



Municipal Securities Rulemaking Board

APRIL 2024

Pre-Trade Market Activity in Municipal Securities: Recent Developments

Pre-Trade Data Analysis

Table 1. Market Share by Trade Type

Trade Type	2018 (June-November)		2022 (April-June)	
	Trades	Par Value	Trades	Par Value
Customer Buy	38.1%	45.3%	35.2%	44.5%
Customer Sell	23.1%	18.4%	25.5%	38.1%
Inter-Dealer	38.9%	35.7%	39.3%	17.5%

Source: MSRB analysis with data obtained from MSRB's Real-Time Trade Reporting System (RTRS).

Since many investors, especially individual investors,¹⁵ do not have access to ATS platforms directly, a vast majority of reported trades executed on ATS platforms are trades between dealers, as opposed to trades between dealers and customers.¹⁷ Table 2 examines the percentage of inter-dealer trades executed via an ATS and finds, overall, between 55.2% and 57.6% of inter-dealer trades were executed on all ATS platforms for the relevant periods by par value fluctuated between 28.8% and 31.4%, suggesting that the average inter-dealer trade size on ATS platforms was smaller than the average inter-dealer trade size on ATS platforms.

¹⁵ All commercial paper and variable rate securities are included in this analysis those securities are not believed to be traded on an ATS platform.

¹⁶ For purposes of this analysis, individual investors refer to individual non-institutional customers for their own personal accounts and often amounts, such as a par value of \$100,000 or less when trading municipal securities.

¹⁷ There has been an increasing number of customer trades on ATS platforms, though customer trades are not flagged to RTRS. See Bagley, John and Marcelo Vieira, "Customer Trades on ATS Platforms," Research Paper, Municipal Securities Rulemaking Board, 2023.

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Abstract¹

Since releasing its last research report on pre-trade market activity in July 2020 (based on data from 2018), the Municipal Securities Rulemaking Board (MSRB) has analyzed more recent quote data obtained from the same two alternative trading systems (ATSs) with a significant presence in the municipal securities market. The MSRB's new analysis, which reviewed quote data from three-month periods in 2021 and 2022,² indicates that there was a substantial increase in the number of quotes and trading activity on the two ATS platforms between 2018 and 2022. Request for Quotes (RFQs, also known as "bid-wanted"), responses to RFQs, live quotes³ and trades on the platforms all nearly doubled or more than doubled during the period. Increases ranged from 92.4% to 125.4%, compared to an increase of only 37% in the broader municipal securities market. In addition, there was trade price improvement for both customer buy and sell trades relative to the best quotes at the time of a trade between 2018 and 2022, likely as a result of increased quote provision and quote price competition by market participants.

Overall, there has been some decline of market quality when comparing the high-volume, high-volatility year of 2022 to the low-volume, low-volatility year of 2021, though pre-trade data continued to demonstrate its relevance and usefulness for the market. The number of responses to RFQs went down from a median of seven responses in 2021 to a median of five responses in 2022, with slightly more RFQs not receiving any responses in 2022. In addition, the average difference between customer buy trade prices and best offer quotes increased from 5 basis points in 2021 to 22 basis points in 2022. These changes, however, were not unexpected, and the statistics for 2022 were still superior to the comparable statistics for 2018.

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

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

³ Live quotes typically are unsolicited and reside on an ATS platform until they are executed, canceled or time expired.

Introduction and Background

In July 2020, the MSRB published a research study on pre-trade market activity for municipal securities (the "2020 MSRB Report").⁴ Utilizing RFQ and live quote data provided by two predominant municipal securities electronic ATS platforms, in conjunction with trade data from MSRB's Real Time Trade Reporting System (RTRS), the MSRB analyzed a six-month period from June 1, 2018, through November 30, 2018 (the "2018 Data"). Since 2018, the municipal securities market has experienced periods of volatility, including 2022, when the inflation rate and interest rates rose swiftly.⁵ Given the ever-changing dynamics in the municipal securities market, the MSRB considered it prudent to analyze newer data to provide further insights into how the pre-trade market has changed in recent years, as well as how the market behaved during periods of low volatility and high volatility. Accordingly, the MSRB obtained more recent data from the same two ATS platforms ("ATS 1" and "ATS 2") it had studied earlier.⁶ The new data covers the three-month period from April 1, 2021 through June 30, 2021 (the "2021 Data"), a period of low interest rates and low volatility, and the three-month period from April 1, 2022 through June 30, 2022 (the "2022 Data"), a period of rising interest rates and higher volatility.

Pre-trade information broadly can include quote data (bid-side and offer-side) signaling trading interests available on electronic platforms or through non-electronic means, new issue pricing scales, yield curves and indices, evaluated prices, trading in similar securities and other material disclosure information. The MSRB currently publishes certain pre-trade municipal securities pricing-related information to the public, such as yield curves, municipal market indices and new issue pricing scales on its [Electronic Municipal Market Access \(EMMA®\) website](#). This is in addition to the post-trade municipal securities data it has collected and disseminated since 1995 through RTRS and its predecessor, the Transaction Reporting System. However, the MSRB neither collects nor disseminates price and size of quotes for municipal securities signaling trading interests. In addition, there is currently no central facility in the municipal market through which such pricing information is made broadly available to the public in a consolidated manner.⁷ In other words, there are no national best bid and offer indicators for municipal securities as there are in the equity securities market. To the extent that pre-trade pricing information is available, it typically is provided by proprietary electronic networks but only to paid data subscribers, such as those

⁴ Wu, Simon Z. and John Bagley, "Municipal Securities Pre-Trade Market Activity: What Has Changed Since 2015?," Research Paper, Municipal Securities Rulemaking Board, July 2020 (<https://www.msrb.org/sites/default/files/MSRB-Pre-Trade.pdf>). Previously in 2018, the MSRB also conducted an in-depth analysis covering a four-month period from February 1, 2015 through May 31, 2015 (the "2018 MSRB Report"). See Wu, Simon Z., John Bagley and Marcelo Vieira, "Analysis of Municipal Securities Pre-Trade Data from Alternative Trading Systems," Research Paper, Municipal Securities Rulemaking Board, October 2018 (<http://www.msrb.org/Market-Topics/~media/28D243F1ECC040BB81BA1DC8FD869454.ashx?>).

⁵ The other volatile period was during the COVID-19 financial crisis in the spring of 2020, which was dramatic but brief.

⁶ For confidentiality purposes, this report anonymizes the name of an ATS when describing detailed results.

