of the time an RFQ received fourteen responses, 0.1 percent of the time an RFQ received fifteen responses, 0.1 percent of the time an RFQ received sixteen responses, 0.1 percent of the time an RFQ received seventeen responses, 0.1 percent of the time an RFQ received eighteen responses, 0.1 percent of the time an RFQ received nineteen responses, and 0.1 percent of the time an RFQ received twenty responses.

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Abstract¹

With the recent focus on potentially improving municipal market transparency through increased public availability of pre-trade pricing information, the Municipal Securities Rulemaking Board (MSRB) obtained quote data from two alternative trading systems (ATSs) with significant presence in the municipal securities market and conducted an in-depth analysis of the data for the period from February 1, 2015–May 31, 2015.² The MSRB currently publishes certain pre-trade information to the public, such as yield curves, municipal market indices and new issue pricing scales, in addition to collecting and disseminating post-trade data. For the purposes of this report, pre-trade information refers to the indication of size and price of prospective trading interest in specific securities. The access to this type of pre-trade pricing information is limited to market professionals, and some information may be further limited to market professionals involved in some of those potential transactions. This analysis of quote data indicates that live posted quote information could be useful pre-trade data for price discovery purposes. For Request-for-Quote (RFQ) data, it is possible that public disclosure of responses to RFQs may still add value to the price discovery process even if the RFQ process does not result in a trade execution. Public disclosure of RFQ responses could lead to potential benefits for pricing efficiency, investor confidence and market liquidity in the municipal market. Additional research in this area, particularly with more recent data, is needed to arrive at a definitive conclusion about the value of pre-trade data.

The authors welcome feedback and suggestions on this report, as well as recommendations on additional data and analysis that could be helpful to municipal market stakeholders. Please contact Simon Wu, MSRB Chief Economist, at swu@msrb.org or 202-838-1500.

¹ The views expressed in this research paper are those of the author(s) and do not necessarily reflect the views and positions of the Board of Directors of the MSRB.

² ATSs are sometimes referred to as electronic platforms or electronic venues.

Background on the Municipal Bond Market

The U.S. municipal bond market is the predominant source of capital for municipal entities. Both the public purpose and size of the municipal securities market underscore its importance in the U.S. economy. In addition to financing critical government projects and operations, municipal securities are used by state and local governments to meet a wide variety of other public needs, including transportation, infrastructure, economic development, and educational and healthcare facilities, among others. Issuers of municipal securities include towns, cities, counties and states, as well as state and local government agencies and entities with authority to issue debt. There are estimated to be over 50,000 issuers of municipal securities.³ At the end of the second quarter of 2018, the outstanding principal value of municipal securities was estimated to be \$3.85 trillion.⁴

The municipal bond market also provides investment and trading opportunities for investors—both retail and institutional—and other market participants. By purchasing municipal bonds, investors are, in effect, lending money to a bond issuer in exchange for a promise of interest payments—usually semi-annually—and the return of the original investment, or “principal.”⁵ The return of principal occurs on a pre-specified maturity date or on a call date, or the date on which the issuer repays the bond before its stated maturity date. Generally, the interest on municipal bonds is exempt from federal income tax and may also be exempt from state and local taxes depending on investors’ state of residency.⁶ Other market participants, such as brokers, dealers and municipal securities dealers (collectively, “dealers”), including algorithmic and proprietary-trading firms, seek trading profits by making a market for municipal bonds and charging a spread (the difference between an ask and a bid for a security) or a commission on trades with investors or other market participants.

The MSRB, which is a self-regulatory organization (SRO) created by Congress in 1975, has collected and disseminated post-trade municipal securities data since 1995 through the Real-Time Transaction Reporting System (RTRS) and its predecessor, the Transaction Reporting System (TRS). In addition, the MSRB provides certain pre-trade information to the public, such as yield curves, municipal market indices and new issue pricing scales on its Electronic Municipal Market Access (EMMA[®]) website. The MSRB neither collects nor disseminates other pre-trade information, such as quote data about the price and size of quotes for municipal bonds signaling trading interests available on electronic or proprietary systems. Potentially, this pre-trade information could provide securities regulators, investors and all other market participants with important information currently only accessible to select market participants. Thus, this information could improve pricing efficiency, investor confidence and market liquidity in the municipal market.

³ Securities Industry and Financial Markets Association (SIFMA), “2017 Fact Book,” August 25, 2017. This compares to the public corporate securities market, which has approximately 5,500 issuers who have issued approximately 50,000 individual securities.

⁴ Board of Governors of the Federal Reserve System, “Financial Accounts of the United States,” Table L-212, Federal Reserve Bank, September 20, 2018.

⁵ Bond investors typically seek a steady stream of income payments and tend to be more risk-averse and more focused on preserving, rather than increasing, wealth.

⁶ Given the tax benefits, the interest rate for municipal bonds is usually lower than on comparable taxable fixed income securities, such as corporate bonds and even some Treasury securities.

In 2018, the U.S. Securities and Exchange Commission (SEC) and its Fixed Income Market Structure Advisory Committee (FIMSAC) have been focused on pre-trade price information on municipal bonds, and in July 2018 the SEC's Division of Economic and Risk Analysis (DERA) published a study on municipal bond trading and quotes on ATS platforms. The SEC study primarily addressed transaction costs for customer and inter-dealer trades using the ATS quote data as a benchmark. The MSRB staff authors sought to assess the quality of the live posted quote and RFQ data collected from two ATSs prominent in municipal bond trading to determine whether quote information on ATSs is useful for price discovery purposes and may provide value for investors and market participants. The report provides an in-depth analysis of the ATS quote data and RTRS trade data for the period from February 1, 2015–May 31, 2015.

Municipal Bond Market Structure

In general, municipal securities investors tend to be “buy and hold” investors. Trading patterns for municipal securities typically involve relatively frequent trading during the initial period after issuance, followed by infrequent or sporadic trading activity during the remaining life of the security. Of the one million outstanding municipal securities, approximately one percent of those bonds trade on a given day.⁷ Aggregate daily trading activity from 2010–2017 averaged nearly 39,000 transactions each business day, resulting in an average total par value of about \$11 billion traded per day.

The municipal bond market largely functions as an over-the-counter (OTC) market, where investors place their orders with dealers directly. Dealers either execute the orders by committing dealer capital (in the case of principal trades) or by searching for a counterparty in the market to facilitate the transactions (known as riskless principal trades or agency trades), with the dealers charging a mark-up, commission or management account fee to the investors.

