Report on Secondary Market Trading in the Municipal Securities Market

JULY 2014

MSRB

Municipal Securities Rulemaking Board

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COMMISSIONED BY:
Municipal Securities Rulemaking Board

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Executive Summary

To gain a better understanding of secondary market trading practices in the municipal securities market, including basic patterns of trading, pricing differentials associated with trading patterns, and the impact of price transparency on pricing differentials, the Municipal Securities Rulemaking Board (MSRB) commissioned Erik R. Sirri, professor of finance at Babson College and former director of the Division of Trading and Markets of the Securities and Exchange Commission, to review municipal securities transaction data from calendar years 2003 through 2010. With this report, the MSRB seeks to provide market stakeholders and the academic community with a shared baseline set of market statistics about municipal bond trading to enable market participants, the regulatory community and researchers to make further advancements toward a fairer, more efficient, more transparent and better understood municipal securities market.

This report provides an overview of the data studied, describes the methodology used in conducting the study and provides statistics and related analyses regarding certain general characteristics of secondary market trading. In particular, this report includes information on the average price differential of moving municipal securities, in pairs of consecutive trades through a single broker, dealer or municipal securities dealer ("dealer") acting as an intermediary, from one market participant to another market participant (the "paired-trade differential"). This report further provides details on the average total price differential of moving municipal securities from one non-dealer investor ("customer") to another through one or more dealer intermediaries (the "total customer-to-customer differential"). While statistics on paired-trade differentials and total customer-to-customer differentials included in this report can provide broad market structure insights on the cost of moving municipal securities from one customer to another, these statistics do not generally equate to the formal concepts of "mark-up" and "mark-down," as described in the report and generally would not be suitable for making direct comparisons to individual transactions in the current market without an individualized review of the specifics of that current market trade.

The study data set consisted of over 43 million secondary market principal trades in over 1 million distinct fixed-rate, tax-exempt municipal securities reported to the MSRB during calendar years 2003 through 2010. The characteristics of the data and the methodology used to conduct the statistical study are described in Section I: Overview of Data Studied and Section II: Methodology. Key statistical result categories of the study are described below, with a complete description of the results and the specific parameters and meaning of the results set out in Sections II through VI. All statistical results should be viewed in light of the nature, source and quality of the underlying data studied and the methods used to analyze the data.

- **Paired-Trade Differential by Paired-Trade Type** — The average paired-trade differential was calculated for four categories of paired trades by subtracting the price at which the initial customer sold the security in the first trade from the price at which the second customer purchased the security in the second trade. For each paired trade, the buying dealer in the first trade is the same as the selling dealer in the second trade. The four categories of paired trades consisted of (i) dealer buys (DB) from a customer followed by dealer sells (DS) to a customer (DB-DS); (ii) DB trades followed by inter-dealer (ID) trades (DB-ID); (iii) ID trades followed by DS trades (ID-DS); and (iv) ID trades followed by ID trades (ID-ID). These average paired-trade differentials were calculated for paired trades occurring over a range of periods up to 30 days of each other, as well as for paired trades occurring within 30 minutes of each other. See Section IV: Paired-Trade Differentials of Secondary Market Trading.

- **Trade Size of Paired Trades** — The frequency with which the first trades of paired trades were followed by second trades that were of the same size, smaller size (that is, the initial trade size was broken down into smaller trade sizes) or larger size (that is, securities from inventory or other sources added to the municipal securities in the initial trade to complete the second trade) were calculated. See Section IV: Paired-Trade Differentials of Secondary Market Trading.

- **Total Customer-to-Customer Differential in Secondary Market Trading** — The average customer-to-customer differential of moving municipal securities from one customer through one or more dealers to another customer was calculated by subtracting the price at which the initial customer sold the security in the first trade in the customer-to-customer chain of transactions from the price at which the second customer purchased the security in the last trade in the chain of transactions. See Section V: Total Customer-to-Customer Differentials of Secondary Market Trading — Distribution of Customer-to-Customer Differentials.

- **Total Customer-to-Customer Differential and Number of Dealer Intermediaries by Trade Size** — Average total customer-to-customer differentials for transaction chains involving various trade sizes and various numbers of dealer intermediaries were calculated and compared. See Section V: Total Customer-to-Customer Differentials of Secondary Market Trading — Total Customer-to-Customer Differentials and Number of Dealer Intermediaries by Trade Size.

