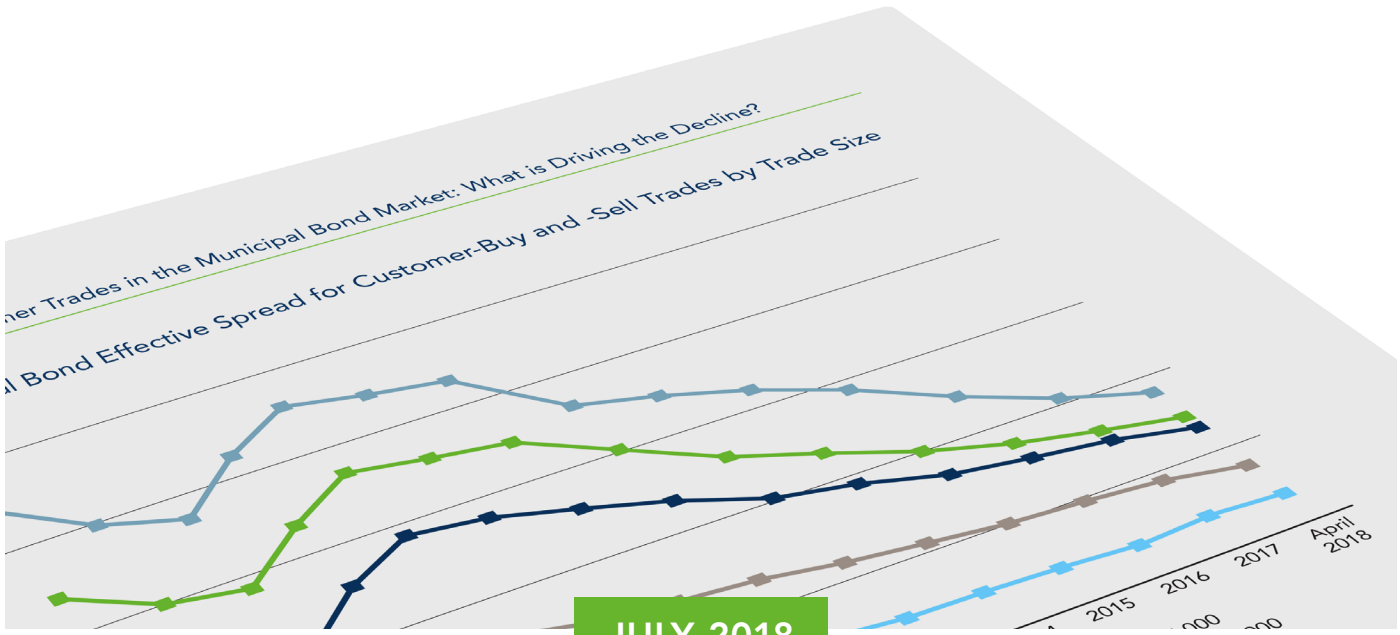




Municipal Securities Rulemaking Board



JULY 2018

Transaction Costs for Customer Trades in the Municipal Bond Market: What is Driving the Decline?

Note: Municipal variable rate securities excluded from analysis.
Source: MSRB

This analysis shows that the decline in effective spread for trades of \$10,000 par value or less, while dramatic, is approaching 60% for customer trades. However, despite the narrowing gap, smaller-sized effective spread (and transaction costs) than larger-sized trades as of 2017.

On the other end, the average effective spread for over-\$1,000,000 trades has been relatively constant in recent years. In light of the fact that smaller-sized trades have historically demanded more liquidity than larger-sized trades, the overall market liquidity for institutional size transactions has not worsened since the financial crisis. Other factors contributing to the drop in spread for smaller-sized trades include the implementation of various market-making initiatives, both of which have helped to narrow the bid-ask spread. Other factors contributing to the decline in spread for smaller-sized trades are discussed in detail in the report above.

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Abstract¹

Trading activity in the municipal bond market has been relatively stable over the past decade, while effective spread, which measures transaction costs paid by investors to execute a trade, has steadily declined. Between 2005 and April 2018, the average effective spread for all dealer-to-customer municipal securities trades declined by 51 percent to 73 basis points; for retail-sized customer trades, the decrease of 55 percent, to 80 basis points, was even more pronounced. Given the Municipal Securities Rulemaking Board's (MSRB) fundamental mission to ensure a fair and efficient market, MSRB staff determined to explore the likely causes of the decrease in effective spread. The findings of this analysis indicate that market-wide technological advancements as well as MSRB's regulatory activities to protect investors and enhance transparency likely accounted for a significant portion of this downward trend. This research establishes a benchmark for future research, particularly given the dynamic nature of the financial markets. The purpose of this report is twofold: 1) to provide market participants and other stakeholders with additional perspective on the evolving nature of municipal securities transaction costs; and 2) to promote further research on this topic, such as examining the effective spread in the post-dealer compensation (mark-up) disclosure environment starting from May 14, 2018.

¹ The views expressed in the research papers are those of the author and do not necessarily reflect the views and positions of the MSRB.

I. Introduction and Background

Spread is a common measure of transaction costs paid by investors to execute their trades and is one barometer of financial market liquidity for economists.² Transaction costs are important to investors because they are among the key determinants of net investment returns. Transaction costs diminish returns and can be an important factor in an investor's decision to invest in certain types of securities. Contributing factors to transaction costs generally include characteristics of individual securities, market liquidity, counter-party search cost and dealer-customer bargaining power as a result of information opacity.³

Academic economists have developed several methods to measure spread. A quoted bid-ask spread is a common transaction cost measure, especially for the equity market where quotes are consolidated and widely available, and securities are listed and primarily traded on an exchange. Bid-ask spread is calculated as the difference between the lowest ask quote and the highest bid quote and represents indicative transaction costs before a trade is executed. A related metric is the effective spread, which is calculated based upon actual trade execution price and is perhaps a better proxy for true transaction costs. In markets such as the municipal securities market, where quotes are not universally available or consolidated, the effective spread is the preferred method for assessing transaction costs.

In the context of this analysis, the effective spread is calculated as the difference between the price a selling investor receives for a security and the price a purchasing investor pays, with dealers acting as intermediaries assisting the purchasing and selling. The spread therefore also represents the gross compensation received by dealers — known as a mark-up/mark-down in the securities industry — for providing liquidity. In the municipal bond market, actual transaction costs incurred by investors can also include brokers' commissions for a small percentage of agency-based trades.⁴

² See Division of Economic and Risk Analysis, the Securities and Exchange Commission, "Report to Congress — Access to Capital and Market Liquidity," August 2017.

³ See Cuny, Christine, "Municipal disclosure and the small trade premium," Working Paper, November 28, 2016; Green, Richard, Burton Hollifield and Norman Schürhoff, "Financial Intermediation and Costs of Trading in an Opaque Market," *Review of Financial Studies*, Volume 20, 2007; and Harris, Larry and Michael Piwowar, "Secondary Trading Costs in the Municipal Bond Market," *Journal of Finance*, Volume 61, 2006. "Search cost" is defined as the cost investors and dealers incur when seeking a counterparty to trade, while "information opacity" refers to the cost of gathering fundamental information that affects an investor's bargaining power with dealers.

⁴ MSRB's Real-Time Transaction Reporting System (RTRS) database converts the commission amount to the same units as dollar price and computes and disseminates a net dollar transaction price to customers inclusive of commission amount. See "Specifications for Real-Time Reporting of Municipal Securities Transactions," Version 3.0, July 2016.

a. Background on the Municipal Bond Market

The municipal bond market in the United States is one of the main sources of capital for municipal entities. 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. At the end of 2017, the outstanding principal value of municipal securities was estimated to be approximately \$3.9 trillion.⁵

The municipal bond market also provides important investment opportunities for investors (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 regular interest payments, usually paid semi-annually, and the return of the original investment, or “principal” either on a pre-specified maturity date or on a call date when the issuer is repaying the bond before its 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 state laws and an investor’s residency.⁶ Other market participants, such as brokers, dealers and municipal securities dealers (collectively, “dealers”), as well as proprietary-trading firms, seek trading profits by making a market for municipal bonds and charging a spread or a commission on trades with investors or other market participants.