⁷ This is not unique to the municipal securities market, as the corporate bond market and other FINRA TRACE-eligible securities markets do not provide universally available pre-trade information, either.

operated by ATS platforms, some broker's brokers and market data vendors, and occasionally through non-electronic venues.

As discussed in the 2020 MSRB Report and the prior 2018 MSRB Report ("previous MSRB reports"), the advent of fixed income electronic trading venues changed the trading landscape over the last two decades.⁸ The main functions of an electronic trading venue such as an ATS or some broker's brokers are: 1) posting live quotes and soliciting RFQs electronically; 2) aggregating and consolidating quotes by price/yield and size; and 3) electronic execution of a trade against posted quotes. Electronic trading platforms may facilitate the management of dealer inventory and reduce counterparty search costs between dealers and investors, especially individual investors.⁹ ATS platforms also offer anonymity to participants that post quotes, though not always after a trade is executed, depending on the platform. As a result, one of the reasons market participants such as dealers, proprietary trading firms and institutional investors may prefer using an ATS to find counterparties for trading is that they can do so without broadcasting their trading position to the market.¹⁰ Electronic platforms typically do not share pre-trade information (bids, offers, RFQs, or responses to an RFQ) with the broader market. They make this data available only to ATS participants engaging directly with such venues or other proprietary data subscribers, predominantly financial professionals.¹¹

For a detailed description of municipal securities market structure, electronic trading venues and broker's broker platforms and the academic research performed in the area of pre-trade information transparency, please refer to the previous MSRB reports.¹²

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- ⁸ See Wu, Bagley and Vieira, "Analysis of Municipal Securities Pre-Trade Data from Alternative Trading Systems," October 2018.
- ⁹ Staff of the Division of Economic and Risk Analysis of the SEC, "Report to Congress: Access to Capital and Market Liquidity," Page 178, August 2017. <https://www.sec.gov/files/access-to-capital-and-market-liquidity-study-dera-2017.pdf>.
- ¹⁰ Traditionally, broker's brokers also performed 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. Many broker's broker platforms have 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. See SIFMA, "The Role of Municipal Securities Broker's Brokers in the Municipal Markets," 2017.
- ¹¹ See Wu, Bagley and Vieira, "Analysis of Municipal Securities Pre-Trade Data from Alternative Trading Systems," October 2018. Not only is access to pre-trade pricing information limited to ATS data subscribers, information may be further restricted to a few market participants involved in some of those potential transactions. For example, responses to RFQs are only visible to market participants who request bids but are not visible to other ATS participants. Also, the level of live quote information disseminated could also be 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 Also see Craig, Louis, Abby Kim and Seung Won Woo, "Pre-Trade Information in the Municipal Bond Market," Division of Economic and Risk Analysis of the SEC, July 2018; Davies, Ryan and Erik R. Sirri, "The Economics and Regulation of Secondary Trading Markets," Working Paper, March 16, 2017; Financial Economists Roundtable, "Statement on the Structure of Trading in Bond Markets," May 11, 2015; and the Securities and Exchange Commission, "Report on the Municipal Securities Market," July 31, 2012.

Pre-Trade Analysis Data and Methodology

For purposes of this report, pre-trade information specifically refers to the narrower definition, which is the indication of size and price of prospective trading interest in specific securities. This includes responses to RFQs and live 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.

The MSRB performed an in-depth analysis of two ATS platforms' quote and trade data, along with market-wide trade data collected from RTRS,¹³ and compared the results from the newer 2021 Data and 2022 Data with the results from the 2018 Data previously presented in the 2020 MSRB Report. The same two ATS platforms voluntarily provided the MSRB with the pre-trade data, including RFQ (bids and offers wanted), response to RFQ, live quote and associated transaction data for three-month periods (April through June) in both 2021 and 2022. The RFQ data includes quantity and price information for each RFQ, RFQ response and associated trade, if any. The live quote data contain bidding and offering amount, bidding and offering price, and bidding and offering yield information. These two ATS platforms are known for having a significant amount of individual investor-sized trades (\$100,00 par value or less), for their prominent market shares during the relevant timeframes, and for their ability and willingness to voluntarily deliver a large amount of data quickly and efficiently.

It should be noted that pre-trade quote data are also available from other ATS platforms, electronic venues designed for institutional investors, broker's brokers, dealers' proprietary systems and third-party vendors. Dealers may have multiple offerings for an individual bond depending on where the quote is shown, for example, an offer quote on an ATS versus an offer quote to a client.¹⁴ In particular, institutional investors may prefer other electronic platforms that are more tailored toward large block-size traders.

¹³ For the purposes of this research report, only secondary market trades in municipal securities are included in the analysis.

¹⁴ In addition to MSRB's registered dealers, other market participants, such as institutional investors, can have access to an ATS to post and solicit quotes. For the purposes of this report, dealers henceforth refer to all market participants who are subscribed to one or both ATS platforms.

Findings of Pre-Trade Data Analysis

When available, the empirical analysis in this report focuses on the changes in pre-trade market activities between 2018, 2021 and 2022, a four-year time span.

Market Share of Inter-Dealer and ATS Trades

Before analyzing the ATS data, this section first compares the market share of different types of trades during the relevant periods. Table 1 presents the market share by number of trades and par value for customer purchase, customer sell and inter-dealer trades. The percentage breakdown by trade count and by par value traded did not change substantially between 2018 and 2022, despite some fluctuations among individual years, as there does not appear to be any discernable trend over time. In particular, the market share for inter-dealer trades was between 37.6% and 39.3% by trade count and between 17.5% and 21.7% by par value traded.

Table 1. Market Share by Trade Type¹⁵

Trade Type	2018 Data (June-November)		2021 Data (April-June)		2022 Data (April-June)	
	Trades	Par Value	Trades	Par Value	Trades	Par Value
Customer Buy	38.1%	45.9%	33.9%	44.9%	35.2%	44.5%
Customer Sell	23.1%	35.7%	28.5%	33.5%	25.5%	38.1%
Inter-Dealer	38.9%	18.4%	37.6%	21.7%	39.3%	17.5%

Source: MSRB analysis with data obtained from MSRB's Real-Time Transaction Reporting System (RTRS).

Since many investors, especially individual investors,¹⁶ do not have access to ATS platforms directly, a vast majority of reported trades executed on ATS platforms are trades between dealers, as opposed to trades between dealers and customers.¹⁷ Table 2 examines the percentage of inter-dealer trades executed via an ATS and finds, overall, between 55.2% and 57.6% of inter-dealer trades were executed on all ATS platforms for the relevant periods between 2018 and 2022. On the other hand, the percentage of trade executions by par value fluctuated between 28.8% and 31.4%, suggesting that the average inter-dealer trade size on ATS platforms was smaller than the

¹⁵ All commercial paper and variable rate securities are included in this analysis, even though those securities are not believed to be traded on an ATS platform.