The municipal securities market is highly fragmented due to, among other reasons, its size, number of issuers, low trading volume for a typical municipal bond and lack of centralized exchanges. In contrast to other securities markets, the relatively illiquid nature of the municipal market under certain circumstances and the mostly buy-and-hold investor positions make the ability to locate a counterparty to trade municipal securities more difficult. Furthermore, market participants cannot cost-effectively short municipal securities for various reasons, including tax implications under Internal Revenue Service (IRS) rules and the difficulty of locating municipal bonds for borrowing.⁸ Therefore, any type of shorting strategy to arbitrage or hedge certain risks in the municipal market is very difficult or can incur significant costs to market participants.

⁷ MSRB, “2017 Fact Book,” February 27, 2018.

⁸ See Internal Revenue Code, U.S. Code Section 6045(d). Most municipal securities are exempt from federal income tax and in some cases, state and local income tax. However, the IRS does not allow both a borrower and lender of a municipal security to claim a tax exemption; as a result, short positioning of municipal securities is rare because the lender of a municipal security would be trading tax exempt interest for taxable interest. See also FINRA Regulatory Notice 15-27, July 2015.

Electronic Trading Venues

The advent of electronic trading venues in the fixed income markets has changed the trading landscape in recent years. The two main functions of an electronic trading venue, such as an ATS, and some broker's brokers are: 1) posting (live quotes) and soliciting price quotes (request for quotes) electronically and 2) electronic execution of a trade in response to posted quotes. Electronic trading may facilitate the management of dealer inventory and reduce counterparty search costs.⁹

An ATS is an electronic trading system that is not regulated as an exchange but is instead a venue for matching the buy and sell orders of its participants. Most ATSs are regulated as broker-dealers under the Securities Exchange Act of 1934 ("Exchange Act"), as well as Regulation ATS adopted by the SEC in 1998. Regulation ATS was designed to protect investors. Regulation ATS requires stricter recordkeeping and more intensive reporting when an ATS reaches more than five percent of the trading volume of any given security.¹⁰

ATSs offer anonymity to participants that post quotes on their systems. As a result, market participants such as dealers, proprietary trading firms and institutional investors often prefer using an ATS to find counterparties for trading without disclosing their trading position to the broader market.

Traditionally, broker's brokers perform similar functions to those provided by the modern-day ATS, such as aggregating liquidity and acting as agent or riskless principal in the purchase or sale of securities for dealers, institutions and other sophisticated market participants. A broker's broker acts in a limited capacity when providing anonymity, information flow, liquidity, transparency and order matching, and is compensated by a transaction commission or a mark-up. The business model has also evolved from a pure voice brokerage (i.e., via the usage of a telephone) historically to a hybrid usage of telephone negotiation and electronic systems.¹¹

Pre-Trade Information

Regardless of the method of searching for liquidity and counterparties for trading, most electronic platforms do not share the pre-trade information (bids and offers of a security) with the broader market; this information is available only to ATS participants, predominantly financial professionals who are engaging directly with such venues. Financial economists, regulators and policymakers have shown a keen interest in learning whether the currently non-publicly available pre-trade information has implications for the broader market's price discovery process.

Pre-trade information broadly includes quote data (bid-side and offer-side) signaling trading interests available on electronic platforms, new issue pricing scales, yield curves and indices, evaluated prices and other material disclosure information. For purposes of this report, pre-trade information specifically refers to the indication of size and price of prospective trading interest in specific securities. This includes firm quotes of a specified size—that is, a commitment to buy or sell a specific quantity of a municipal security at a stated price. There is currently no central repository in the municipal securities market and other fixed income

⁹ Staff of the DERA of the SEC, "Report to Congress: Access to Capital and Market Liquidity," Page 178, August 2017.

¹⁰ These requirements are provided in Exchange Act Rule 301(b)(5)(ii) of Regulation ATS.

¹¹ SIFMA, "The Role of Municipal Securities Broker's Brokers in the Municipal Markets," 2017.

markets through which such pricing information is made broadly available to the public in a comprehensive manner (i.e., no national best bid and offer indicators as in the equity securities market). To the extent that pre-trade pricing information is available, it typically is provided by electronic networks operated by broker's brokers, ATs and other similar systems, and occasionally through non-electronic venues. Not only is the access to pre-trade pricing information limited to ATS participants, information may be further limited to a few market participants involved in some of those potential transactions. The level of information disseminated is limited depending on each market participant's willingness to share the information on some or all the bids and offers entered for a potential transaction.¹²

Recent Regulatory Developments in Pre-Trade Disclosure

In January 2012, the MSRB published a *Long-Range Plan for Market Transparency Products*, which highlighted the absence of widespread pre-trade transparency.¹³ The MSRB envisioned a new real-time central transparency platform (CTP) that would, over time, evolve to become a centralized venue that provides universal public access to pre-trade, concurrent/real-time and post-trade pricing information across the municipal market accumulated from primary market pricing and secondary market trade submission information required to be submitted under MSRB rules, as well as live and historical bid-offer and related pre-trade information provided voluntarily by private sector CTP participants.

Around the same time in 2012, a Government Accountability Office (GAO) report found, among other things, that the lack of access to pre-trade pricing information in the form of bids and offers for municipal securities was a key barrier for individual investors to independently assess the quality of bids and offers they received from their dealers.¹⁴ Separately, in July 2012, the SEC published a report recommending enhancements to the flow of information to municipal securities investors.¹⁵ The report noted that investors had very limited access to the level of interest in a particular municipal security and specific price levels. Furthermore, the report suggested that bids and offers are generally not made publicly available by ATs, broker's brokers or dealers that use their facilities, even though these electronic trading systems are primarily used for smaller, retail-size orders.

In light of the 2012 GAO and SEC reports, the MSRB in July 2013 published a concept release seeking input from market participants and stakeholders with regard to the potential benefits and burdens of providing pre-trade pricing information on a voluntary basis to be disseminated to the public through the MSRB's EMMA website.¹⁶ This concept release also sought input on the appropriate method and technology that could be used by the MSRB in collecting such information to support a broad array of data types in a manner that is most efficient for the MSRB, as well as for market participants that may have a role in the submission or dissemination of such data.

¹² For example, responses to RFQs are visible only to market participants who respond to RFQs. Also, market participants who post live quotes have an option to prohibit certain subscribers from viewing their quotes.

¹³ MSRB, "Long-Range Plan for Market Transparency Products," January 27, 2012.

¹⁴ GAO, "Municipal Securities: Overview of Market Structure, Pricing, and Regulation," GAO-12-265, January 17, 2012.

¹⁵ SEC, "Report on the Municipal Securities Market," July 31, 2012.

¹⁶ MSRB Notice 2013-14, "Concept Release on Pre-Trade and Post-Trade Pricing Data Dissemination Through a New Central Transparency Platform," July 31, 2013.