The MSRB has collected and disseminated post-trade data since 1995, such as the RTRS data since January 2005 and its predecessor Transaction Reporting System (TRS) data.⁷

b. Municipal 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 approximately one-million outstanding municipal securities, the likelihood of any specific security trading on a given day is about one percent.⁸ Notwithstanding the infrequent secondary market trading in individual municipal securities, aggregated daily trading activity in the market is substantial. During the period from 2010 to 2017, an average of nearly 39,000 transactions in municipal securities was reported to the MSRB each business day, resulting in an average total trading (par) value of about \$11 billion per day.

⁵ March 2018 estimates. See Financial Accounts of the United States, Table L-211. This compares to the public corporate securities market which has approximately 5,500 issuers, who have issued approximately 50,000 individual securities. See SIFMA 2017 Fact Book.

⁶ 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. 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.

⁷ By contrast, the MSRB currently does not collect pre-trade information, such as quotation (price and size) data for municipal bonds available on electronic or proprietary systems signaling trading interests.

⁸ Source: MSRB 2017 Fact Book.

Unlike the equity market, the municipal bond market largely functions as an over-the-counter market, where investors place their orders with dealers directly. Dealers either execute the orders by committing dealer capital (principal trades) or by searching a counterparty in the market to facilitate the transactions, with the dealers charging a mark-up or a commission to the investors.⁹

The municipal securities market is highly fragmented due to, among other reasons, its size, number of issuers, varying tax treatment by states, low trading volume and lack of centralized exchanges. In contrast to common practices in other markets, the relatively illiquid nature of the municipal market and the mostly buy-and-hold investor positions make the ability to locate a counterparty to trade municipal bonds more difficult. Furthermore, market participants cannot cost-effectively short municipal securities as shorting can be cost-prohibitive for various reasons, including tax regulation promulgated by the Internal Revenue Service and the difficulty of locating municipal bonds for borrowing.¹⁰ Therefore, unlike in other securities markets, dealers and other market participants mostly avoid offering municipal bonds to the market if they do not already own the bonds in inventory or know they can readily source the bonds if necessary.

⁹ The dealer's compensation depends on the type of trade in which it engages — principal, riskless principal or agency.

¹⁰ Most municipal securities have tax-exempt status; as a result, short positioning municipal securities is rare because the Internal Revenue Service does not allow both a borrower and lender of a municipal security to claim a tax exemption.

II. Recent Developments in the Municipal Bond Market

There have been a number of significant developments in the municipal bond market since January 2005. First, usage of electronic trading systems, particularly among dealers, proprietary trading firms and sophisticated institutional investors, has become more prevalent. Next, as implemented by the MSRB, a significant transition occurred in post-trade price transparency from next-day to 15-minute public dissemination of trade prices to market participants. In addition, the MSRB created the Electronic Municipal Market Access (EMMA[®]) website to expand public availability of municipal securities primary offering documents and secondary market trading information. The financial crisis of 2008 and 2009 also had a dramatic impact on the financial markets, including the municipal securities market, especially in terms of the elevated credit risk associated with bonds, multiple downgrades of mono-line insurance companies and fleeting market liquidity in certain sectors of the market place or during a period of market stress.

a. Electronic Trading Venues

The advent of electronic trading venues in the fixed income market has changed the trading landscape in the last two decades. Prior to 2000, voice-based trading was the common medium of trading in the fixed income market, including the dealer-to-customer market as well as in the inter-dealer market.¹¹ Since then, electronic trading systems have progressed, especially in the inter-dealer market where in the municipal securities market alternative trading systems account for nearly 60% of the inter-dealer trades.¹²

An alternative trading system (ATS) is an electronic trading system that is not regulated as an exchange but is a venue for matching the buy and sell order of its subscribers.¹³ The two main functions of an ATS are: posting and soliciting price quotes electronically; and electronic execution of a trade against posted quotes. Electronic trading may facilitate the management of dealer inventory and reduce counterparty search costs, as trading interests are more visible to subscribers.¹⁴

All ATSs are registered as broker-dealers and are regulated as such under the Securities Exchange Act of 1934 as well as Regulation ATS, introduced by the Securities and Exchange Commission (SEC) in 1998.¹⁵ An ATS and broker's broker offer anonymity as an incentive to subscribers who post quotes on their systems. As a result, market participants such as

¹¹ See Mattmann, Brian, "Electronic Trading Platforms in an Evolving Bond Market: An Overview." Lucerne University of Applied Sciences and Arts, November 2017.

¹² See MSRB Market Insight, "Inter-Dealer Municipal Trading," November 2017. By comparison, almost 85% of investment grade corporate bond investors and close to 73% of high-yield corporate bond investors use electronic trading. See Leising, Matthew and Molly Smith, "Electronic Bond Trading Gains Ground," Bloomberg, February 15, 2018. Corporate bonds, however, are very different from municipal bonds in terms of the number of issuers, liquidity, types of investors and credit risks, among others.

¹³ ATSs are also known as electronic communication networks (ECNs), cross networks and call networks, depending on the situation.

¹⁴ See Division of Economic and Risk Analysis, the Securities and Exchange Commission, "Report to Congress — Access to Capital and Market Liquidity," August 2017.

¹⁵ Regulation ATS was designed to protect investors and resolve any concerns arising from ATSs by requiring stricter record keeping and demand more intensive reporting on issues like market transparency once an ATS reaches more than five percent of the trading volume of any given security. See Rule 301 (b)(5)(ii) of Regulation ATS. Unlike national exchanges, ATSs do not set rules governing the conduct of their subscribers or discipline subscribers in any way other than severing the business relation and excluding them from trading, as ATSs are not registered as a self-regulatory organization (SRO) like a national exchange would be.

dealers, proprietary trading firms and some institutional investors often prefer to use an ATS or broker’s broker to find counterparties for trading because there is less risk of being subject to front-running or stepping ahead by revealing their trading intention.

Before the advent of ATSs and other electronic messaging systems such as the Bloomberg® Terminal, municipal securities market participants primarily relied upon a broker’s broker to perform similar functions as the modern-day ATS, such as engaging in anonymous trading.¹⁶ The broker’s broker business model offered a voice-to-voice brokerage (i.e., via the usage of a telephone) to search for counterparty liquidity, though in recent years the model has evolved into a hybrid of telephone and electronic systems.¹⁷ The ATS and other technological advancements have greatly improved the efficiency of trading and likely reduced the counterparty search costs, potentially passing the savings onto investors.

b. Recent Regulatory Developments in Transparency

Since 2005, the MSRB has undertaken a series of initiatives aimed at improving the secondary market trading for investors in the municipal securities market. Table 1 summarizes these key regulatory and transparency changes relevant to secondary market trading between 2005 and 2018.

Table 1. Timeline of MSRB Regulatory Changes Relevant to Secondary Market Trading

Timeline	Event
January 2005	MSRB establishes the Real-Time Transaction Reporting System (RTRS)
March 2008	MSRB launches EMMA® website, which includes post-trade information
January 2009 to December 2017	MSRB makes numerous EMMA transparency and functionality improvements, including voluntary bank loan disclosure, special indicators for trades, security credit ratings and price discovery tools
March 2016	MSRB establishes best-execution rule for transactions in municipal securities
May 2018	MSRB establishes mark-up disclosure rule for certain retail customer transaction in municipal securities

The MSRB’s initiatives were intended to provide transparency, improve trading execution and expand investors’ access to information about municipal securities, particularly retail investors who traditionally have had more limited information than professional market participants regarding municipal security pricing and trading mechanisms. As indicated in the following economic literature summary, a more informed investor is likely to have more effective negotiating power with dealers who execute trades on their behalf.