¹⁶ For purposes of this analysis, individual investors refer to individual non-professional investors who buy and sell securities for their own personal accounts and often trade in relatively small amounts, such as a par value of \$100,000 or less when trading municipal securities.

¹⁷ There has been an increasing number of customer trades on ATS platforms, especially by institutional customers, though customer trades are not flagged as an ATS trade when reporting to RTRS. See Bagley, John and Marcelo Vieira, "Customer Trading with Alternative Trading Systems," Research Paper, Municipal Securities Rulemaking Board, August 2022.

average inter-dealer trade size executed elsewhere. Table 2 confirms that ATS participation in the overall inter-dealer market remained significant and steady through 2022.

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

2018 Data (June-November)		2021 Data (April-June)		2022 Data (April-June)	
Trades	Par Value	Trades	Par Value	Trades	Par Value
57.6%	28.8%	55.2%	29.7%	56.5%	31.4%

Source: MSRB analysis with data obtained from RTRS and two alternative trading systems.

Volume of ATS Quote Data¹⁸

The volume of quote data on the two ATS platforms continued to rise between 2018 and 2022, though some of the increases may be the result of exceptionally heavy trading activity in 2022.¹⁹ Table 3 compares the size of the pre-trade data during the relevant periods. While the monthly average number of trades on ATS 1 and ATS 2 in 2022 was noticeably higher than the number of trades in 2018, with a 107.3% increase, the quote volume also rose substantially. The monthly average number of RFQs went up from 199,000 in 2018 to 423,000 in 2022, a 112.5% increase, and the growth rate for responses to RFQs was comparable, at 92.4%. Similarly, the number of live quotes also rose dramatically, from 39.3 million live quotes per month in 2018 to 88.5 million live quotes in 2022, a 125.4% rise. Unlike in prior years, when the quote volume had grown noticeably faster than the trade volume on the two ATS platforms,²⁰ it appears that their respective growth rates between 2018 and 2022 were similar. By comparison, market-wide trades only grew by 37% during the relevant period.

Overall, the amount of quote data dwarfs the amount of trades reported through the MSRB's RTRS database, as the live quote data from a single ATS platform (ATS 1) during a three-month period in 2022 had more data points (over 200 million live quotes) than the number of reported trades in the RTRS database for its entire 19-year existence from January 2005 through December 2023 (184.5 million reported trades).²¹ Along the same lines, the monthly market-wide trade count was significantly less than the amount of live quote volume on either ATS 1 or ATS 2 during the relevant periods.

¹⁸ The quote data volume in this section refers to the raw count. The numbers may differ from the quote volume in the subsequent sections as redundant or inaccurate data are filtered out for analyses.

¹⁹ In 2022, the highest number of trades on record were reported to the MSRB since the RTRS system was implemented in 2005, though the record was subsequently surpassed in 2023.

²⁰ See the comparison of quote and trade volume between 2015 and 2018 in the 2020 MSRB Report, which attributed the rapid increase in live quotes to the likelihood of increasing usage of automated quotation systems.

²¹ Of the 184.5 million reported trades to RTRS, 178.4 million are secondary-market trades.

Table 3: Quote and Trade Data Volume on ATS 1 and ATS 2²²

	RFQs	Responses	Live Quotes	Trades on ATS Platforms	All Secondary Market Trades
2018 Data (June-November)					
ATS 1	621,587	2,970,950	161,664,641	588,148	
ATS 2	573,821	3,386,483	73,881,567	323,460	
Total	1,195,408	6,357,433	235,546,208	911,608	4,857,895
Average Per Month	199,235	1,059,572	39,257,701	151,935	809,649
2021 Data (April-June)					
ATS 1	452,724	2,840,053	78,801,025	240,232	
ATS 2	403,131	2,675,392	42,114,122	248,261	
Total	855,855	5,515,445	120,915,147	488,493	1,861,573
Average Per Month	285,285	1,838,482	40,305,049	162,831	620,524
2022 Data (April-June)					
ATS 1	596,904	2,947,607	200,966,121	444,267	
ATS 2	672,951	3,168,676	64,474,588	500,450	
Total	1,269,855	6,116,283	265,440,709	944,717	3,327,417
Average Per Month	423,285	2,038,761	88,480,236	314,906	1,109,139
Percentage Change: 2018 to 2022	112.5%	92.4%	125.4%	107.3%	37.0%

Source: MSRB analysis with data obtained from RTRS and two alternative trading systems.

Request-for-Quote Data

As indicated in the previous MSRB reports, there is an information imbalance for quote data in the municipal securities market, as a vast majority of RFQs were solicited for bids while most live quotes were offer quotes. The imbalances continued in 2021 and 2022, with most of the RFQ data from the two ATSs being requests for bids and only between 0.4% and 0.7% of the data representing offers wanted, similar to 0.3% in 2018 (See Table 4). There were also significantly fewer live bid quotes posted by market participants on the platforms in comparison to live offer quotes, resulting in more RFQs soliciting bids whenever an investor wanted to sell a position. The average and median number of responses per each RFQ across the two platforms increased between 2018 and 2021 before dropping back down in 2022. The average went from 5.6 responses in 2018 to 6.6 responses in 2021 before coming down to five responses

²² The volume data in this table represent the gross numbers, therefore may not exactly match the volume data in the subsequent tables, which represent the “net” numbers after data cleaning and filtration.

in 2022. Meanwhile, the median went from five responses in 2018 to seven responses in 2021 before coming back down to five responses in 2022.²³ In addition, only 2.7% of RFQs on the two platforms received no responses at all in 2021 and 4.5% received no responses in 2022, a slight decline from 5.7% in 2018.²⁴ The decline in the number of responses per each RFQ, as well as the rise in the percentage of no responses from 2021 to 2022, were likely associated with the rapidly rising interest rates and volatility in 2022. However, while both measures deteriorated in 2022, they were still either superior to or no different from the comparable 2018 numbers.

Table 4 also shows that, overall, the trade-to-request ratio (number of trades divided by number of RFQs) declined from 21.4% on each requesting ATS platform in 2018 to 15.3% in 2021 and 14.1% in 2022.²⁵ This indicates that the execution rate on the platforms decreased in recent years. It should be noted that an RFQ could still result in a trade but not necessarily through the requesting ATS platform(s), as a portion of the “non-executed” RFQs could also be internalized by the RFQ-requesting dealer or be executed elsewhere on other platforms, such as a dealer’s proprietary platform, a broker’s broker platform or another ATS platform. Finally, the vast majority of these trades resulting from an RFQ process were individual investor-sized, that is, 100 bonds or fewer. Individual investor-sized trades represented 91.8% of trades resulting from an RFQ process in 2021 and 89.8% in 2022, similar to 91% in 2018.