The MSRB received numerous comments in response to its concept release that reflected differing opinions. For example, some commenters stated that pre-trade information is essential to closing the information gap between dealers and retail investors and should be made available immediately to help investors and inform valuation models. Several commenters believed that dealers should not be required to provide this information for a number of reasons, including that some data points may be confusing and data-quality issues could make the information difficult to process; the information may not be valid or useful if no trade actually occurs; dealers' trading strategies may be compromised; there could be negative impact on liquidity; and it could be difficult to implement and would be a significant cost to the municipal securities industry.

Existing Literature

An emerging body of financial economic research literature is devoted to recent changes in the municipal bond market, as well as in other fixed income securities markets such as corporate bonds and Treasury securities, particularly related to the impact of disclosure and transparency on market liquidity. In addition, some recent literature also focuses on electronic trading of fixed income securities, including studies that assessed the impact of bond quote data on trading costs. Generally, these studies found that electronic trading has had a positive impact on transparency, including reduced transaction costs. This section summarizes the relevant literature. It should be noted that the authors of this MSRB report neither endorse nor reject the conclusions or the views expressed in these research papers.

Municipal Bond Pre-Trade Transparency and Electronic Trading

There have been few studies conducted on the potential implications of pre-trade transparency in the municipal bond market, mainly because widely available pre-trade data are nearly non-existent to academic and industry researchers. Price quotes in the municipal bond market are available only to select market participants, and even the largest market participants have a limited view of pre-trade data. Researchers and policymakers have increasingly shown an interest in the potential impact of providing pre-trade transparency to the entire municipal securities market.

Davies and Sirri (2017) summarized recent academic literature, finding that trading costs in the corporate and municipal bond markets far exceed those in equity securities markets.¹⁷ They mentioned several fundamental factors that contribute to the high cost of trading in fixed income instruments, including: 1) the large number of separate offerings particularly for the municipal bond market, with the odds of a buyer and a seller having coincidental interest to transact being low; 2) the difficulty of two investors finding each other, even if they have simultaneous demand for the trade, unless they are customers of the same dealer; and 3) the information environment for municipal securities is very different than it is for publicly traded equity securities. The authors encouraged regulators to continue the trend of the last decade in improving the structure of the fixed income markets and the quality of information surrounding them.

As mentioned previously, DERA published a white paper in July 2018 on municipal bond trading and quoting on four ATS platforms for the period of August 2014–November 2014. The paper combined live offer quotes with response to bid-wanted requests and formed a “two-sided” quote to evaluate market trade prices relative to the quotes on the four ATSs. This report found the majority of customer trades were executed at worse prices than the best available dealer quotes on the platforms, which the paper stated might indicate a lack of knowledge of existing quotes.¹⁸ The SEC paper concluded that these facts highlight the relative dearth of accessible pre-trade information in the municipal bond market.

Finally, in addition to the literature cited above, in May 2015, the Financial Economists Roundtable released a statement on the structure of trading in bond markets in which member financial economists recommended pre-trade transparency for corporate and

¹⁷ Ryan Davies and Erik R. Sirri, “The Economics and Regulation of Secondary Trading Markets,” March 16, 2017.

¹⁸ This is likely because of the dealer mark-up built into the trade prices to compensate dealers (and financial advisors, if applicable).

municipal bonds by urging the SEC, the Financial Industry Regulatory Authority, Inc. (FINRA) and the MSRB to require broker-dealers to post customer limit orders in an actionable electronically accessible order display facility.¹⁹ The economists believe this recommendation would substantially increase liquidity in fixed income markets.

Municipal Bond Post-Trade Transparency

Compared to the handful of empirical studies addressing pre-trade transparency, there is substantial research on information disclosure, post-trade transparency and the impact on municipal securities market liquidity in the last decade. These research papers generally agree that post-trade transparency and other information disclosure initiatives in the municipal bond market have had a positive effect on reduced investor transaction costs.

Sirri (2014) studied the manner by which municipal bond dealers act as intermediaries for trades between customers and showed that the transition in January 2005 from next-day trade disclosure under transaction reporting system (TRS) to real-time transparency under RTRS reduced average customer trading costs, in spite of the significant dislocations to the market resulting from the financial crisis in the late 2000s.²⁰ He also found that the effects of implementation of RTRS were not immediate, but took time to be realized over the course of several years.

Chalmers, Liu and Wang (2017) confirmed what Sirri (2014) found and showed that both large and small municipal bond trades benefit from a significant reduction in overall trading costs and intra-day price dispersion.²¹ They concluded that timelier post-trade disclosure has reduced transaction costs in the secondary market for municipal bonds.

Finally, Wu (2018) measured the decline in transaction costs for municipal bond customer trades from January 2005–April 2018 and explored the likely factors that may explain the drastic decline in transaction costs.²² The paper concluded that market-wide technology advancements and recent transparency initiatives were likely important contributors to the narrowing of effective spread.

Other Fixed Income Securities' Pre-Trade Transparency and Electronic Trading

There is also abundant literature covering the issue of price transparency in other fixed income securities, such as corporate bonds and Treasury securities. The findings from several research papers are summarized below and focus on the impacts of pre-trade and post-trade transparency, as well as the recent development of electronic trading on price discovery and transaction costs.

¹⁹ Financial Economists Roundtable, "Statement on the Structure of Trading in Bond Markets," May 11, 2015.

²⁰ Erik R. Sirri, "Report on Secondary Market Trading in the Municipal Securities Market," Research Paper Commissioned by the Municipal Securities Rulemaking Board, July 2014.

²¹ John Chalmers, Yu Liu and Z. Jay Wang, "The Difference a Day Makes: Timely Disclosure and Trading Efficiency in the Muni Market," Working Paper, September 2017.

²² Simon Z. Wu, "Transaction Costs for Customer Trades in the Municipal Bond Market: What is Driving the Decline?" MSRB, July 2018.

A 2015 study by Harris of the University of Southern California found that information asymmetry inflated transaction costs in the corporate bond market.²³ Harris suggested that a lack of pre-trade information causes trade-throughs to occur more frequently, where a trade execution is carried out at a suboptimal price even though a more favorable price was available in the market. He asserts that equity securities markets are more efficient, primarily because of the dissemination of the national best bid and offer (NBBO) and calls for an equivalent facility in the bond markets.²⁴

A paper by Hendershott and Madhavan (2015) examined the impact of electronification on the OTC financial markets.²⁵ Using corporate bond data, they demonstrate that electronic trading typically results in lower one-way transaction costs. Their findings suggest that the benefits of electronification are greater for liquid securities, which will generate more responses on an electronic platform.

Mizrach (2015) explored liquidity provisions in the corporate bond market using a variety of metrics.²⁶ In particular, the paper relied on survey data from Greenwich Associates to show that electronic platforms played an important role in facilitating trading of corporate bonds, with an estimate of 80 percent usage of electronic platforms for investment grade bonds and 43 percent for high-yield bonds in 2014. However, most of these electronic platforms did not provide direct access to corporate bond investors; therefore, the market share of electronic trading volume was still very low as of 2014.