¹⁶ A broker’s broker acts as an agent or riskless principal in the purchase or sale of securities for registered broker-dealers, institutions and other sophisticated market participants. They act in the limited capacity of providing anonymity, information flow, liquidity, transparency and order matching, and are compensated by a transaction commission rather than a mark-up.

¹⁷ See SIFMA’s “The Role of Municipal Securities Broker’s Broker in the Municipal Markets,” 2014.

c. Market Liquidity

In the aftermath of the financial crisis, market liquidity has become a renewed focus in the fixed income market. Economists and market participants generally define market liquidity as a market feature whereby an individual or a firm can quickly purchase or sell a financial asset without causing a drastic change in the asset's price. Liquidity is an important consideration for investors and in policy discussion involving market structure.¹⁸

Market participants in recent years have expressed concerns about difficulties in sourcing liquidity after the financial crisis as a result of transformative changes in the fixed income markets due to a combination of regulatory initiatives, policy considerations and market innovations, with a particular focus on reduced dealer inventory and the possible retreat from liquidity provisions by banks and dealers in the bond market.¹⁹ In addition, while the markets may function well on an average trading day, there have been several noticeable "flash" crashes in the fixed income markets in recent years due to fleeting liquidity and market volatility, such as the 2013 "Taper Tantrum" in response to Federal Reserve's monetary policy changes and the October 15, 2014 flash crash in the Treasury market. On the other hand, recent empirical research studies either did not find any or found only limited evidence consistent with deterioration of market liquidity in the fixed income markets during the post-Dodd-Frank Congressional Act era.²⁰ Those studies primarily focused on the United States Treasury securities, corporate bond and credit default swap markets.

While these empirical studies did not cover the municipal bond market, Chart 1 shows that when measuring market liquidity in the municipal bond market with the total annual par value traded, on average, liquidity has been steady since the end of the financial crisis in 2009. The annual trading volume consistently hovered near \$1.4 trillion par value between 2009 and 2017. Trading activity is one metric of measuring liquidity, with greater activity likely reflecting an increased ability of a market participant to buy or sell a bond.²¹ This analysis, however, does not isolate stress periods when market liquidity is needed the most but tends to disappear at least momentarily.²²

¹⁸ See e.g., the 2018 agenda of the Fixed-Income Market Structure Advisory Committee (FIMSAC) sponsored by the SEC.

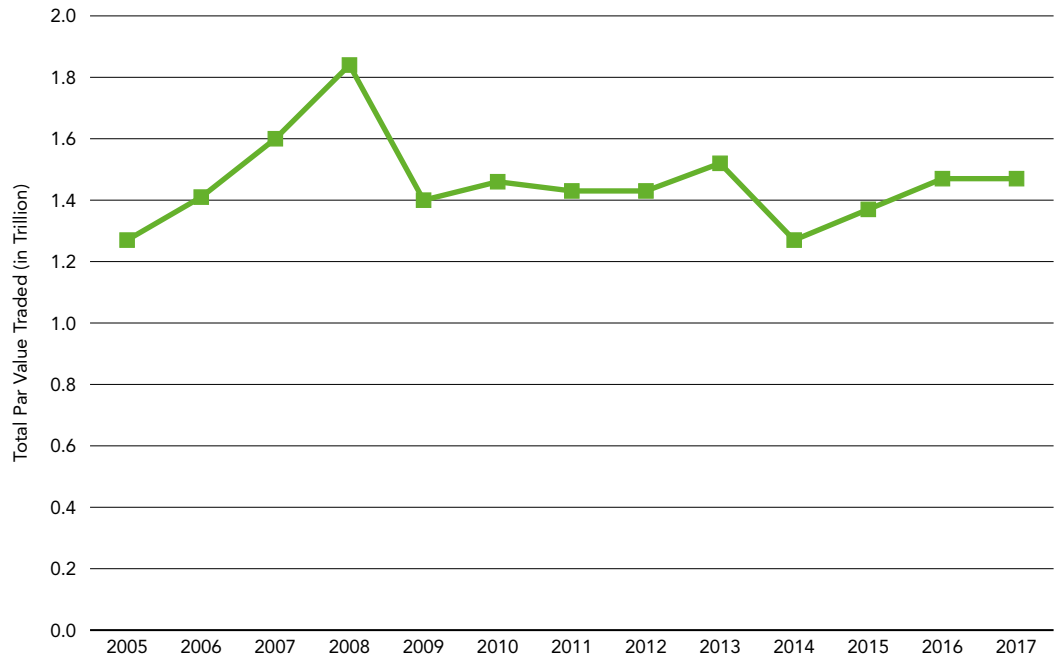
¹⁹ See Mattmann, Brian, "Electronic Trading Platforms in an Evolving Bond Market: An Overview," Lucerne University of Applied Sciences and Arts, November 2017; and MSRB, "Trends in Municipal Bond Ownership," 2017.

²⁰ See Division of Economic and Risk Analysis, the Securities and Exchange Commission, "Report to Congress — Access to Capital and Market Liquidity," August 2017; and Adrian, Toby, Michael Fleming, Or Shachar and Erik Vogt, "Market Liquidity after the Financial Crisis," Federal Reserve Bank of New York Staff Reports, June 2017.

²¹ See Division of Economic and Risk Analysis, the Securities and Exchange Commission, "Report to Congress — Access to Capital and Market Liquidity," August 2017.

²² See Franklin Templeton, "Taper Tantrum Grips Muni Market," Beyond Bulls & Bears U.S. Edition, July 3, 2013.

Chart 1. Municipal Bond Total Par Value Traded in the Secondary Market (2005–2017)

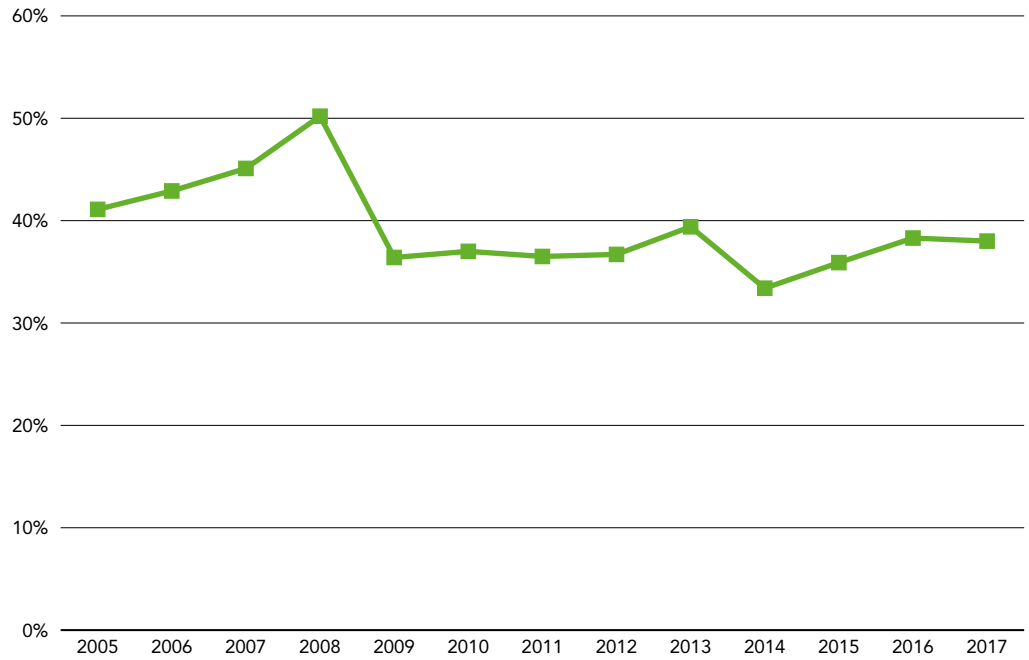


Note: Municipal variable rate securities are excluded from this analysis.
 Source: MSRB

Another metric frequently used by economists to measure liquidity is the turnover ratio, which measures the annual trading volume relative to the amount of outstanding assets.²³ Chart 2 shows the annual turnover ratio for municipal securities was relatively stable between 2009 and 2017, mostly fluctuating between 35% to 40%.