²³ As noted in the 2020 MSRB Report, the average and median number of responses were considerably lower in 2015, where the average was 3.9 responses and the median was only three responses.

²⁴ The previous MSRB reports highlighted that RFQ response information is not available to all market participants, unlike RFQ itself and live quote data, which are generally available to most of the subscribers on a platform. In some instances, an RFQ-requesting dealer or a dealer who provides a live quote may not allow all market participants on a platform to see the request or the live quote.

²⁵ The 2018 MSRB Report found the trade-to-request ratio to be 24.9% in 2015, suggesting a continuous decline since at least 2015.

Table 4: Summary Statistics for Request-for-Quote Data

	2018 Data (June-November)			2021 Data (April-June)			2022 Data (April-June)		
	Total	Average Per Day	CUSIP ²⁶ Numbers Per Day	Total	Average Per Day	CUSIP Numbers Per Day	Total	Average Per Day	CUSIP Numbers Per Day
Number of RFQs	1,195,408	9,405	6,375	855,855	13,554	9,029	1,269,855	20,479	14,465
Percentage of Bids Wanted	99.7%			99.3%			99.6%		
Inter-Dealer	38.9%	18.4%		37.6%	21.7%		39.3%	17.5%	
Number of RFQ Responses	6,357,431	50,056	6,102	5,515,445	87,440	8,818	6,116,283	98,650	14,019
Average Number of Responses Per RFQ	5.6			6.6			5.0		
Median Number of Responses Per RFQ	5.0			7.0			5.0		
Percentage of RFQs with No Response	5.7%			2.7%			4.5%		
Number of Trades Resulting From RFQs	255,365	2,010	1,841	130,604	2,073	1,924	179,502	2,895	2,714
Trade-to-Request Ratio	21.4%			15.3%			14.1%		
Percentage of Individual-Sized Trades (Quantity <= 100)	91.0%			91.8%			89.8%		

Source: MSRB analysis with data obtained from two alternative trading systems.

Table 5 shows that for the vast majority of RFQs receiving at least one response on the two platforms, the trade-to-request ratio was 13.6% in 2021 and 13.4% in 2022, compared to 20.4% in 2018, while the overall trade-to-request ratio, regardless of whether an RFQ received any response, was 13.3% in 2021 and 12.9% in 2022 compared to 19.2% in 2018. These percentages differ from the percentages in Table 4 above, mainly because on ATS 1, four RFQ-requesting firms typically provided the only response to their own RFQs and then traded with themselves, essentially internalizing the trades.²⁷ Those four firms' RFQs were therefore excluded in the analysis

²⁶ CUSIP is the universally recognized unique nine-digit, alphanumeric identifier for a wide range of financial instruments and their issuers, including municipal securities. One CUSIP number represents one unique security. See <https://www.msrb.org/sites/default/files/LocatingCUSIPsinvestor.pdf>.

²⁷ We understand these four firms used an ATS platform for order management and real-time trade processing. For example, it is possible these firms received responses from other platforms where they solicited similar RFQs and only entered the best bid into ATS 1 for trade processing. Alternatively, they may have simply used ATS 1 for processing internalized trades.

in Table 5.²⁸ Further, as an RFQ received more responses, it became more likely to result in a trade, with the trade-to-request ratio going up uniformly with the number of responses received for all three time periods. The trade-to-request ratio ranged from between 6.6% and 7.5% when an RFQ received only one response, to between 39.3% and 54.7% when an RFQ received 15 responses. The positive correlation between the trade-to-request ratio and the number of responses received is consistent for all three years (2018, 2021 and 2022).

Table 5: Relationship Between Number of Responses and Trade-to-Request Ratio

Number of Respondents	2018 Data (June-November)			2021 Data (April-June)			2022 Data (April-June)		
	Number of RFQs	Number of Trades	Trade-to-Request Ratio	Number of RFQs	Number of Trades	Trade-to-Request Ratio	Number of RFQs	Number of Trades	Trade-to-Request Ratio
1	59,341	4,461	7.5%	32,770	2,470	7.5%	71,381	4,683	6.6%
2	101,467	12,454	12.3%	52,127	5,427	10.4%	119,714	10,202	8.5%
3	131,665	19,175	14.6%	63,624	8,167	12.8%	149,803	14,881	9.9%
4	146,505	24,098	16.4%	75,967	9,700	12.8%	170,012	19,469	11.5%
5	145,254	27,246	18.8%	85,737	10,800	12.6%	171,696	22,485	13.1%
6	131,553	27,437	20.9%	93,625	11,617	12.4%	158,807	22,772	14.3%
7	111,068	25,161	22.7%	95,249	11,805	12.4%	127,984	20,175	15.8%
8	86,583	22,361	25.8%	88,496	11,022	12.5%	89,370	15,517	17.4%
9	63,445	18,542	29.2%	72,513	9,756	13.5%	52,587	10,960	20.8%
10	42,879	13,987	32.6%	52,194	7,963	15.3%	26,363	6,619	25.1%
15	2,766	1,385	50.1%	3,489	1,371	39.3%	201	110	54.7%
20	60	34	56.7%	123	52	42.3%	1	1	100.0%
>= 20	82	60	73.2%	97	57	58.8%	0	0	N/A
All RFQs with Responses	1,082,919	221,187	20.4%	790,228	107,480	13.6%	1,157,176	154,617	13.4%
All RFQs	1,151,543	221,187	19.2%	809,106	107,480	13.3%	1,201,201	154,617	12.9%

Source: MSRB analysis with data obtained from two alternative trading systems.

²⁸ No similar incidences occurred on ATS 2. Had those four firms' RFQs been included, the trade-to-request ratio for both ATS platforms would have been 22.8% for one response, as opposed to between 6.6% and 7.5% in Table 5. For the 2018 data, only three firms' RFQs were excluded in this analysis in the 2020 MSRB Report when those RFQs only received one (self) response.