Leveraging data from two Treasury securities trading platforms with differing levels of pre-trade information, Dunne, Li and Sun (2015) examined the impact of additional pre-trade information on price discovery in the Treasury securities market.²⁷ Their findings imply that additional information does equate to improved price discovery, though price discovery does not derive equally from the two platforms. Rather, they find that more price discovery occurs on the more active, but less transparent, platforms.

In their study of corporate bonds, Bessembinder, Jacobsen, Maxwell and Venkataraman (2017) documented that both banks and non-bank dealers reduced capital commitment as a percentage of volume traded in the portion of the market where electronically facilitated trades are most likely to occur.²⁸ These results support the interpretation that electronic venues have reduced liquidity search costs and the need for dealer intermediation services in some segments of the corporate bond market, despite the fact that electronically facilitated trading still represents a relatively small share of the overall market in corporate bonds.

²³ Lawrence Harris, "Transaction Costs, Trade Throughs, and Riskless Principal Trading in Corporate Bond Markets," October 24, 2015.

²⁴ SEC Regulation National Market System (Regulation NMS).

²⁵ Terrance Hendershott and Ananth Madhavan, "Click or Call? Auction versus Search in the Over-the-Counter Market," *The Journal of Finance*, February 2015.

²⁶ Bruce Mizrach, "Analysis of Corporate Bond Liquidity," FINRA Office of the Chief Economist, 2015.

²⁷ Peter G. Dunne, Youwei Li and Zhuowei Sun, "Price Discovery in the Dual-Platform US Treasury Market," *Global Finance Journal*, 28, 95-110. October 2015.

²⁸ Hendrik Bessembinder, Stacey Jacobsen, William F. Maxwell and Kumar Venkataraman, "Capital Commitment and Illiquidity in Corporate Bonds," *The Journal of Finance*, Forthcoming.

The SEC's August 2017 study on capital markets and liquidity specifically addressed pre-trade transparency and electronic trading in the corporate bond market for the period from August 2014–November 2014.²⁹ The SEC staff found that ATS trades were small in size. In addition, ATS quote activity was concentrated in bond issues with larger issue size, investment grade, longer original maturity and less complex features. Finally, when comparing pre-trade price quote information with customer trades, over 90 percent of customer trades had a quoted price on at least one of the ATSs at the time of a trade execution.

²⁹ Staff of the DERA of the SEC, "Report to Congress: Access to Capital and Market Liquidity," August 2017.

Pre-Trade Analysis Data and Methodology

The MSRB obtained data for a four-month period from February 2015–May 2015 (“relevant period”) from two ATS platforms³⁰ with significant presence in the municipal securities market and conducted an analysis of these data.³¹ Both platforms voluntarily provided the MSRB with pre-trade and post-trade data, including RFQ (bids and offers wanted), live quote and associated transaction data. The RFQ data include quantity and price information for each RFQ, RFQ responses and associated trades, if any, with nearly 700,000 requests and 2.6 million responses. The live quote data contain bidding and offering amount, bidding and offering price, and bidding and offering yield information, with about 8.1 million quote updates from the two platforms.³²

Initially, this report sought to assess live quote and RFQ data as a first step toward determining whether quote information could be useful for price discovery purposes and may have value for market participants. An in-depth analysis was then performed on the ATS quote data and RTRS trade data. For the purposes of this research report, only secondary market trades in municipal bonds are included in the analysis.³³

It is important to note that pre-trade data could also be available from other ATSs, broker’s brokers, dealers and third-party vendors. Dealers may have multiple offerings for an individual bond depending on where the quote will be shown (i.e., an offer quote on an ATS versus an offer quote to a client). The MSRB requested ATS data from two specific ATSs because of the significant amount of retail-sized trades on those platforms, their prominent market shares at the time, and their ability and willingness to voluntarily deliver a large amount of data quickly and efficiently.

There are several data and methodology differences between this report and the July 2018 SEC white paper on municipal bond trading and quotes on ATSs. The SEC paper:

- analyzed four ATSs’ data for the period from August 2014–November 2014, while this report utilizes two ATSs’ data covering the period from February 2015–May 2015;
- included all trades disseminated via RTRS, while this report excludes primary market offering trades disseminated via RTRS;
- combined live offer quotes and requests for bids and focused on trades when there was at least one live offer quote and at least one response quote to a bid-wanted request contemporaneously. For purposes of this report, the live quotes and responses to bid-wanted requests are treated separately due to the difference between the two processes;
- measured transaction costs for customer and inter-dealer trades using the ATS quote data as a benchmark, while this report focuses on price discovery and the potential usefulness of ATS quotes as pre-trade information.

³⁰ For confidentiality purposes, this report does not reveal the name of an ATS when describing detailed results. In addition, the MSRB removed redundant quotes from the same firm in the same bond.

³¹ The SEC also obtained similar municipal bond ATS data from August 2014–November 2014, while the SEC and FINRA separately obtained corporate bond ATS data from August 2014–November 2014. See Staff of the DERA of the SEC, “Report to Congress: Access to Capital and Market Liquidity,” pages 178–190, August 2017.

³² Duplicate quotes for each dealer across both platforms were removed for this analysis based on CUSIPs, date and general timeframe of the quotes.

³³ In addition to excluding primary offering trades, a few trades with erroneous information were also removed from the analysis, including securities with a maturity date before a trade date, or an issuance date before a trade date.

Report Findings

This report first summarizes the overall picture of inter-dealer and ATS trading in municipal securities from 2015–2018 and then presents the analyses for RFQs and live quotes.

Market Share of Inter-Dealer and ATS Trades

This report compares the market share of different trade types for the relevant period to the period of January 2018–June 2018 to gauge whether the market share has changed significantly. Table 1 presents types of trades by market share and par value for customer buy, customer sell and inter-dealer trades. The percentage breakdown between customer buy, customer sell and inter-dealer trades, whether by trade type or by par value, does not differ substantially when comparing the two periods measured.

Table 1. Percent of Total Market Trades Comparison

	Most Recent Period 1/2018–6/2018		Relevant Period 2/2015–5/2015	
	Trades	Par Value	Trades	Par Value
Customer Buy	37.3%	43.1%	39.8%	40.9%
Customer Sell	23.8%	37.6%	22.2%	33.3%
Inter-Dealer	38.9%	19.3%	37.9%	25.8%

Table 2 on page 14 shows the percentage of inter-dealer trades executed via an ATS from August 2016–June 2018. About 60 percent of inter-dealer trades were executed on ATSs during each month in 2017 and the first half of 2018, while the percentage by par value was approximately 30 percent. Both percentages are slightly higher than those in late 2016. Table 2 therefore confirms that ATS participation in the overall inter-dealer market has remained significant and steady throughout 2017 and 2018.³⁴

³⁴ In November 2017, the MSRB produced a fact sheet summarizing inter-dealer ATS activity. See MSRB, “Inter-Dealer Municipal Trading,” November 9, 2017. Prior to July 2016, the MSRB did not receive an indicator via the RTRS data for transactions conducted on an ATS, so the MSRB was not able to perform an assessment of the market share of ATS trades for the relevant period.