²³ See Division of Economic and Risk Analysis, the Securities and Exchange Commission, “Report to Congress — Access to Capital and Market Liquidity,” August 2017.

Chart 2. Municipal Bond Turnover Ratio (2005–2017)



Note: Municipal variable rate securities are excluded from this analysis.²⁴
 Source: MSRB and the Federal Reserve

A recently published paper by Schwert (2017) also implies that the tax-adjusted yield spread attributable to the liquidity risk for a typical municipal bond had been relatively steady after the financial crisis from 2010 to 2015.²⁵

²⁴ When including municipal variable rate securities in Chart 1 and Chart 2, the conclusion for the post-2009 period is still valid: the total par value traded in the secondary market and the turnover ratio were both stable.

²⁵ See Schwert, Michael, "Municipal Bond Liquidity and Default Risk," *Journal of Finance*, Volume 72, Issue 4, August 2017.

III. Review of Academic Literature

While fewer academic studies have been performed on trading-related issues in the municipal securities market as compared to some of the other financial markets, since 2005 several research papers have focused on transaction costs in the municipal bond market.

Harris and Piwowar (2006) estimated transaction costs from a one-year (November 1999 through October 2000) sample of municipal bonds and found that transaction costs decrease with trade size but increase with instrument complexity, time to maturity and time since issuance, and do not depend on trade frequency. The authors attributed these results to the general lack of price transparency in the municipal bond market.

Green, Hollifield and Schürhoff (2007) confirmed what Harris and Piwowar (2006) found in the municipal bond market by concluding that dealers earn lower average mark-ups on larger trades, even though dealers bear a higher risk of losses with larger trades. They estimated a bargaining model and computed measures of dealers' bargaining power, and found dealers exercise substantial market power. Their measures of market power decrease in trade size and increase in the complexity of the trade for the dealer.

In 2014, Erik Sirri, Professor of Finance at Babson College, published an MSRB-sponsored study of customer-to-customer transaction chains through which municipal securities move from a customer selling a security into the market through one or more dealers to a new customer purchasing the same security in the secondary market from a dealer. For each transaction chain, Sirri matched customer trades based on dealer identity, CUSIP number, aggregate trade size and a last-in-last-out algorithm. Sirri then calculated the total customer-to-customer differentials (transaction costs) based on the transaction chains during the period from 2003 to 2010 and found there was a statistically significant decline in the differential after the implementation of the MSRB's RTRS in January 2005.

Bergstresser and Luby (2017) measured trading costs by identifying matched trades for the period from 2000 to 2016 through a sequence with a bond purchase from a customer, followed by sales to customers of the same bond in the same amounts, potentially with inter-dealer trades between the customer purchase and sale. Their data also illustrated a downward trend in transaction costs during the covered period.

Finally, Chalmers, Liu and Wang (2017) also examined the impact of the RTRS trade reporting on customer trading costs. They matched customer buy and sell trades based on CUSIP number, trade size and the first-in-first-out algorithm for the period from 2002 through 2012 and concluded that the 2005 initiation of the RTRS and the real-time dissemination of trade data had a statistically significant downward effect on municipal bond transaction costs.

In addition to academic literature devoted to transaction costs in the municipal bond market, there also have been research papers focusing on the corporate bond secondary market, among those are Goldstein (2007), Edwards (2007), Bessembinder (2007) and the most recent paper from Adrian, Fleming, Shachar and Vogt (2017). These papers generally found similar trends in the corporate fixed income market, such as the overall decline in transaction costs since early 2000, the decrease in transaction costs with trade size but increase with the complexity of the bond, and the decline in execution costs after the introduction of the TRACE reporting system because of post-trade transparency and the ability of investors to negotiate better terms of trade with dealers once they had access to such information.

IV. Empirical Analysis

Very few academic research papers have captured the trend of municipal bond transaction costs after 2012. In this report, the MSRB examines the most recently available municipal bond transaction data and performed the following analyses: 1) a time series analysis of transaction costs for municipal bond dealer-to-customer trades by calculating effective spread from January 2005 through April 2018 (“Time Series Analysis”); 2) a regression analysis that controls for idiosyncratic characteristics of the aggregate pool of municipal bonds over the same period (“Regression Analysis”); and finally, 3) a difference in differences analysis comparing dealer-to-customer trades’ effective spread to inter-dealer trades’ effective spread for the same security traded on the same day (“Difference in Differences Analysis”) over the relevant period.

a. Data and Methodology

The MSRB’s RTRS trade reporting data are mainly used for this analysis, in addition to third-party descriptive data that show an individual security’s relevant characteristics such as coupon rate, insurance status, type of issuance, rating status and bond maturity date.

Similar to the working paper of Adrian, Fleming, Shachar and Vogt (2017) published by the Federal Reserve Bank of New York, which concentrated on liquidity and transaction costs for the U.S. Treasury and corporate bond markets, municipal bond effective spreads are computed daily for each bond as the difference between the average (volume-weighted) dealer-to-customer buy price and the average (volume-weighted) dealer-to-customer sell price, and then averaged across bonds using equal weighting.²⁶ This is a straight-forward methodology measuring effective spread for *same-day* customer transactions with dealers without relying upon complex matching algorithms based on assumptions.

All secondary market customer purchase and sell trades are included in this analysis, except for variable-rate securities.²⁷ To be eligible for this analysis, for each trading day, each security CUSIP number must have at least one customer purchase and one customer-sell trade for both Time Series Analysis and Regression Analysis and, in addition, at least one inter-dealer trade for Difference in Differences Analysis.²⁸

The beginning period of January 2005 represents the initiation of the MSRB’s RTRS, and the end point of April 2018 represents the last month before the MSRB’s requirement that dealers, when acting as principal, disclose compensation (mark-up) on retail customer trade confirmations, which went into effect on May 14, 2018.²⁹

²⁶ This method corresponds to round-trip transaction costs to customers.

²⁷ Primary offering transactions are not included in this analysis. In addition, Sirri (2014) and Chalmers, Liu and Wang (2017) also excluded variable rate securities in their analyses.

²⁸ As a result, the sample size for Difference in Differences Analysis is smaller than the size for Time Series Analysis and Regression Analysis.

²⁹ See “MSRB Provides Implementation Guidance on Confirmation Disclosure and Prevailing Market Price,” July 12, 2017.

b. Trading of Municipal Bonds in the Secondary Market

Historically, the municipal bond market is characterized as a “buy-and-hold” market where investors, especially retail investors, purchase a bond with an intent of holding the bond until its maturity.³⁰ Seldom are those bonds resold to the market before their maturities; therefore, the volume of customer-buy transactions significantly exceeds the volume of customer-sell transactions, as shown in Table 2. However, in recent years, there has been a gain in the market share of customer-sell volume relative to customer-buy volume, suggesting a more frequent turnover of securities among at least some investors of municipal securities.

Table 2. Percentage Breakdown of Trade Type by Par Value (2005–2018)

Year	Customer Buy	Customer Sell	Inter-Dealer
2005	43.7%	26.2%	30.2%
2006	40.2%	27.3%	32.5%
2007	42.6%	29.1%	28.3%
2008	43.9%	28.4%	27.6%
2009	40.3%	27.7%	32.0%
2010	41.8%	27.7%	30.5%
2011	38.8%	30.0%	31.2%
2012	36.4%	26.2%	37.4%
2013	36.8%	28.9%	34.3%
2014	36.1%	27.6%	36.3%
2015	36.5%	26.8%	36.7%
2016	37.8%	28.3%	33.9%
2017	38.3%	29.7%	31.9%
April 2018	38.7%	31.6%	29.7%

Note: Municipal variable rate securities are excluded from this analysis.