Live Quote Data²⁹

As mentioned in the previous MSRB reports, the fragmented nature of the municipal securities market and the difficulty in shorting tax-exempt municipal securities³⁰ are unique characteristics that present significant market challenges, such as discouraging dealer quotations in most municipal securities, as dealers can only provide offer quotes when they possess the securities. Moreover, there is little economic incentive to provide quotes in securities that are infrequently traded,³¹ and dealers may believe that dealer capital is better concentrated in a few highly traded municipal securities to maximize the market-making opportunity.³²

Unlike the RFQ data, a majority of live quotes were offer quotes as opposed to bid quotes, though the share of bid quotes and offer quotes both declined between 2018 and 2022 as a result of increasing usage of two-sided live bid-and-offer quotes on one ATS platform (ATS 1). Table 6A shows that the percentage of live offer quotes submitted fell from 89.7% in 2018 to 72.9% in 2021 before rising to 80.6% in 2022, while the share of live bid quotes submitted declined from 5.3% in 2018 to 4.5% in 2021 then to 2.2% in 2022. Meanwhile, the share of two-sided live bid-and-offer quotes rose significantly from 5% in 2018 to 22.6% in 2021 before declining to 17.2% in 2022. Anecdotal evidence suggests some market participants submit and update live bids and live offers simultaneously with high frequency on ATS platforms using a computerized algorithm. In fact, when examining the number of quote updates per each initialized quote in Table 6A, on average in 2022, while live offer quotes were updated 1.6 times and live bid quotes were updated 3.3 times, live bid-and-offer quotes were updated 260.8 times, implying the likely automated nature of quote submitters for live bid-and-offer quotes.³³ Still, the continued imbalance in live quote submission for municipal securities, albeit less imbalanced over time due to the growth of two-sided quotes on ATS 1, likely is the consequence of investors executing a “buy-and-hold” strategy for municipal securities and rarely selling off a position before maturity. Since investors generally don’t sell off their accumulated positions, dealers are less likely to post a live bid quote and would only submit a bid response to an RFQ when there was an indication of an interest to sell. This is further exacerbated by the sheer number of municipal CUSIP numbers outstanding and how unlikely an aged bond is to trade on any given day.

²⁹ For all the live quote analyses, after confirming with each ATS platform’s actual practice, ATS 1’s live quotes are allowed to be carried over from previous trading days unless a quote was explicitly canceled, while for ATS 2, only the same-day live offer quotes are incorporated, and quotes submitted on prior days are assumed to be canceled or expired.

³⁰ Shorting tax-exempt municipal bonds is frequently cost-prohibitive. Therefore, dealers typically cannot offer a competitive quote unless they own the bond or have immediate access to it.

³¹ Despite the large number of municipal bonds in the market, only 1-2% of the outstanding bonds trade on any given day.

³² Dealers do often commit their capital when a customer is selling a municipal bond, even if the bond is rarely traded. Some of live offer quotes may also reflect either a customer’s selling interest or a dealer’s action to offload the position after purchasing from a customer sell.

³³ Some of the frequent quote updating activities in 2022 were likely driven by the volatile market. Also, the number of quote updates per each initialized quote declined significantly for both live bids and live offers between 2018 and 2022, from 13.5 to 1.6 for live offers and from 9.8 to 3.3 for live bids, indicating that some previous frequent submitters of quote updates for live bids and live offers might have migrated to using two-sided live bid-and-offer quotes.

Table 6A. Summary Statistics for Live Quote Data—Type of Quotes

	2018 Data (June-November)			2021 Data (April-June)			2022 Data (April-June)		
	Total	Percent	Number of Quote Updates per Each Initialized Quote	Total	Percent	Number of Quote Updates per Each Initialized Quote	Total	Percent	Number of Quote Updates per Each Initialized Quote
Number of Live Quotes	232,133,064			120,915,147			265,440,709		
Number of Live Offers	208,150,637	89.7%	13.5	88,130,509	72.9%	1.5	213,961,365	80.6%	1.6
Number of Live Bids	12,290,834	5.3%	9.8	5,467,991	4.5%	2.2	5,823,392	2.2%	3.3
Number of Live Bids and Offers (ATS 1 Only)	11,691,593	5.0%	138.3	27,316,647	22.6%	118.1	45,655,952	17.2%	260.8

Source: MSRB analysis with data obtained from two alternative trading systems.

Table 6B shows the average number of CUSIP numbers quoted per day was 96,300 in 2018, 88,400 in 2021 and 93,800 in 2022, less than 10% of all outstanding municipal securities.³⁴ The average number of CUSIP numbers quoted at the 10 a.m. snapshot was also similar between 2018 and 2022, ranging from 74,000 to 83,200. Essentially, at any given moment, no more than 8% of the approximately one million municipal securities outstanding had live quotes. This compares with between 1% and 2% of outstanding municipal securities that were traded daily during the relevant period.

Table 6B. Summary Statistics for Live Quote Data—Number of CUSIPs Quoted

	2018 Data (June-November)		2021 Data (April-June)		2022 Data (April-June)	
Number of CUSIPs Quoted	302,202	235,278	269,287	44.9%	35.2%	44.5%
Average Number of CUSIPs Quoted Per Day	96,315	88,352	93,821	33.5%	25.5%	38.1%
Average Number of CUSIPs Quoted at 10 A.M. Snapshot Per Day	77,619	74,017	83,242	21.7%	39.3%	17.5%

Source: MSRB analysis with data obtained from two alternative trading systems.

³⁴ This is in stark contrast to the corporate bond market, where over 54% of corporate bonds have at least one quote across the top two ATS platforms on an average day. See the SEC's "[Report to Congress: Access Capital and Market Liquidity](https://www.sec.gov/files/access-to-capital-and-market-liquidity-study-dera-2017.pdf)" study published in August 2017, Table 18 on Page 200 (<https://www.sec.gov/files/access-to-capital-and-market-liquidity-study-dera-2017.pdf>). The corporate bond quotation data collected by the SEC came from KCG ("Knight") and TMC for the period from August 1, 2014 through November 28, 2014.