Table 2. Market Share of ATS Trades Among Inter-Dealer Transactions

Month	Trades	Par Value	Month	Trades	Par Value
Aug-16	56.0%	27.0%	Aug-17	60.4%	32.7%
Sep-16	57.2%	28.2%	Sep-17	60.0%	33.6%
Oct-16	57.7%	24.9%	Oct-17	59.6%	32.7%
Nov-16	58.0%	28.0%	Nov-17	59.8%	32.1%
Dec-16	59.0%	27.2%	Dec-17	58.9%	29.2%
Jan-17	59.9%	29.5%	Jan-18	59.3%	29.7%
Feb-17	60.0%	32.3%	Feb-18	59.4%	30.5%
Mar-17	59.5%	31.7%	Mar-18	58.2%	28.9%
Apr-17	59.7%	30.1%	Apr-18	59.2%	29.1%
May-17	60.9%	32.3%	May-18	59.5%	28.5%
Jun-17	60.7%	33.6%	Jun-18	58.8%	29.3%
Jul-17	61.1%	32.5%			

In terms of bond characteristics, municipal bonds quoted on the two ATS platforms, whether via RFQs or live quotes, had substantially higher principal amounts at issuance than an average municipal bond.³⁵

Table 3 shows that the average issuance size of municipal bonds quoted on the two ATS platforms, whether via the RFQ process or the live offer quote provision, were larger than the average issue size for all municipal bonds during the relevant period.

Table 3. Issue Size of Bonds Quoted on ATS Platforms (2015)³⁶

Median Issue Size for Bonds with RFQs	Median Issue Size for Bonds with Live Offer Quotes	Average Issue Size for All Tax-Exempt Municipal Bonds
\$45,000,000	\$40,800,000	\$25,800,000

This analysis shows the median maturity length is 14 years for bonds sought via RFQs and 12 years for bonds offered via live quotes.

Request-for-Quote Data

Most of the RFQ data from the two ATSs are bids-wanted with only 0.3 percent of the data representing offers-wanted. There was a total of approximately 697,800 RFQs (see Table 4 on page 15) in the relevant period, with an average of about 8,400 RFQs per trading day across the two platforms.³⁷ By comparison, there were over 2.7 million total responses to

³⁵ Issue size refers to the total amount of a bond offering in an issuance, which includes securities with all maturity dates.

³⁶ The issue size for all municipal bonds is provided by Barclays Municipal Index as of September 2016. Bernhard H. Fischer, "Taxable U.S. Municipal Bonds Make Sense for Non-U.S. Investors," Exhibit 6, *Principal Global Fixed Income*, October 18, 2016.

³⁷ Duplicated RFQs on both ATS platforms were eliminated based on CUSIPs, quantity and general timeframe of RFQs.

the 697,800 RFQs with about 32,700 responses across the two platforms each day, with an average of almost four responses per each RFQ (the median is three responses). Eleven percent of RFQs on the two platforms received no responses. Table 4 also shows that, overall, there were about 173,800 trades associated with the 697,800 RFQs, with a trade-to-quote ratio of 25 percent on the two platforms. Therefore, the remaining 75 percent of all RFQs, representing about 524,100 RFQs with an average of around 6,300 RFQs per trading day, did not result in a trade, but nonetheless represented a potentially significant amount of data that could be useful for the marketplace. The great majority of these trades on the two platforms (approximately 91 percent) are “retail-sized”—meaning 100 bonds or fewer.

Table 4. Descriptive Statistics for RFQs Data

	February– May 2015	Average Per Day	Number of CUSIP Numbers Represented Per Day
Number of RFQs	697,844	8,408	5,694
Percentage of Bids Wanted	99.7%		
Number of RFQ Responses	2,713,207	32,689	5,242
Average Number of Responses Per RFQ	3.9		
Median Number of Responses Per RFQ	3.0		
Percentage of RFQ’s with No Response	10.9%		
Number of Trades Resulting from RFQs	173,751	2,093	1,902
Trade-to-Quote Ratio	24.9%		
Percentage of Retail-Sized Trades	91.2%		
Number of RFQs Resulting in No Trades	524,093	6,314	4,369
Percentage of Total RFQs	75.1%		

Generally speaking, RFQ response information is not available to all ATS participants, unlike RFQ and live quote data, which are available to many participants on a platform unless a live quote submitter chooses to limit the view to select market participants. Regardless, as indicated here, the results of some RFQs can be useful information for both buy- and sell-side market participants.

The most frequently quoted and traded quantity is 10 bonds, or \$10,000 par value, followed by 25 (\$25,000 par value), five (\$5,000 par value), 20 (\$20,000 par value) and 50 (\$50,000 par value) bonds as the next most-frequently quoted and traded on the two platforms³⁸. Table 5 on page 16 illustrates the number of RFQs for each of those bond sizes under 100 bonds, as well as the number of trades associated with each of the RFQ quantities. For the listed, most frequently used RFQ quantities, the trade-to-quote ratio was the highest for the 25-, 20-, 30-, 40- and 50-bond RFQ sizes (between 28 percent and 29 percent, respectively), but the lowest for the five-bond RFQ size (19 percent). In addition, for the 89 percent of RFQs receiving at least one response on the two platforms, the trade-to-quote ratio was 28 percent, compared to the overall trade-to-quote ratio of 25 percent.

³⁸ In this example and in Table 5, on page 16, the illustrated quantities are discrete quoted quantities, not ranges of quantities.

Table 5. RFQ Quantities and Trade-to-Quote Ratio

RFQ Quantity	Number of RFQs	Percent of Total RFQs	Number of Trades	Trade-to-Quote Ratio
5	85,332	12.2%	16,357	19.2%
10	113,171	16.2%	28,896	25.5%
15	59,399	8.5%	15,508	26.1%
20	58,057	8.3%	16,375	28.2%
25	92,377	13.2%	26,855	29.1%
30	30,163	4.3%	8,442	28.0%
35	16,804	2.4%	4,675	27.8%
40	18,806	2.7%	5,257	28.0%
45	9,943	1.4%	2,512	25.3%
50	59,581	8.5%	16,702	28.0%
55	5,833	0.8%	1,472	25.2%
60	7,361	1.1%	1,819	24.7%
65	5,010	0.7%	1,217	24.3%
70	4,885	0.7%	1,213	24.8%
75	12,050	1.7%	2,764	22.9%
80	4,005	0.6%	919	22.9%
85	3,098	0.4%	708	22.9%
90	3,257	0.5%	744	22.8%
95	2,085	0.3%	473	22.7%
100	35,572	5.1%	8,374	23.5%
Total for Above RFQ Quantities	626,789	89.8%	161,282	25.7%
All RFQs	697,844	100.0%	173,751	24.9%
All RFQs with Responses	621,977	89.1%	173,751	27.9%

Further, when an RFQ received more responses, it became more likely to result in a trade. When examining the trade-to-quote ratios by the number of responses received on ATS 2 in Table 6 on page 17,³⁹ the authors of this report found that the trade-to-quote ratio ranged from nine percent when an RFQ received only one response to 40 percent when an RFQ received 20 responses.