Source: MSRB

Inter-dealer trades have consistently made up between 28% and 37% of all par value traded during the period, with no discernable trend. With the electrification of trading mechanisms, inter-dealer trades are increasingly occurring on an ATS, with about 60% of all inter-dealer trades reported through ATSs as of the end of 2017.³¹

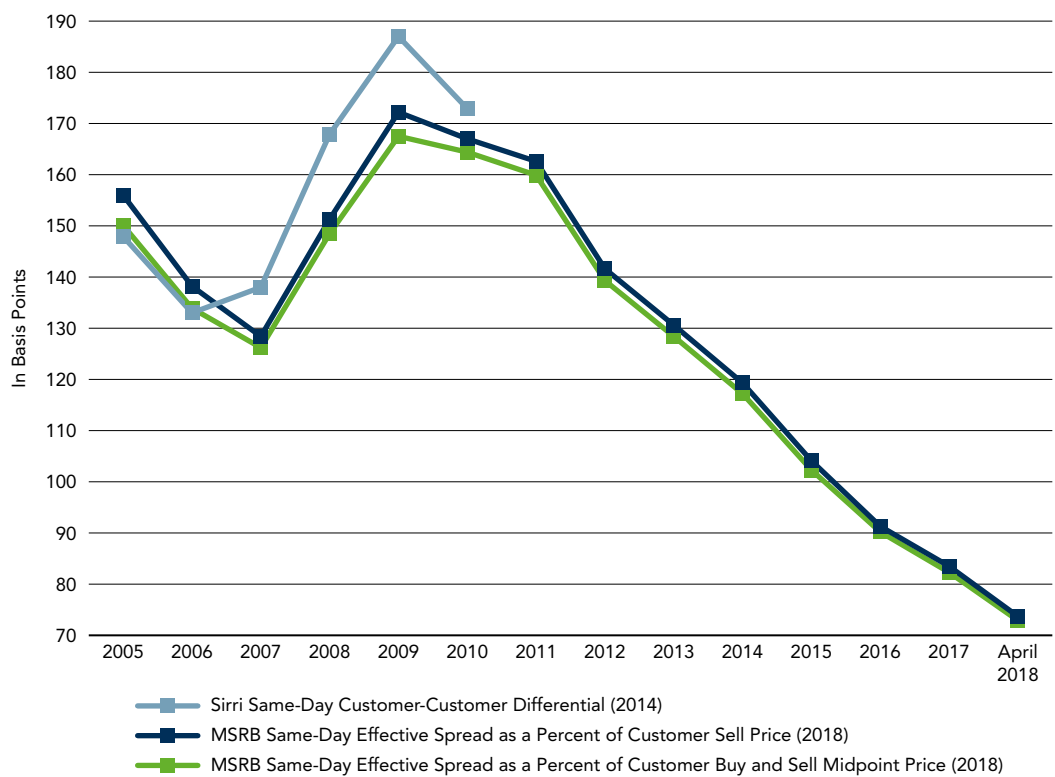
³⁰ A higher percentage of municipal bonds are held by retail investors than other securities. See MSRB, “Trends in Municipal Bond Ownership,” 2017.

³¹ Since July 2016, MSRB’s RTRS trade reporting data displays a flag for trades executed on an ATS.

c. Comparison of Effective Spread Measures for Municipal Bond Customer Trades

Given the methodology difference in measuring the effective spread for municipal bonds between this paper and other recent research papers, to test the validity of this paper’s methodology, it is prudent to first compare the results from different studies for the same timeframe. Chart 3 compares the effective spread measured as a percent of average customer sell price (blue line)³² to Sirri’s (2014) customer-to-customer differential, which is also measured as a percent of customer sell price. The Sirri study, which allowed for matched customer trades across trading days,³³ found that effective spread is lower when matched customer-buy and -sell trades occur only on the same day than when allowing matched customer purchase and sell trades over multiple days. Since this paper’s analysis focuses on the same-day effective spread, it is more appropriate to compare comparable same-day effective spreads. Between 2005 and 2010, when both analyses overlap in the same period, MSRB’s two lines from this analysis closely track Sirri’s line, with similar trend movement. Hence, despite the methodology differences, the time-series analysis of effective spread confirms Sirri’s conclusions.

Chart 3. Municipal Bond Effective Spread for Customer-Buy and -Sell Trades (2005–2018)



Note: Municipal variable rate securities are excluded from this analysis.

Source: MSRB and Sirri (2014)

³² The effective spread measured as a percent of the midpoint between average customer buy and sell prices is also provided in Chart 3. Not surprisingly, the blue line is a bit higher than the green line as a result of the lower denominator when using the average customer sell prices rather than the midpoint, but the difference is relatively minor. All effective spread measures after Chart 3 use the midpoint price as the denominator.

³³ Both Sirri (2014) and Chalmers, Liu and Wang (2017) explicitly mentioned the cross-day matches for up to 30 trading days, while Bergstresser and Luby (2017) did not elaborate on whether they allowed for cross-day matches, but the matching algorithm they described in their paper seems to allow for multiple-day matching.

Appendix B presents a more complete comparison of the effective spread from 2000 through 2018 from various sources. Regardless of the methodology used, all time-series lines exhibit a similar trend over the course from the pre-financial crisis era, to the financial crisis years and to the post-financial crisis period.

d. Steady Decline of Effective Spread in Recent Years

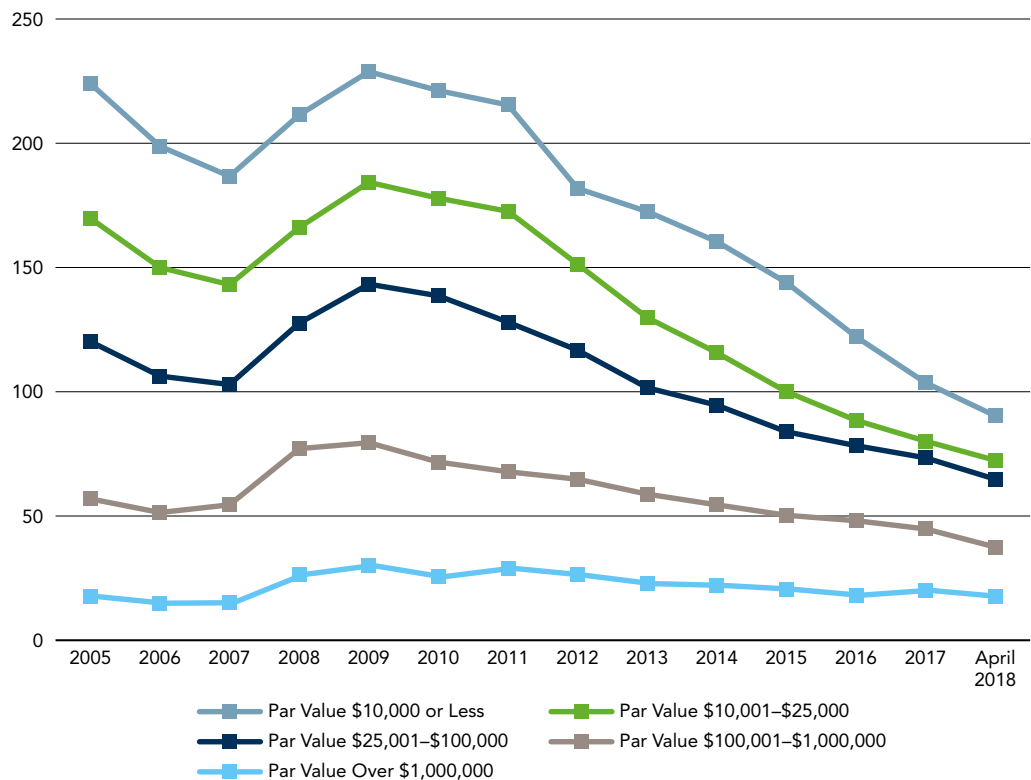
Despite a sharp uptick of the effective spread during the financial crisis, Chart 3 illustrates that the long-term trend continues to decline through the beginning of 2018. The average effective spread exceeded 150 basis points in 2005, or 1.5% of the midpoint price, and dropped to 73 basis points in early 2018, a 51% decline from the 2005 level.³⁴

This paper next analyzes the effective spread for customer trades in different size groups. Traditionally, there is an inverse relationship between trade size and transaction costs in the municipal securities market, with transaction costs decreasing as trade size increases. Academic researchers and economists generally attribute this inverse relationship to the different degrees of information transparency available for retail and institutional investors, as well as to market structure issues such as a lack of an order display requirement.³⁵ Chart 4 shows the effective spread by five trade-size groups during the relevant period: \$10,000 par value or less, \$10,001–\$25,000 par value, \$25,001–\$100,000 par value, \$100,001–\$1,000,000 par value and over \$1,000,000 par value trades.