Even for the municipal securities with live quotes, a vast majority of these securities only had one or two dealers offering quotes at any given time.³⁵ Similar to the previous MSRB reports, a snapshot was taken at 10 a.m. every trading day for both ATS platforms to derive the number of offering quotes at a given time. Comparing the percentages of CUSIP numbers with one or two dealers offering quotes on each ATS platform, for ATS 2, these numbers didn't change much from 2018 to 2022. On ATS 2, the percentages of securities with quotes from one dealer were 81.3% in 2018, 83.4% in 2021 and 81.4% in 2022, while the percentages having quotes from two dealers were 14.1% in 2018, 13.6% in 2021 and 14.6% in 2022. However, for ATS 1, the percentage of CUSIP numbers with a single dealer quoting declined from 80.6% in 2018 to 75.4% in 2021 and 70% in 2022, with a corresponding rise in the percentage of CUSIP numbers with two dealers quoting from 14.7% in 2018 to 18% in 2021 and 19.9% in 2022. In addition, the aggregate percentage of CUSIP numbers with one or two dealers quoting on ATS 1 also declined from 95.2% in 2018 to 93.3% in 2021 and 89.9% in 2022. This suggests that there were slightly more dealers quoting per each CUSIP on ATS 1. The fact that only ATS 1 had more dealers quoting per each CUSIP in 2021 and 2022 than in 2018 was likely the result of increased usage of two-sided live bid-and-offer quotes on ATS 1, as shown in Table 6A above, which may have bolstered the depth on both the bid side and offer side. While ATS 2 did not have any two-sided quotes throughout the period, on ATS 1, about 34.7% of live quotes in 2021 and 22.7% in 2022 were two-sided quotes, compared to only 7.4% in 2018.

That said, over 90% of all CUSIP numbers still had only one or two dealer quotes on each ATS platform as recently as in 2022, which is unique to the municipal securities market,³⁶ especially when compared with more active securities markets such as the equity market. As elaborated earlier, because of the vast number of securities in the municipal market and the relative high cost of shorting tax-exempt municipal securities, it is highly unlikely that dealers would offer live quotes for a majority of individual bonds. Dealers prefer offering bonds they own or have immediate access to buying.

Table 7. Percentage of Municipal Securities with One or Two Dealers Quoting at 10 A.M.

Number of Quoting Dealers Per CUSIP	2018 Data (June-November)		2021 Data (April-June)		2022 Data (April-June)	
	ATS 1	ATS 2	ATS 1	ATS 2	ATS 1	ATS 2
One	80.6%	81.3%	75.4%	83.4%	70.0%	81.4%
Two	14.7%	14.1%	18.0%	13.6%	19.9%	14.6%
One or Two	95.2%	95.4%	93.3%	97.0%	89.9%	96.1%

Source: MSRB analysis with data obtained from two alternative trading systems.

³⁵ The number of dealers bidding at any given time would likely be even lower, as less than 30% of all submitted live quotes contained a bid quote (a live bid or a two-sided live quote).

³⁶ Some dealers are offering duplicated live quotes across multiple platforms; therefore, the actual number of non-duplicated quoting dealers at a given time on a given ATS is likely even lower than indicated.

Table 8 shows that fewer trades were considered individual investor-sized trades in 2021 and 2022 than in 2018, declining from 92% in 2018 to 87.1% in 2021 and to 82.7% in 2022. As a result, the average trade size went up from \$52,400 par value in 2018, to \$91,300 par value in 2021 and \$138,500 par value in 2022, though the median trade size remained at 25 bonds or \$25,000 par value consistently throughout the period. The increases in the average trade size were primarily driven by large-size trades on ATS 2 (outlier effect). Still, even on ATS 2, the median was no more than \$45,000 par value and over 70% of the trades were at \$100,000 par value or less (100 bonds or less), suggesting that individual investor-sized trades predominated on these ATS platforms during the period. Overall, the average trade size on the ATS platforms was much smaller than the average trade size for all municipal securities at approximately \$300,000 par value between 2018 and 2022, while the median trade size was in the range of a typical municipal bond individual investor-size trade, which is \$100,000 par value or less. The median live offer size on the two ATS platforms was \$20,000 par value in 2018, \$15,000 par value in 2021 and \$25,000 par value in 2022. When isolating to live offer quotes at the time of a trade only, the median offer size declined from \$75,000 in 2018, to \$30,000 in 2021 before rising to \$45,000 in 2022.

Table 8. Summary Statistics for Trades Executed Against Live Offer Quotes

	2018 Data (June-November)		2021 Data (April-June)		2022 Data (April-June)	
	Total	Average Per Day	Total	Average Per Day	Total	Average Per Day
Number of Trades	656,243	5,165	245,802	3,900	489,496	7,895
Percentage of Individual-Sized Trades	92.0%		87.1%		82.7%	
Median Live Offer Quote Size	\$20,000		\$15,000		\$25,000	
Median Live Offer Quote Size at Time of Trade	\$75,000		\$30,000		\$45,000	
Average Trade Size	\$52,400		\$91,363		\$138,497	
Median Trade Size	\$25,000		\$25,000		\$25,000	

Source: MSRB analysis with data obtained from two alternative trading systems.

Comparing Trade Price to Consolidated Best Quotes

Finally, to examine whether RFQs and live quotes provide any indicative value to trade prices regardless of whether a trade was executed on an ATS platform, market-wide trades were matched with all quotes at the time of a trade. With the rapidly rising market share of two-sided live bid-and-offer quotes on a single ATS platform, for the first time (unlike in the previous MSRB reports), market-wide customer sell trade prices were compared with the consolidated best bid responses to RFQs and best live bid quotes at the time of a trade, as opposed to only the best bid responses to RFQs. On the other hand, inter-dealer trades and customer buy trades were still matched with

live offer quotes.³⁷ Essentially, this analysis attempted to simulate what a market participant (a dealer or an investor) would observe on the two ATS platforms at the time of a trade if all pre-trade information from the two platforms were available.³⁸

For 2021 and 2022, more market-wide trades had at least one quote available at the time of a trade when compared to 2018. While 71.3% of all secondary market trades during the 2018 period had a quote on at least one of the two platforms at the time of an execution, the percentage rose to 71.8% in 2021 and 78.4% in 2022 (see Table 9). The increase in the percentage was consistent with the rise in the number of quotes from 2018 to 2022, as shown in Table 3, suggesting that even though many of these trades were not executed on ATS platforms themselves, a vast majority of them had some pre-trade quotes on the two ATS platforms at the time of execution.

Table 9. Percentage of Trades With at Least One Quote at the Time of a Trade³⁹

	2018 Data (June-November)	2021 Data (April-June)	2022 Data (April-June)
Total Number of Trades	4,857,895	1,861,573	3,327,417
Trades with at Least One Quote at the Time of a Trade	3,466,056	1,336,935	2,609,004
Percent	71.3%	71.8%	78.4%

Source: MSRB analysis with data obtained from RTRS and two alternative trading systems.

For trades with at least one quote at the time of execution, the median price difference between inter-dealer trades and best live offer quotes (lowest offered price) residing on the two ATSs at the time of a trade was zero for both 2018 and 2022, and -0.05 basis points (or -\$0.50 per bond) for 2021, as shown in Table 10. In addition, about half of all inter-dealer trades were executed within 25 basis points (0.25%, or \$2.50 per bond) of a best offer quote in all three periods.⁴⁰ For example, the spread between the 30th and 70th percentile range was only 20 basis points in 2018, 25 basis points in 2021 and 19 basis points in 2022.⁴¹ These results suggest that live offer

³⁷ As illustrated above, only 0.3% of all RFQs were requests for offers. Therefore, only live offer quotes are included when comparing with inter-dealer trades and customer buy trades.