³⁹ The authors of this report found irregularity in data captured by ATS 1 in which some market participants essentially internalized many RFQ trades, but the data still show the number of responses as one. The authors of this report believe that the overall trade-to-quote ratio on ATS 1 was still valid, but the analysis of the ratios by number of responses received may not be meaningful.

Table 6. Relationship Between Number of Respondents and Trade-to-Quote Ratio on ATS 2

Number of Respondents	Trade-to-Quote Ratio
1	9.4%
2	12.6%
3	14.8%
4	16.3%
5	18.4%
6	20.9%
7	23.5%
8	25.9%
9	28.6%
10	30.5%
15	36.4%
20	40.4%

Next, the authors of this report examine what price levels at which those RFQ trades were executed. These RFQ trades were primarily inter-dealer trades, but also included some institutional customer trades. Table 7 shows that, for the 25 percent of RFQs that resulted in a trade execution on the two platforms, nearly all bid-wanted trades occurred at the highest bid price (or the lowest offer price for the very few offer-wanted RFQs).

Table 7. Relationship Between RFQ Responses and Trade Price

Trades Occurred at Most Favorable RFQ Response Price	172,643
Trades Did Not Occur at Most Favorable RFQ Response Price	1,109
Percent of Trades at Most Favorable RFQ Response Price	99.4%

However, as mentioned, 75 percent of all RFQs, or 6,300 RFQs per day, did not result in a trade on the platform. The percentage of RFQs that did not result in a trade is even higher for those RFQs with few or no responses, as illustrated in Table 6. For those 6,300 RFQs per day that did not result in a trade, most of the market cannot discern at what price those trades might have been executed. Certainly, having multiple respondents improves price information, as demonstrated by the relationship between number of respondents and trade-to-quote ratio; however, even with 20 responses to an RFQ on ATS 2, 60 percent of those RFQs still did not lead to a transaction.

Even if many RFQs resulted in no trades, could responses to RFQs still add value to the price discovery process, if publicly disclosed? Table 8 on page 18 shows that of all the trades during the relevant period, around 815,000 (or 27 percent of all trades), had at least one response to a bid-wanted RFQ in the same CUSIP number on the same trading day.⁴⁰ Perhaps not coincidentally, out of those 815,000 trades, there were nearly twice as many customer sell trades than customer buy trades. The ratio is a reverse from a normal day during the same period, where there were nearly twice as many customer-buy trades as

⁴⁰ CUSIP numbers and certain related descriptive information are copyrighted by the American Bankers Association (ABA) and are used with permission from CUSIP Global Services managed on behalf of the ABA by Standard & Poor's. ©2018 ABA. "CUSIP" is a registered trademark of ABA.

customer sell trades (see Table 1 on page 13), suggesting that there is a connection between bid-wanted RFQ activities and customer selling activities.

Table 8. Market Share of Trade Types When Matched with Same-Day Responses to an RFQ

	Interdealer	Customer Buy	Customer Sell	Total
Number of Trades with Same-Day Responses to an RFQ	323,350	173,147	318,529	815,026
Percent of Total	40%	21%	39%	

When comparing customer sell prices for those 318,529 customer sell trades with the highest bid quotes from the same-day responses to an RFQ, Table 9 shows that the median difference was only about 12 basis points, in the range of what SEC staff found and published in their recent white paper (July 2018).⁴¹

Table 9. Difference Between Best Bid Response Quote and Customer Sell Trade Price

Percentile	Customer Sell (Best Bid Quote — Trade Price)
10th	-1.44
20th	-0.56
30th	-0.12
40th	0.00
50th	0.12
60th	0.39
70th	0.63
80th	0.83
90th	1.10

In conclusion, 25 percent of RFQs resulted in a trade execution. In addition, even though 75 percent of RFQs did not lead to a trade, the bid responses to an RFQ process represent a significant amount of potential information that could still be beneficial to price discovery if publicly disseminated as a pre-trade indicator signaling the highest price a market participant is willing to pay at the time. More research would need to be performed in this area to assess the costs and benefits of releasing such information.

Live Quote Data

Unlike responses to RFQs, where only market participants who submit a bid-wanted request can observe all responding quotes, generally live quotes are more visible than RFQs to participants of ATS platforms and therefore are more widely broadcast to the trading community than RFQs.⁴²

⁴¹ Using a slightly different methodology, the SEC study illustrated that the mark-down for customer sell trades averaged 7.8 basis points, with a median of 23.2 basis points, during the period from August 2014–November 2014.

⁴² A live quote submitter does have the option to prohibit select subscribers from seeing the submitter’s quotes.

Before the authors of this report present the analysis of live quote data, it is important to note relevant differences between the municipal bond market and other fixed income markets, such as the Treasury and corporate bond markets. Specifically, the fragmented nature of the municipal bond market and the difficulty in shorting municipal bonds are unique characteristics that present significant market challenges. With a large number of municipal bonds in the market, fewer than one percent of the outstanding bonds trade on any given day, and many municipal bonds will not trade for extended periods of time, if at all, after the initial offering. This fragmentation discourages dealer quotes in many municipal bonds, since there is little economic incentive to do so because of the small chance that a quote could lead to a trade unless a bond is actively traded and quoted. Dealer capital would be better concentrated in a few highly traded municipal bonds. In addition, this limitation of dealer quoting activities is further exacerbated by bond shorting difficulties, as shorting tax-exempt municipal bonds is frequently cost-prohibitive, and dealers typically cannot offer a competitive quote unless they own the bond or have immediate access to it.

By comparison, one could also expect that the percentage of bonds with only one offer at a given time in the corporate bond and Treasury bond markets would be substantially lower than the percentage of municipal bonds with only one offer. The ability of dealers to short corporate and Treasury bonds allows them to offer bonds they do not own. Because of the cost and difficulty in shorting municipal bonds, fewer dealers and other market participants would be able to offer municipal bonds to sell on an ATS unless they already own the bonds.