³⁴ Similarly, when using the average customer sell price as the denominator, the effective spread went from 156 basis points in 2005 to 74 basis points in early 2018, a decrease of 53%.

³⁵ See Harris, Larry and Michael Piwowar, "Secondary trading costs in the municipal bond market," *Journal of Finance*, 2006; Cuny, Christine, "Municipal disclosure and the small trade premium," Working Paper, 2016; Komla, Dzigbede, "Regulatory disclosure interventions in municipal securities secondary markets," Working Paper, 2017; and the Financial Economists Roundtable, "Statement on the Structure of Trading in Bond Markets," 2015. Also, smaller-sized trades may have a higher fixed-cost component proportionately than larger-sized trades,

Chart 4. Municipal Bond Effective Spread for Customer-Buy and -Sell Trades by Trade Size (2005–2018)



Note: Municipal variable rate securities are excluded from this analysis.
Source: MSRB

This analysis shows that the decline in effective spread has been the most pronounced for trades of \$10,000 par value or less, while the \$10,001 to \$25,000 group also shows a dramatic decline, with the percentage decline approaching 60% for both categories of customer trades. However, despite the narrowing gap, smaller-sized trades still had higher effective spread (and transaction costs) than larger-sized trades as of early 2018.

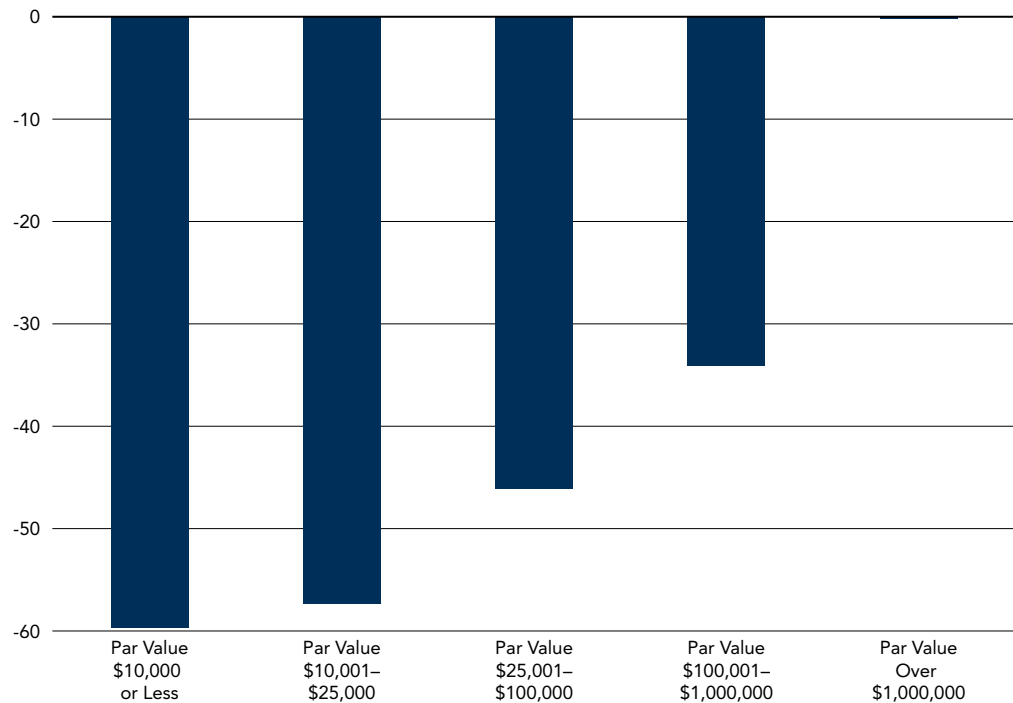
On the other end, the average effective spread for over-\$1,000,000 par value trades has been relatively constant in recent years. In light of the fact that large-sized trades would typically demand more liquidity than smaller-sized trades, the results seem to suggest that the overall market liquidity for institutional size transactions, at least measured by the effective spread, has not worsened since the financial crisis, in line with the results from Chart 1 and Chart 2 above.

It is possible that the large drop in spread for smaller retail-sized trades is the result of transparency and rulemaking initiatives, both of which are aimed at improving information for and protecting retail investors. Other factors that may contribute to narrowing transaction costs include advancements in trading technology such as electronic trading and aggregate display of liquidity via ATs and inter-dealer brokers, which could reduce searching costs. The following section explores some of these possible explanations.

While Chart 4 suggests that the smaller the trade-size group, the larger the decrease of the average effective spread over time, Chart 5 shows that the amount of decrease is relatively similar once the trade-size groups reach below \$25,000 par value. Between 2005 and early

2018, the effective spread for trades with par value between \$10,001 and \$25,000 dropped by 57%, while trades with par value of \$10,000 or below decreased by 60%, only slightly more. By comparison, the spread for trade size between \$25,001 and \$100,000 decreased by 46%, and for trade size between \$100,001 and \$1,000,000 declined by only 34% during the relevant period, while it essentially did not change at all for trades with over \$1,000,000 par value.

Chart 5. Percentage Change in Effective Spread by Trade Size Group (2005–April 2018)



Note: Municipal variable rate securities are excluded from this analysis.
Source: MSRB

Overall, the evidence suggests that, except for trades with par value over \$1,000,000, investors benefited significantly from lower transaction costs during the past 13 years.

e. Regression Analysis Controlling for Municipal Bond Characteristics

A natural concern in drawing a conclusion from the Time Series Analysis is that there may have been a change in the idiosyncratic characteristics of municipal bonds traded in the secondary market during the past 13 years. Without controlling for the characteristics of bonds, the analysis could incorrectly attribute the decline in effective spread to market-wide factors when in fact the changes in the underlying bond characteristics could be the explanation.

For example, prior to the financial crisis, proportionately more municipal bonds were insured to reduce credit risks and to attract more investors. However, the bond insurance industry suffered through the recession; as a result, the post-crisis issuance of municipal bonds has had a much lower proportion of insured bonds, as illustrated in Table 3. If insured bonds tend to have a different level of transaction costs from non-insured bonds, the change in

market-wide effective spread may simply reflect the change in the characteristics of the underlying bonds, all else being equal. Similarly, the average yield for traded bonds in the secondary market, an indicator of their level of risk, has declined precipitously during the relevant period, as shown in Table 3. Conversely, as another confounding factor, Table 3 also demonstrates that the average trade size for municipal bonds was noticeably lower in 2017 than in 2005. If bonds with larger trade size have lower effective spread than bonds with smaller trade size, the market-wide spread may increase when the average trade size declined over the relevant period, holding everything else constant.

Table 3. Municipal Bonds with Same-Day Customer Buy and Sell Trades

Year	Percentage Insured	Average Trade Size	Average Yield for Traded Bonds
2005	62.7%	\$291,633	4.4%
2017	19.2%	\$225,831	2.2%

Note: Municipal variable rate securities are excluded from this analysis.
Source: MSRB

Consequently, to validate that the decrease in effective spread was likely caused by market-wide factors, such as technology advancement or transparency improvement, but not simply the result of a change in characteristics for underlying bonds, such as a shift in the proportion of bonds that were insured, a regression model is used to control for the characteristics of municipal bonds traded over the relevant period.