- **Total Customer-to-Customer Differential by Duration of Customer-to-Customer Chain and Trade Size** — Average total customer-to-customer differentials for transaction chains completed within various lengths of time, ranging from chains completed within the same day to chains completed in up to 30 days, and involving various trade sizes were calculated and compared. See Section V: Total Customer-to-Customer Differentials of Secondary Market Trading — Total Customer-to-Customer Differentials by Duration of Customer-to-Customer Transaction Chain and Trade Size.

- **Effect of Implementation of Real-time Trade Reporting in Reducing Total Customer-to-Customer Differentials** — The transition in January 2005 from next-day transparency under the MSRB's former Transaction Reporting System (TRS) to real-time transparency under the MSRB's current Real-time Transaction Reporting System (RTRS) was shown to have reduced average total customer-to-customer differentials from what they would have been under TRS, in spite of the significant dislocations to the market resulting from the financial crisis. See Section VI: Effect of Implementation of Real-time Trade Reporting in Reducing Total Customer-to-Customer Differentials. The results of the regression tests supporting these findings are included in Appendix A.

An index of figures presented in this report is included in Appendix B.

As noted above, due to the nature of this report's broad statistical view over an extended period of time during which market conditions changed dramatically, the information included in the report is not designed to serve as a yardstick against which individual transactions or chains of transactions can fairly be measured for regulatory compliance purposes. Rather, viewing current activity in the market in the context of this report requires a meaningful inquiry into the specific factors relevant in the individual circumstances of particular transactions and a thorough analysis of these factors in light of the methods used in this statistical study and the limitations and caveats coincident with any statistical study of this nature. Thus, while market participants engaged in current transactions in the marketplace may find the report helpful in gaining a generalized understanding of the market, questions or concerns regarding specific transactions should be addressed based on the particular terms, facts and circumstances of the transactions.

Introduction and Background

Purpose. The Municipal Securities Rulemaking Board (MSRB) is publishing statistical results of a historical study of secondary market trading in the municipal securities market conducted on behalf of the MSRB.[1] Erik R. Sirri, professor of finance at Babson College and former director of the Division of Trading and Markets of the Securities and Exchange Commission (SEC), was engaged by the MSRB to review the publicly available trade data provided through the MSRB's Real-time Transaction Reporting System (RTRS) and its predecessor Transaction Reporting System (TRS) for calendar years 2003 through 2010, together with certain non-public data collected through RTRS and TRS for surveillance purposes and additional third-party data, as described below.[2]

The MSRB commissioned this study to gain a better understanding of broad trading behaviors in the municipal securities market, including basic patterns of trading and trade pricing as well as the impact of price transparency on trade pricing. This study is designed to provide market stakeholders and the academic community with a shared baseline set of market statistics to enable market participants, the regulatory community and researchers to make further advancements toward a fairer, more efficient, more transparent and better understood municipal securities market. Due to the nature of the broad statistical view over an extended period of time during which market conditions changed dramatically, the information included in this report is not designed to serve as a yardstick against which individual transactions or chains of transactions can fairly be measured for regulatory compliance purposes. Rather, viewing current activity in the market in the context of this report requires a meaningful inquiry into the specific factors relevant in the individual circumstances and a thorough analysis of these factors in light of the methodology

[1] For purposes of the statistical study, "secondary market trading" encompasses all trades in municipal securities other than trades occurring during and closely following the initial distribution of a new issue, as described in Section I: Overview of Data Studied.

[2] In undertaking this research on behalf of the MSRB, Professor Sirri was provided the right to use this data set also for purposes of any of his future academic research activities independently from the MSRB, subject to confidentiality requirements with respect to certain non-public information included in the Surveillance Transaction Data described below. No other compensation was provided to Professor Sirri in connection with the study.

of this statistical study and the limitations and caveats coincident with any statistical study of this nature. Thus, while market participants engaged in current transactions in the marketplace may find this report helpful in gaining a generalized understanding of the market, questions or concerns regarding specific transactions should be addressed based on the particular terms, facts and circumstances of the transactions.

The MSRB expects to take the statistical results in this report, together with other statistically sound research and findings from the academic community and others, into account in any future rulemaking and market transparency activities pertaining to secondary market trading and associated market structure matters. In particular, future enhancements to the MSRB's RTRS price transparency services and the development of a central transparency platform designed to integrate RTRS post-trade transparency with the potential introduction of pre-trade transparency data for the municipal securities market will benefit from such data-driven analysis. The MSRB hopes that market participants and the academic community similarly will find this information useful for their market-related and research purposes as they undertake further inquiries into market behavior during the period covered by this report or as the market has evolved.