In addition, live quotes in municipal bonds are heavily one-sided, as about 95 percent of all live quotes submitted are offer quotes and only five percent are live bid quotes. Less than 0.01 percent of all ATS quote submissions by a particular dealer contain bids and offers simultaneously. Further, there were very few two-sided markets during the relevant period.⁴³ By contrast, the corporate bond market has a substantially higher number of CUSIP numbers with bid and offer quotes on ATSs. For example, using corporate bond ATS quote data from 2014, the SEC economists found that an average of about 35 percent corporate bonds have both bid and offer quotes during the covered period.

For most CUSIP numbers, there is only one dealer offering the bond at a time on a given ATS. To get an idea of the depth of offerings on the ATS platforms, the authors of this report took a snapshot at 10 a.m. ET every trading day during the relevant period for both ATSs and found that:

- 79.4 percent of CUSIP numbers on ATS 1 had only one dealer offering a quote;⁴⁴
- 95.4 percent of CUSIP numbers on ATS 1 had two or fewer dealers offering a quote;
- 94.4 percent of CUSIP numbers on ATS 2 had only one dealer offering a quote; and
- 99.4 percent of CUSIP numbers on ATS 2 had two or fewer dealers offering a quote.

Having over 90 percent of all CUSIP numbers with only one or two dealer quotes is unique to the municipal bond market. As previously described, because of the vast number of securities in the municipal market and the relatively high cost of shorting tax-exempt municipal bonds, very few dealers can offer a quote for a majority of individual CUSIP numbers. This is in stark contrast to the corporate bond market. This analysis shows that on

⁴³ While two-sided markets can happen when different dealers submit bids and offers for the same CUSIP, a two-sided market is highly unlikely, due the fact that only five percent of all live quotes are bids.

⁴⁴ On ATS 1, a certain dealer appeared to be duplicating other firms' offerings, meaning this dealer's offerings were redundant, as this dealer had the most offerings of any dealer on ATS 1 but less than one percent of all trades on ATS 1. This duplication caused ATS 1 to appear to have fewer unique offerings. The percentages shown for ATS 1 in this report therefore represent the percentages after excluding that one dealer's quotes by the MSRB.

an average trading day only 12 percent of municipal bonds outstanding had at least one quote on at least one platform; by comparison, a SEC report from August 2017 shows over 54 percent of corporate bonds have at least one quote across the two ATSs in their sample.⁴⁵

Table 10 shows that there was a total of 8.1 million live quote updates during the relevant period, with an average of 98,000 live quotes per day. Nearly 95 percent of these live quotes, or 7.7 million, were live offers. During the four-month period, a total of 194,300 CUSIP numbers were represented by these live offers, with an average daily total of 125,400 CUSIPs. This report also examined the number of CUSIP numbers quoted at the 10 a.m. ET snapshot and found that an average of 47,300 CUSIP numbers, or 38 percent of all CUSIP numbers quoted on a given day, were quoted at that moment.

Table 10. Descriptive Statistics for Live Quotes

	February – May 2015	Average Per Day
Number of Live Quotes	8,120,471	97,837
Number of Live Offers	7,694,560	92,706
Percentage of Live Offers	94.8%	
Number of CUSIPs Quoted	194,317	125,389
Number of CUSIPs Quoted at 10 AM Snapshot	47,286	

In terms of trading, Table 11 shows a total of about 667,100 trades executed against offer quotes on these two ATS platforms, with an average of about 8,000 trades per day. The median offer size on the two ATSs is 35 bonds or \$35,000 par value. By comparison, the median trade size on the platforms is 25 bonds or \$25,000 par value, while the average trade size is 53 bonds or \$53,000 par value. Overall, 88.7 percent of the trades executed on the two platforms have a trade size of 100 bonds or less (or \$100,000 par value or less), which is in the range of a typical municipal bond retail-sized trade.⁴⁶ The average trade size on the ATSs was significantly smaller than the average trade size of about \$260,000 par value for all municipal bonds during the relevant period as well as in 2017 and 2018. However, the median trade size of \$25,000 par value on ATS platforms was nearly the same as the overall median trade size during those periods.

Table 11. Descriptive Statistics for Trades Executed Against Live Offer Quotes

	February – May 2015	Average Per Day
Number of Trades	667,120	8,038
Percentage of Retail-Sized Trades	88.7%	
Median Offer Size	\$35,000	
Average Trade Size	\$53,000	
Median Trade Size	\$25,000	

⁴⁵ SEC, "Report to Congress: Access Capital and Market Liquidity," Table 18, Page 200, August 2017.

⁴⁶ A trade size of 100 bonds or less is frequently used as a proxy for retail-size trades; however, some of these executions came from institutions.

When matching live offer quotes with all secondary market trades, almost 70 percent of trades in the market had a live offer quote on at least one of the two platforms at the time of an execution, with a median of three live offer quotes on ATS 1 and one live offer quote on ATS 2.⁴⁷ The analysis shows that bonds that were more frequently quoted were more likely to trade.

For those inter-dealer trades with at least one live quote available, the median price difference between inter-dealer trades and best offer quotes residing on the two ATSs at the time of a trade was zero, as shown in Table 12. In addition, nearly half of all inter-dealer trades were executed within 25 basis points of a best offer quote. Furthermore, the spread of price differentials between inter-dealer trades and best offer quotes seems to be symmetrical around the median price difference.

Table 12. Difference in Trade Price and Best Offer Quotes for Inter-Dealer Trades

Percentile	Inter-Dealer Trades (Trade Price — Best Offer Quote)
Number of Trades	851,415
Percent of Total Trades	41%
10th	-1.36
20th	-0.57
30th	-0.25
40th	-0.06
50th	0.00
60th	0.00
70th	0.19
80th	0.51
90th	1.09

Note: All prices are expressed as a percentage of 100.

For dealer-to-customer trades with at least one live offer quote at the time of execution, the authors of this report found that the median difference in price between the customer buy trade and the best offer quote (lowest offered price) was 75 basis points, or 0.75 percent higher than the best offer quote (equivalent to \$7.50 per bond). On the other hand, the median difference in price between the best offer quote and the customer sell was 73 basis points, or 0.73 percent lower than the best offer quote (equivalent to \$7.30 per bond). Table 13 on page 22 illustrates the difference in trade prices and best offer quotes ranked in percentiles for different types of trades.

⁴⁷ This report removed live quotes for one dealer on ATS 1 that was duplicating other firms' quotes. In addition, this report removed redundant quotes from the same firm in the same bond. The authors believe that not removing the duplicated and redundant quotes would be an inaccurate representation of liquidity in the market.

Table 13. Difference in Trade Price and Best Offer Quotes for Customer Trades

Percentile	Customer Buy (Trade Price— Best Offer Quote)	Customer Sell (Best Offer Quote—Trade Price)
Number of Trades	801,153	438,808
Percent of Total Trades	38%	21%
10th	-0.29	-0.59
20th	0.00	0.00
30th	0.10	0.19
40th	0.32	0.43
50th	0.75	0.73
60th	1.13	1.07
70th	1.57	1.47
80th	2.00	2.00
90th	2.54	2.87

Note: All prices are expressed as a percentage of 100.