³⁸ In reality, dealers would also see live offer quotes from other ATS platforms and/or broker's broker networks.

³⁹ At least one live offer quote for inter-dealer trades and customer buy trades, and at least one live bid quote or one bid response to an RFQ for customer sell trades.

⁴⁰ While customer trades tend to pay a higher spread due to dealers providing services to execute the trades, inter-dealer trades, in theory, should also have a spread, as one side typically initiates a trade as a liquidity taker, although the spread would be much narrower than what a customer trade would have. Therefore, it is not surprising that half of inter-dealer trades were executed at more than 25 basis points away from the best offer quotes.

⁴¹ Other factors, such as interest rates and volatility, could also impact the trade price dispersion around the best offer quote, as a higher-interest-rate environment and a higher-volatility environment may increase the likelihood that trade prices would scatter. In fact, interest rates were increasing between 2018 and 2022, especially in 2022.

quotes continue to be informative to market participants executing inter-dealer trades and provide a useful indicator for these trades. This is perhaps not surprising, as dealers and institutional investors tend to have access to pre-trade quotes on the platforms.

Table 10. Difference in Trade Price and Best Offer Quotes – Inter-Dealer Trades

	2018 Data (June-November)	2021 Data (April-June)	2022 Data (April-June)
Number of Trades	1,463,107	488,888	1,004,149
Price Difference by Percentile			
5th	(1.93)	(1.57)	(2.00)
10th	(1.19)	(1.04)	(1.12)
20th	(0.48)	(0.53)	(0.32)
30th	(0.20)	(0.25)	(0.13)
40th	(0.08)	(0.13)	(0.05)
50th	0.00	(0.05)	0.00
60th	0.00	0.00	0.00
70th	0.00	0.00	0.07
80th	0.14	0.16	0.24
90th	0.54	0.60	0.64
95th	1.02	1.34	1.29

Source: MSRB analysis with data obtained from RTRS and two alternative trading systems.

Table 11 illustrates the difference in customer trade prices and the consolidated best quotes ranked in percentiles for the relevant periods, with a lower percentile being more favorable to customers.⁴² For those trades with at least one quote at the time of an execution, the median price difference between customer buy trades and best offer quotes (lowest live offer price) was 38 basis points in 2018,⁴³ 5 basis points in 2021 and 22 basis points in 2022.⁴⁴ If equating the price difference to the markup that a dealer charges a customer to get a trade executed, the customer paid less of a markup in 2021 and 2022 than in 2018, even though the decline over

⁴² The formula used is customer trade price—best quoted price. For customer buy trades, a lower number (less positive or more negative) is more beneficial to the customers, while for customer sell trades, the percentile ranking is reversed in Table 11 to reflect the fact that a higher number (less negative or more positive) is more beneficial to the customers.

⁴³ Trade price was 0.38% higher than the best offer quote.

⁴⁴ The increase from 5 basis points in 2021 to 22 basis points in 2022 was likely due to the rising interest rates and volatility in 2022.

the period did not exhibit a straight-line downward trajectory.⁴⁵ On the other hand, the median price difference between customer sell trades and best bid quotes (highest of bid response price to RFQs and/or live bid price) was zero basis points in 2018, 10 basis points in 2021 and 10 basis points in 2022. In the case of a customer sell trade, a positive price difference illustrates that the customer is receiving a better sell price than the highest bid quote, which is equivalent to a negative markdown. Therefore, customer sell trades were receiving increasingly negative markdowns between 2018 and 2022, suggesting an improvement for the selling customers, similar to the customers purchasing municipal securities. These findings are in line with MSRB's recent research showing a steady decline of the effective spread between customer buy and customer sell trades in recent years.⁴⁶ The improvement in customer trade price may be the result of increased quote provision, therefore more quotes available at the time of a trade and increased quote price competition by market participants. In addition, quoted prices may have also become more visible to market participants, and therefore more informative to execution prices for customer trades.

The fact that the median difference between the customer sell trade price and the highest bid quote was either at zero or above zero would seem surprising, as typically a dealer would charge a markdown so that the customer sell price would be lower than the highest bid quote. This is, however, not entirely impossible and is likely explained by the following factors. First, some of the customer sell trades may be initiated by separately managed accounts (SMAs) affiliated with a dealer firm that typically charges a fee for managing the accounts based on the amount of assets under management rather than a per-transaction markup. Second, it should be noted that not all of these customer sell trades are directly tied to an RFQ process or a live bid. While live quotes are visible to nearly all market participants who have access to ATS quotes, responses to RFQs are only visible to requesting dealers but not to other market participants. Third, it is possible that there may be other outstanding live bids or an RFQ requesting dealer might have solicited additional responses from other ATS, broker's broker or electronic platforms, and the actual best bid quote could have been higher than the best bid quote from the two ATS platforms in this analysis. If this is true, the median difference between the actual best bid response and customer sell trade price (markdown) would have been higher than zero. Fourth, it is also possible that a dealer for a customer sell order might have considered that the best bid quote was too low based on other bond valuation criteria, or a dealer may have had a higher bid internally but chose not to enter the bid into the auction. In that case, the dealer could have internalized the customer sell order by buying the bond at a price that was higher than the best bid received. Lastly, when comparing the amount of markdown to the amount of markup, past research has indicated that the markdown

⁴⁵ As alluded to above, the municipal securities market experienced one of the slowest trading volume years in 2021 and one of the highest trading volume years in 2022. MSRB research showed that the customer transaction costs hit the lowest level in 2021 but bounced back significantly from 2021 to 2022 when interest rates rose sharply. See Wu, Simon and Nicholas Ostroy, "What Has Driven the Surge in Transaction Costs for Municipal Securities Investors Since 2022?" August 2023.