The Regression Analysis uses an ordinary least-square regression approach for pooled cross-sectional and time-series data points by incorporating independent variables such as trade size, coupon rate, annual trading volume, issuance type (general obligation, revenue, etc.), yield, insurance status, maturity, age and a time-trend term. Specifically,³⁶

$$\begin{aligned}
 \text{Effective Spread}_{it} &= \alpha + \beta_1 \text{Trade Size}_{it} + \beta_2 \text{Coupon Rate}_{it} + \beta_3 \text{Annual Trading Volume}_{it} \\
 &+ \beta_4 \text{Issuance Type}_{it} + \beta_5 \text{Yield}_{it} + \beta_6 \text{Insurance Status}_{it} + \beta_7 \text{Maturity}_{it} \\
 &+ \beta_8 \text{Age}_{it} + \lambda \text{Time Trend}_t + \varepsilon_{it}
 \end{aligned}$$

where all variables are specified in percentage change except for issuance type, insurance status and time trend,³⁷ and subscript *i* corresponds to a particular security and *t* corresponds to a particular trading date.

Time Trend is specified as a running count of calendar days from January 1, 2005 through the trading date of each trade. It is the key variable to be tested based on an estimation of the coefficient λ , as the goal of the Regression Analysis is to measure the change in effective spread over time after controlling for all the other independent (control) variables in the model. Among the control variables, trade size is expressed as par value, annual trading volume is the total par value traded for a security during the same calendar year of each

³⁶ Another independent variable that could be considered in the future is the call feature of a municipal bond, as the percentage of municipal bonds with the call feature could vary across the bonds and also change over time.

³⁷ The report uses the natural log difference as a proxy for percentage difference for all variables in the equation.

trade, and maturity measures the life span of a security at the time of its trade. In addition, two of the control variables are “dummy” variables, essentially a yes-or-no test:³⁸

- Issuance Type: assigned a value of one if the security is a general obligation bond and zero if it is not; and
- Insurance Status: assigned a value of one if the security is insured and zero if it is not.

The parameter estimates for control variables are mostly as expected and mirror the recent findings in academic literature, such as the studies from Sirri (2014) and Chalmers, Liu and Wang (2017). For example, coupon rate and trade size are found to be inversely related to effective spread, while age and maturity of a bond are positively related to effective spread. In addition, yield of a bond is found to be positively correlated with its effective spread. Since bond yield is typically associated with the riskiness of a bond, all else being equal, the result suggests that a riskier bond tends to have higher effective spread. Finally, whether a bond is insured or is a general obligation bond has weak impact on the spread. Appendix C captures the full results of the regression analysis.

Table 4 compares the actual change in effective spread between 2005 and 2017 to the model-predicted change which controls for the relevant confounding factors that may have impacted the spread.³⁹ In fact, while bond characteristics such as the percentage of bonds that are insured, average yield and average trade size have changed significantly over the relevant time period, the model-predicted decline in effective spread is 35.8 basis points, after controlling for changes in the characteristics of bonds traded, more than half of the actual decline of 67.8 basis points.

Table 4. Change in Effective Spread Between 2005 and 2017 (in basis points)

Actual Change Without Controlling for Bond Characteristics	Model-Predicted Change After Controlling for Bond Characteristics
-67.8	-35.8

Note: Municipal variable rate securities are excluded from this analysis.
Source: MSRB

These results imply that over half of the decline in municipal bond dealer-to-customer trades from 2005 to 2017 was driven by factors independent of the characteristics of underlying bonds and cannot entirely be explained by a change in the characteristics of municipal bonds traded in the secondary market.

³⁸ In statistics and econometrics, particularly in regression analysis, a dummy variable is one that takes the value of zero or one to indicate the absence or presence of some categorical effect that may be expected to shift the outcome.

³⁹ Data for 2018 are only available for the first four months, therefore, 2017 full-year data are used in this exercise for the most-recent period.

f. Possible Market-Wide Factors Contributing to Decline in Effective Spread

Since the decline in effective spread cannot be explained exclusively by a change in the characteristics of municipal bonds traded in the secondary market, a few frequently cited market-wide factors may explain the remaining decline in spread, including market liquidity, technology advancement and information transparency. However, as elaborated above, market liquidity — at least as measured by par volume traded and turnover ratio — has remained stable since the end of the financial crisis; therefore, liquidity's impact on transaction costs has likely been neutral. By process of elimination, recent MSRB regulatory activities to protect investors and enhance transparency in the market and the advancing trading technology, such as the proliferation of electronic trading systems, may be prime candidates when accounting for the downward trend of transaction costs. The Difference in Differences analysis attempts to quantify the relative scale of the impacts on transaction costs by comparing effective spread for dealer-to-customer trades with effective spread for inter-dealer trades.

Technology advancement, in theory, should reduce the search time and cost for finding counterparty liquidity, and therefore should benefit both dealer-to-customer trades and inter-dealer trades equally in terms of lowering transaction costs, as search cost is a component of the overall transaction costs. Electronic trading platforms may not necessarily increase the market liquidity but can make the liquidity more visible to other market participants, including indirectly retail investors who rely on dealers to search for counterparty liquidity, and simplify the process for market participants to locate liquidity.

By comparison, recent market transparency initiatives are thought to have benefited investors, particularly retail investors, more so than dealers as investors historically have had much less access to relevant information related to pricing of a security. Economic studies in the past concluded that dealers had substantial information advantages over less informed customers in the municipal bond market (see Harris and Piwovar 2006 and Green, Hollifield and Schürhoff 2007).

Using inter-dealer trades matched by date and CUSIP numbers, the Difference in Differences analysis is performed to specifically identify the above-and-beyond percentage decline of effective spread for retail-sized dealer-to-customer trades relative to the average percentage decline of spread for similar-sized inter-dealer trades. The analysis presumes that, but for the absence of increased market transparency in recent years, the effective spread would have a parallel trend for both inter-dealer and dealer-to-customer trades over the period. The above-and-beyond percentage decline in effective spread for dealer-to-customer trades, thus, may be attributed to the outsized impact on retail investors from the market transparency initiatives since 2005. This is not to say that the recent transparency initiatives have not benefited dealers themselves, but likely at a much lower degree than retail investors, given that dealers were relatively informed previously.

Table 5 shows the average effective spread in 2005 and 2017 for matched pairs of dealer-to-customer trades and inter-dealer trades on the same trading day for the same CUSIP number.⁴⁰ All trades included in this analysis have par value of \$100,000 or less. While the

⁴⁰ For dealer-to-customer trades, customers are liquidity demanders and dealers are liquidity providers. However, for inter-dealer transactions between two dealers, while usually one dealer who initiates a trade would be a liquidity demander and another dealer would be a liquidity supplier, RTRS data do not indicate who initiates the trade. To calculate the effective spread for inter-dealer trades, the midpoint price of the average dealer-to-customer buys and sells prices is used as a benchmark. The effective spread is simply computed as twice the absolute value of the difference between an inter-dealer trade price and the midpoint price.

percentage decline for inter-dealer trades was 44%, a substantial amount by itself that likely also reflects the technological progression and the change in the characteristics of bonds traded, the percentage decline for dealer-to-customer trades was about ten percentage points higher.

Table 5. Effective Spread with Trade Size \$100,000 or Less (2005 and 2017, in basis points)⁴¹

	Dealer-to-Customer Trades	Inter-Dealer Trades
2005	219.9	136.5
2017	101.8	76.6
Percentage Decline	-53.7%	-43.8%

Note: Municipal variable rate securities are excluded from this analysis.
Source: MSRB

Table 6 calculates the hypothetical effective spread for retail-sized dealer-to-customer trades assuming the percentage decrease was the same for dealer-to-customer trades as for inter-dealer trades. The hypothetical effective spread for dealer-to-customer trades would be 123.5 basis points as of 2017, about 21.6 basis points higher than the actual effective spread of 101.8.