Context. This statistical study illustrates certain trading behaviors during a period in the municipal securities market characterized by a number of transformative changes. These include, among others, the January 2005 transition in price transparency from next-day to 15-minute public dissemination of trade prices to market professionals. In addition, the study period saw the beginning of the financial crisis in 2007 and its immediate aftermath thereafter, resulting in substantial effects to the financial markets globally as well as a number of dislocations in the municipal markets. These included the effective de-commoditization of the AAA-insured segment of the market and the unwinding of significant municipal holdings by key institutional investors such as mutual funds and sponsors of tender option bond programs and similar structured holdings, and other related effects that were viewed as negatively affecting liquidity for an extended period of time. Shortly after the financial crisis began, the MSRB introduced in March 2008 its Electronic Municipal Market Access (EMMA®) website at emma.msrb.org, which provided for the first time free and easy access by all market participants, including retail and other non-institutional investors, the financial press and the general public, to the MSRB's real-time trade data.

Understanding the Study Results. As noted above, the MSRB seeks to provide through this report a clearer understanding of characteristics of secondary market trading in municipal securities during the study period and to shed light on areas where further study may be appropriate. This report does not seek to address regulatory matters that may arise or could be implicated by the findings reported herein, although the report may serve as a source of data to inform potential future regulatory activities. Readers should take care in fully understanding the specific nature of each item of data presented in this study to ensure that they can properly assess how such data compares to, or contrasts with, the information they receive in the context of individual current transactions, as well as to appropriately consider the extent to which the data are fully reflective of — or at best suggestive of but not necessarily fully consistent with — statutory, regulatory or common law duties of professionals in the municipal market. In this regard, the overview of the data studied and the methodology used in undertaking this study, as described in Section I and II, as well as the detailed descriptions provided in connection with each table and chart included in this report, should be read carefully.

Furthermore, this study provides data on an aggregated basis rather than characterizing individual transactions, and generally does not adjust the data to take into account the potential impacts of the individualized circumstances of market participants, changes in the credit worthiness or other aspects of issuers, or events or trends having an impact on the municipal securities market, particular

segments of the market, or the broader economy. Any of these factors could have a material impact on individual transactions or chains of transactions included in the study data set, and the likelihood that any such material factor could arise generally would increase as the time between the initial and final transaction in a transaction chain gets longer. Further, while the aggregation of data presented in this study would tend to mitigate the particularized effects of these factors on individual transactions or chains of transactions, such factors may in some cases have a potential impact on the aggregated data that readers should consider when drawing any conclusions from the data, particularly when comparing the data in this report to information relating to specific transactions or chains of transactions occurring in the current market as contrasted to the study data derived from the transformative and sometimes volatile period covered by the study.

Report Structure. This report is divided into six sections:

- **I: Overview of Data Studied** — This section provides a basic understanding of the underlying data set used to conduct the study,[3] including the nature of data included or excluded from the analysis and the rationale for such inclusion or exclusion. This will assist readers in understanding the breadth of the statistical findings in this report, in assessing the validity, causes and meaning of the findings, and in determining the potential scope of further studies that readers may wish to conduct in areas either covered by this report or in areas or time periods outside the scope of this report.

- **II: Methodology** — This section describes the methods by which the various statistical findings included in the report were developed, including the rationale for using the selected methods. A careful review of the methodology is important to understand the data included in this report and can provide critical guidance to others seeking to engage in studies of the municipal marketplace on how to approach the complexities of the market to derive results that properly take into account these complexities.

- **III: General Characteristics of Secondary Market Trading** — This section provides baseline statistics on secondary market trading activity in the municipal securities market during the study period.

- **IV: Paired-Trade Differentials of Secondary Market Trading** — This section provides statistics on the average price differential during the study period of moving municipal securities, in pairs of consecutive trades through a single broker, dealer or municipal securities dealer (a "dealer") acting as an intermediary, from one market participant to another market participant (the "paired-trade differential"),[4] based on the parties involved in the paired trades, the role of the parties as purchaser or seller, and the timing for completion of the paired trades. This includes four types of paired trades: (i) a dealer buy from a customer

[3] The public MSRB data constituting the bulk of the data analyzed for purposes of this report are described in Section I: Overview of Data Studied and are available in a format suitable for formal analysis through the MSRB's subscription products. A complete list of data subscription products available from the MSRB, as well as subscription specifications, pricing and third-party licensing requirements, are available at www.msrb.org/Market-Disclosures-and-Data/Subscription-Services-and-Products.aspx. Questions regarding the full set of data studied for purposes of this report may be directed to the MSRB at 703-797-6668.