This symmetry also generally manifests in price differentials between best offer quotes and customer buy and sell trade prices, where the median distance of 75 basis points between customer buy and best offer quotes is nearly identical to the median distance of 73 basis points between customer sell and best offer quotes. As a further illustration, the 60th-percentile of the price distance between customer buy trades and best offer quotes is also nearly identical to the 60th-percentile of the price distance between customer sell trades and best offer quotes, with both about 110 basis points from the best offer quotes. The same is true for other percentiles presented in Table 13.

These results seem to suggest that the best offer quotes on the two ATSs could be a useful pre-trade indicator for price discovery purposes, as prices for executed customer and inter-dealer trades on and off the platforms seemed to be related to quotes on the platform at the time of a trade. If quoted prices simply represented random price points and were not informative to trade executions in the market, it would be unlikely that the differential between best offer quotes and trade prices would have such an even distribution. More analyses are needed, however, to confirm this pattern using more recent ATS data.

Future Research

Since the MSRB solicited the 2015 quote data for this analysis from the two ATs, the municipal securities industry has continued to evolve, especially in electronic quoting and trading in the secondary market. Many market observers believe there may have been an accelerated shift toward electronic quote and trading on ATs, as opposed to the traditional voice-based OTC trading for fixed income securities, including municipal bonds.⁴⁸ There are also signs that the traditional divide between the inter-dealer bond market, where dealers trade with each other, and the “dealer-to-customer” area, where dealers arrange trades for investors, is beginning to blur, as more and more institutional investors are using electronic platforms, such as ATs, to place their own offers and bids.

Furthermore, a new breed of market participants—proprietary trading firms that rely upon automated algorithms to trade their own capital—have increasingly occupied a significant space in the municipal securities market. While proprietary trading firms are often registered as broker-dealers, they are not a traditional broker-dealer (or an investment adviser, for that matter), since they only trade their principal accounts without acting as an agent, a dealer or an investment manager for their customers. Proprietary trading firms are naturally heavy users of ATs platforms, as they are drawn to the anonymity and speedy auto-execution features of ATs to interact with other market participants.

Today, the growth in algorithmic trading, coupled with increased usage by institutional investors, has led to significantly more offerings and responses to RFQs on ATs. Based on these market changes, it would be prudent for researchers to solicit more current data from market participants and conduct further analysis.

⁴⁸ Robin Wigglesworth and Joe Rennison, “Bond Trading: Technology Finally Disrupts a \$50 Trillion Market,” *Financial Times*, May 9, 2018.

Conclusions

This report focused on price discovery and usefulness of ATS quotes as pre-trade information by separately examining RFQ data and live offer data from two prominent ATS platforms in the municipal securities market. The main findings are as follows:

- There were information imbalances for quote data in the municipal bond market, as a majority of live quotes were offer quotes as opposed to bid quotes, while a vast majority of RFQs were for bids rather than for offers.
- 89 percent of RFQs received at least one response on the two platforms, and 25 percent of RFQs resulted in an execution. The trade rate was higher when an RFQ received more responses.
- Over 90 percent of all CUSIP numbers quoted had only one or two dealer quotes on each ATS platform at 10 a.m. ET each day.
- Prices for executed customer and inter-dealer trades on and off the platforms seemed to be related to the best offer quotes on the platform at the time of a trade, with the median customer buy trade price 75 basis points higher than the best live offer quotes and the median customer sell trade price 73 basis points lower than the best live offer quotes.
- ATS participation in the overall inter-dealer market has remained significant and steady throughout 2017 and 2018 (see Table 2 on page 14).

In addition, the analysis of ATS quote data indicates that live quote information is likely useful pre-trade data for price discovery purposes, because trade prices for both customer and inter-dealer trades executed on and off the platforms seem to be related to the best offer quote. For RFQ data, it is possible that public disclosure of responses to RFQs may still benefit the market, even if the RFQ process does not result in a trade execution, because those responses would provide the market an indication of latent trading interest.

More research is needed in this area to arrive at a more definitive conclusion. In addition, since the ATS data used in this report are from early 2015, it would be prudent to examine more recent data.

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Appendix A—About the Authors

Simon Wu, Ph.D., Chief Economist—Mr. Wu is the Chief Economist for the Municipal Securities Rulemaking Board (MSRB). With nearly two decades of experience applying economic expertise to securities policymaking and regulation, Mr. Wu oversees economic analysis of MSRB rulemaking and municipal market transparency initiatives, and leads related statistical, econometric and financial economic analysis. Before joining the MSRB's Market Structure department, Mr. Wu served as a financial economic expert on securities trading, market structure, best execution, investment management and financial institution risk management at several economic consulting firms. Mr. Wu also served as Chief Economist at the Federal Housing Finance Agency (FHFA), Office of Inspector General, where he was involved in regulatory oversight on mortgage-backed securities issuance and trading, capital market risk management and unsecured lending by banks. He began his career as senior economist at the Financial Industry Regulatory Authority (FINRA) where he led economic studies in support of securities rule proposals and policy impact analysis. Mr. Wu has a doctorate and master's degree in economics from Vanderbilt University and a bachelor's degree in economics from Belmont University.

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Marcelo Vieira, Director of Research—Marcelo Vieira is the Director of Research for the Municipal Securities Rulemaking Board (MSRB). As director of the research program, Mr. Vieira's main objectives are to facilitate investor protection, market education and support of other MSRB programs by producing and disseminating analytical and statistical information. He is responsible for producing the MSRB's annual *Fact Book* and other research reports, and supports the organization's use of data in rulemaking and transparency initiatives. Prior to joining the MSRB, Mr. Vieira served in various research-related roles at the Securities Industry and Financial Markets Association (SIFMA), including director of market statistics and analysis and vice president of securities industry research. Mr. Vieira received his bachelor's degree in finance from the Robert H. Smith School of Business at the University of Maryland.

ABOUT THE MSRB

The MSRB protects investors, state and local governments and other municipal entities, and the public interest by promoting a fair and efficient municipal securities market. The MSRB fulfills this mission by regulating the municipal securities firms, banks and municipal advisors that engage in municipal securities and advisory activities. To further protect market participants, the MSRB provides market transparency through its [Electronic Municipal Market Access \(EMMA®\)](#) website, the official repository for information on all municipal bonds. The MSRB also serves as an objective resource on the municipal market, conducts extensive education and outreach to market stakeholders, and provides market leadership on key issues. The MSRB is a Congressionally-chartered, self-regulatory organization governed by a 21-member board of directors that has a majority of public members, in addition to representatives of regulated entities. The MSRB is subject to oversight by the Securities and Exchange Commission.



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