Table 6. Actual and Hypothetical Effective Spread for Dealer-to-Customer Trades with Trade Size \$100,000 or Less (2017, in basis points)

Actual Dealer-to-Customer Trades	Hypothetical Dealer-to-Customer Trades	Difference Between Actual and Hypothetical
101.8	123.5	-21.6

Note: Municipal variable rate securities are excluded from this analysis.
Source: MSRB

The additional 21.6 basis-point reduction in effective spread for retail-sized dealer-to-customer trades, therefore, represents the added benefits of market transparency that may have improved retail customers’ bargaining power with dealers.

⁴¹ The spread numbers for dealer-to-customer trades differ from those in Chart 3 above because the calculation is limited to securities that have both customer and inter-dealer trades on the same trading day.

V. Potential Future Research

As mentioned above, the MSRB's requirement that dealers, when acting in a principal capacity, disclose compensation (mark-up) in municipal bond retail customer trades went into effect on May 14, 2018. This is another crucial step toward increased market transparency to assist retail investors with making more informed decisions. As a result, it would be interesting to examine the change in effective spread pre- and post-rule implementation, aside from all the other relevant market impact factors. In addition, with the recent enactment of the tax reform which substantially reduced the corporate tax rate, there may be a change in the incentive of banks and insurance companies to own municipal bonds. Their potential exit or at least declining interest in the municipal bond market may impact the overall market liquidity and therefore the transaction costs.

Furthermore, as a potential separate study in the future, it might be useful to conduct a cross-sectional analysis examining the effective spread differential across municipal securities (CUSIP numbers) based on a variety of bond characteristics, such as new issue securities, trading volume, issue size, issue structure, types of securities, maturity, etc. Research findings may be helpful to bond issuers by identifying and quantifying relevant factors that could reduce transaction costs, therefore increasing investors' net returns post-issuance and assisting issuers with their decisions on how to optimally structure a municipal bond issue.

Finally, in addition to effective spread, there are other measures of transaction costs and market liquidity, and it would be interesting to see how other measures such as the price impact of a trade or the bid-ask quoted spread on ATSs have evolved over the years.

VI. Conclusions

Between 2005 and early 2018, the effective spread for dealer-to-customer trades in municipal bonds declined by approximately 77 basis points. The decrease was even more prominent for retail-sized customer trades, where the decline was approximately 96 basis points, though small-sized trades still cost more to execute than larger-sized trades.

This paper explored the likely factors that may explain the drastic decline in transaction costs and concluded that market-wide technological advancements and recent transparency initiatives were likely important contributors to the narrowing of effective spread. Changes in the characteristics of municipal bonds traded on the secondary market explained less than half of the decline in transaction costs.

It is encouraging to see that retail investors may have particularly benefited from the recent market transparency initiatives. Ultimately, these reductions in trading costs to investors in the municipal bond market may lead to reduced borrowing costs for municipalities, since investors' required rates of return will reflect the lower costs of transacting in the municipal bond market.

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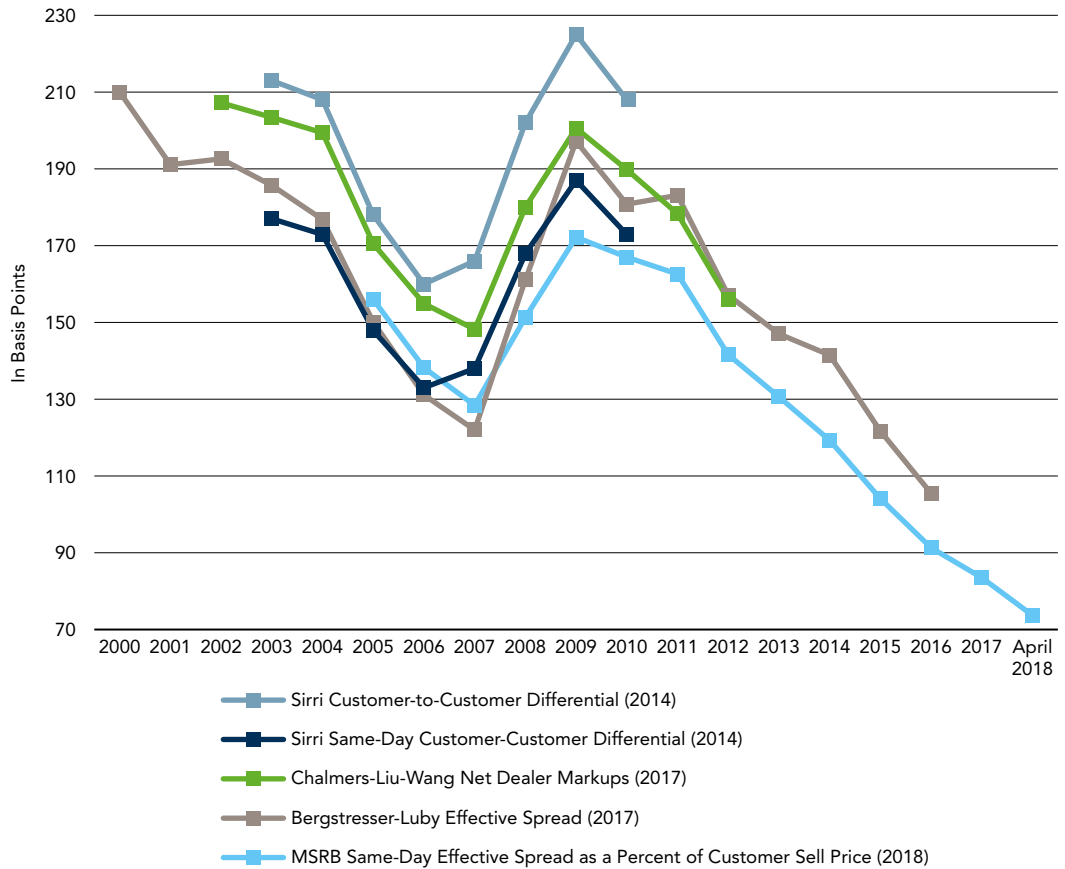
Appendix A — About the Author

Simon Wu, Ph.D., Chief Economist – Mr. Wu is the Chief Economist for the Municipal Securities Rulemaking Board. With 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, 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.

Appendix B — Effective Spread Measure Comparison

All effective spreads are measured as a percentage of customer sell price and are expressed in basis points.

Comparison of Effective Spread Measures



Note: Municipal variable rate securities are excluded from this analysis.

Source: MSRB (2018), Sirri (2014), Chalmers, Liu and Wang (2017) and Bergstresser and Luby (2017). Sirri's (2014) customer-to-customer differentials are presented in two lines: All matched trades and same-day matched trades only.⁴²

⁴² Bergstresser and Luby (2017) and Chalmers, Liu and Wang (2017) did not break out the same-day matched trade spread in their paper.

Appendix C — Regression Analysis

Ordinary Least Squares (OLS) Regression Model

Effective Spread_{it}

$$= \alpha + \beta_1 \text{Trade Size}_{it} + \beta_2 \text{Coupon Rate}_{it} + \beta_3 \text{Annual Trading Volume}_{it} + \beta_4 \text{Issuance Type}_{it} + \beta_5 \text{Yield}_{it} + \beta_6 \text{Insurance Status}_{it} + \beta_7 \text{Maturity}_{it} + \beta_8 \text{Age}_{it} + \lambda \text{Time Trend}_t + \varepsilon_{it}$$

Variable	Parameter Estimate	t Value	Standard Error
Intercept	-5.0570	-925.12	0.00547
Trade Size	-0.3036	-1075.50	0.00028
Coupon Rate	-0.7020	-367.79	0.00191
Annual Trading Volume	0.0156	77.05	0.00020
Issuance Type	0.0190	24.53	0.00077
Yield	0.7035	1051.26	0.00067
Insurance Status	0.0949	121.10	0.00078
Maturity	0.4057	1060.82	0.00038
Age	0.0541	150.61	0.00036
Time Trend	-0.000062	-197.57	0.00000
Adjusted R-Square	0.52		

Note: All variables are in natural logarithm form except for the time trend and the dummy variables insurance and issuance type.

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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