⁴⁶ See Wu, Simon "Transaction costs for Customer Trades in the Municipal Bond Market: What is Driving the Decline?" July 17, 2018; and Wu, Simon and Nicholas Ostroy, "What Has Driven the Surge in Transaction Costs for Municipal Securities Investors Since 2022?" August 2023.

amount for customer sell trades tends to be significantly lower than the markup amount for customer buy trades in municipal securities.⁴⁷

Table 11. Difference in Trade Price and Best Quotes—Customer Buy and Sell Trades⁴⁸

	2018 Data (June-November)		2021 Data (April-June)		2022 Data (April-June)	
	Customer Buy	Customer Sell	Customer Buy	Customer Sell	Customer Buy	Customer Sell
Number of Trades	1,422,287	580,662	486,405	361,642	961,083	643,772
Price Difference Percentile						
5th	(1.04)	1.70	(0.68)	2.32	(0.97)	2.87
10th	(0.39)	0.99	(0.35)	1.44	(0.32)	1.76
20th	(0.05)	0.46	(0.15)	0.68	(0.06)	0.79
30th	0.00	0.25	(0.07)	0.34	0.00	0.39
40th	0.10	0.10	0.00	0.20	0.10	0.21
50th	0.38	0.00	0.05	0.10	0.22	0.10
60th	0.84	0.00	0.17	0.02	0.55	0.06
70th	1.25	(0.10)	0.50	(0.02)	1.00	0.02
80th	1.71	(0.39)	1.08	(0.18)	1.50	0.00
90th	2.07	(0.78)	1.97	(0.70)	2.03	(0.28)
95th	2.43	(1.15)	2.50	(1.13)	2.57	(0.71)

Source: MSRB analysis with data obtained from RTRS and two alternative trading systems.

⁴⁷ For example, using a slightly different methodology based on 2014 data, the 2018 SEC study found the markdown for customer sell trades averaged 7.8 basis points, with a median of 23.2 basis points, while the markup for customer buy trades averaged 78.5 basis points, with a median of 75.7 basis points, during the period from August 2014–November 2014. See Craig, Louis, Abby Kim and Seung Won Woo. “Pre-Trade Information in the Municipal Bond Market.” Division of Economic and Risk Analysis of the SEC. July 2018.

⁴⁸ For both customer buy and sell trades, the percentile ranking is based on how favorable to a customer trade when compared with the best quote at the time of the trade, with the lowest percentile (*i.e.*, the 5th percentile) reflecting the most favorable to the customer trade.

Conclusions

In summary, the analysis of ATS quote data indicates a significant increase in the amount of RFQs, responses to RFQs and live quotes between 2018 and 2022. RFQs, responses to RFQs, live quotes and trades on the two ATS platforms all nearly or more than doubled during the period, ranging from a 92.4% to an 125.4% increase, compared to an only 37% increase in trades in the broader municipal securities market. In addition, there was a trade price improvement for both customer buy and sell trades relative to the best quotes at the time of a trade between 2018 and 2022, likely as a result of increased quote provision, therefore more quotes available at the time of a trade and increased quote price competition by market participants. These findings are in line with MSRB's recent research showing a steady decline in the effective spread between customer buy and customer sell trades in recent years.

Overall, there has been some decline of market quality when comparing the high-volume, high-volatility year of 2022 to the low-volume, low-volatility year of 2021, though pre-trade data continued to demonstrate its relevance and usefulness for the market. The number of responses to RFQs went down from a median of seven responses in 2021 to a median of five responses in 2022, with slightly more RFQs not receiving any responses in 2022. In addition, the average difference between customer buy trade prices and best offer quotes increased from 5 basis points in 2021 to 22 basis points in 2022. These changes, however, were not unexpected, and the statistics for 2022 were still superior to the comparable statistics for 2018.

Separately, for RFQs, the preliminary analysis confirms the results from the prior analysis, that the execution rate on the ATS platforms was higher when more responses were received. The median number of responses per each RFQ varied between five and seven responses during the period. However, despite the steadiness in the number of responses, the overall trade-to-request ratio continued to decline, falling from 21.4% in 2018 to 14.1% in 2022. For live quotes, there were significantly more two-sided live bid-and-offer quotes in 2021 and 2022 than in 2018, with 22.6% of the live quotes in 2021 and 17.2% of live quotes in 2022 containing both bids and offers, as opposed to only 5% of live quotes being bid-and-offer quotes in 2018. Still, a vast majority of live quotes were solely offer quotes in all three years, ranging from 72.9% in 2021 to 89.7% in 2018, with a miniscule amount of live quotes being solely bid quotes (less than 5%). Furthermore, when examining the average number of dealers posting live offer quotes for each CUSIP number at the 10 a.m. snapshot, for ATS 1, the percentage of CUSIP numbers with a single dealer quoting declined from 80.6% in 2018 to 75.4% in 2021 and 70% in 2022, with a corresponding rise in the percentage of CUSIP numbers with two or more dealers quoting. By comparison, there was not much change in the percentages of CUSIP numbers with single dealers or two or more dealers quoting for ATS 2. Finally, there was a lower share of individual investor-sized trades executed against a live quote in 2021 and 2022 than in 2018, declining from 92% in 2018 to 87.1% in 2021 and 82.7% in 2022. This drove the average trade size up, though the median trade size remained at \$25,000 par value throughout the period.

We caution that this analysis reflects market dynamics where generally only subscribers to an ATS platform could access pre-trade information. If some or all of the pre-trade information had been available to a broader market, the quoting and trading patterns observed in this report may have been different due to possible behavioral adjustments by market participants and changes in market structure and liquidity in reaction to broader quote dissemination. In addition, while the pre-trade quote data from the two ATS platforms represent a large portion of the market, it should be noted that there exists additional pre-trade information available on other venues that

is not captured in this report. It is possible a few additional ATS platforms and/or other trading venues may continue to grow their market share and become more prominent in the municipal securities market in upcoming years. In addition, since the two ATS platforms are predominantly used for individual investor-sized trades, the findings in this report may not represent the trading and quoting behavior on other electronic venues with mainly institutional investor-sized pre-trade information, as well as additional liquidity provision that may not be visible on any electronic platform. Given the ever-changing market landscape and a continuing interest in pre-trade-related market structure issues, it would be beneficial to examine data from an electronic platform primarily servicing institutional investors for comparison in the future.

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Appendix A—About the Authors

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ABOUT THE MSRB

The Municipal Securities Rulemaking Board (MSRB) protects and strengthens the municipal bond market, enabling access to capital, economic growth, and societal progress in tens of thousands of communities across the country. The MSRB fulfills this mission by creating trust in our market through informed regulation of dealers and municipal advisors that protects investors, issuers and the public interest; building technology systems that power our market and provide transparency for issuers, institutions, and the investing public; and serving as the steward of market data that empowers better decisions and fuels innovation for the future. The MSRB is a self-regulatory organization governed by a board of directors that has a majority of public members, in addition to representatives of regulated entities. The MSRB is overseen by the Securities and Exchange Commission and Congress.



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