[4] See Section IV: Paired-Trade Differentials of Secondary Market Trading for a discussion of the relationship between paired-trade differentials and the separate but related concepts of mark-ups and mark-downs for regulatory purposes.

(DB)[5] followed by a dealer sell to a customer (DS);[6] (ii) a DB trade followed by an inter-dealer (ID) trade; (iii) an ID trade followed by a DS trade; and (iv) an ID trade followed by an ID trade.

V: Total Customer-to-Customer Differentials of Secondary Market Trading — This section provides a range of statistics on the average total price differential during the study period of moving municipal securities from one customer to another customer through one or more dealer intermediaries (the "total customer-to-customer differential") in the secondary market.[7] This analysis also assesses trade prices based on the trade size of the transactions, the length of time for completion of customer-to-customer chains of transactions, and the number of dealer intermediaries involved in such chains during the study period.

VI: Effect of Implementation of Real-Time Trade Reporting in Reducing Total Customer-to-Customer Differentials — This section assesses the impact of the transition in January 2005 from next-day (T+1) public dissemination of trade data through the MSRB's former Transaction Reporting System (TRS) to real-time public dissemination of trade data reported by dealers within 15 minutes of trade execution through the MSRB's current Real-time Transaction Reporting System (RTRS).

[5] DB trades are shown as "customer sold" trades on the MSRB's Electronic Municipal Market Access (EMMA®) website at emma.msrb.org. For purposes of the study and MSRB trade reporting rules, "customer" excludes any broker, dealer or municipal securities dealer acting in its capacity as such or any issuer in transactions involving the sale by the issuer of a new issue of its securities.

[6] DS trades are shown on the EMMA® website as "customer bought" trades.

[7] As with paired-trade differentials as noted above, the relationship between total customer-to-customer differentials and the separate but related concepts of mark-ups and mark-downs for regulatory purposes is described in Section V: Total Customer-to-Customer Differentials of Secondary Market Trading.

I: Overview of Data Studied

The statistical study is based on a broad set of transaction data as well as related data on certain features of each municipal security for the period consisting of calendar years 2003 through 2010. Specifically, the data reviewed for the statistical study consists of the following data sets:

- **TRS Transaction Data** — These data, covering the period from January 2003 to January 2005, include all next-day trade report data from former Transaction Reporting System (TRS) publicly available through the MSRB's Historical Data Reports[8] for such time period. Relevant data elements include trade type indicator;[9] CUSIP number;[10] security description;[11] dated date;[12]

[8] The Historical Data Reports used to conduct the statistical study, as well as a real-time feed of transaction data, are made available to market participants, data vendors and others through MSRB subscription services. Information regarding MSRB subscriptions is available at http://www.msrb.org/Market-Disclosures-and-Data/Subscription-Services-and-Products/MSRB-Transaction-Subscription.aspx.

[9] Trade type indicator indicates whether a trade was an inter-dealer (ID) trade, a dealer buy (DB) from a customer, or a dealer sale (DS) to a customer.

[10] CUSIP numbers serve as unique identifiers for municipal securities and are assigned by the CUSIP Service Bureau managed on behalf of the American Bankers Association (ABA) by Standard & Poor's. "CUSIP" is a registered trademark of the ABA.

[11] Security description consists of the name of the issuer and a description of the specific issue of the municipal securities.

[12] Dated date generally represents the date from which interest on a particular municipal security started to accrue upon initial issuance.

coupon;[13] maturity date;[14] assumed settlement date;[15] trade date;[16] time of trade;[17] settlement date;[18] par traded;[19] dollar price;[20] yield;[21] and when-issued indicator.[22] These data consist primarily of data self-reported by dealers reporting trades through former TRS, together with certain third-party indicative data as described below.

- **RTRS Transaction Data** — These data, covering the period from January 2005 to December 2010, include all real-time and end-of-day[23] trade report data from current RTRS publicly available through the MSRB's Historical Data Reports for that time period.[24] Relevant data elements include: trade type indicator; CUSIP number; security description; dated date; coupon; maturity date; assumed settlement date; trade date; time of trade; settlement date; par traded; dollar price; yield; and special condition indicators.[25] These data consist primarily of data self-reported by dealers reporting trades through RTRS, together with certain third-party indicative data as described below.

- **Surveillance Transaction Data** — This consists of additional data elements self-reported by dealers reporting trades through former TRS and current RTRS exclusively for regulatory purposes, including the market surveillance, examination and enforcement activities of the Securities and Exchange Commission (SEC) and other regulatory organizations, and not made publicly available. Relevant additional data elements include dealer identifiers and dealer capacity.[26]

13 Coupon indicates the stated rate of interest paid on a periodic basis on a particular municipal security.

14 Maturity date is the date on which the principal of a municipal security becomes due and payable.

15 An assumed settlement date sometimes is used for new issues of municipal securities where the initial settlement date is not known at the time of execution, in which case the settlement date is assumed to occur 15 business days after trade date.

16 Trade date is the date on which the buyer and seller of a municipal security legally agree to a transaction in the security.

17 Time of trade is the specific time (in hours and minutes) at which the buyer and seller of a municipal security legally agree to a transaction in the security.

18 Settlement date is the date on which delivery of and payment for a traded municipal security is scheduled to occur.

19 Par traded represents the principal amount of municipal securities traded in a particular transaction.

20 Dollar price consists of the price at which a municipal security trades, expressed in terms of dollars per $100 of par value.

21 Yield takes into account the purchase price of a municipal security in a particular trade, its coupon and the length of time the security is expected to be held. For purposes of MSRB trade reporting rules, yield normally reflects the lower of a yield calculated based on an investment held to the maturity date of the particular municipal security or of a yield calculated based on the assumption that the municipal security is called for redemption on any date on which an in-whole call of the security may be exercised, as further described under MSRB rules.

22 When-issued indicator is used to indicate a trade occurring prior to the first settlement date of a new issue. Settlements of such when-issued transactions occur upon or after settlement of the new issue rather than pursuant to the standard trade settlement cycle of three business days after the trade date.

23 As noted below, most trade reports to current RTRS that qualify for end-of-day reporting and dissemination are excluded from the statistical study of secondary market trading.

24 This is the same trade data displayed on the Electronic Municipal Market Access (EMMA®) website. Since the EMMA® website includes only trade data from RTRS since January 2005, the TRS data from January 2003 to January 2005 are not available through the EMMA® website and are only available through the Historical Data Reports.

25 Special condition indicators indicate whether a trade is a when-issued trade, a trade by a broker's broker, a list offering price/takedown trade, or a trade reported with a weighted average price.

26 Dealers trade in the capacity as principal or as agent.

- **Third-Party Indicative Data** — This consists of additional indicative data provided by third-party market data services, descriptive of particular features of securities, commercially obtained from third-party data sources.[27] Relevant data elements include issue size, call provision, coupon type,[28] tax status, bond type,[29] use of proceeds and credit rating.

The data set for the full study period consists of 71,286,035 trades.[30] In order to concentrate the statistical study on secondary market principal trading in fixed rate, tax-exempt municipal securities for which the full set of reliable data points is available during this period, this data set is narrowed to eliminate the categories of trades, listed below, that fall outside the intended scope of the study:

- Trades occurring during and closely following the initial distribution of a new issue are excluded ("new issue trades"). Trades are excluded if they occur on or before the later of (i) 45 calendar days after the first trade in such security or (ii) 15 calendar days after the issue closing date. The elimination of these new issue trades is designed to eliminate the effects of trading during the initial distribution of new issues, which typically represents the period during which municipal securities trade with greatest liquidity, although the degree of trading can vary considerably from issue to issue. Trading in municipal securities during this initial period typically is viewed as having significantly different characteristics than trading in the secondary market thereafter, and therefore the statistical study seeks to eliminate the potential effects of these differing characteristics from the study results.

- Trades in securities identified in the full data set as variable rate securities are excluded.[31] Most variable rate securities, such as variable rate demand obligations and auction rate securities, are bought and sold through dealers that have been engaged by the issuer to effectuate remarketings of the securities, in the case of variable rate demand obligations, or resales of securities through an auction process, in the case of auction rate securities, at face (par) value, with such dealers compensated directly by the issuer rather than by investors. These trades are excluded since they generally do not represent market prices of securities that are inclusive of a compensation component like most other trades in the municipal securities market.

[27] Indicative data for the statistical study were obtained primarily from CUSIP Global Services, S&P Capital IQ, Standard & Poor's Ratings Services and Moody's Investors Service, Inc. No data from these sources are reproduced in this report.

[28] Coupon type indicates whether the security bears interest at a fixed rate or a variable rate, or whether the security is a zero coupon bond.

[29] Bond type indicates category of issue, such as general obligation bond, revenue bond, insured bond, etc.

[30] This includes all trades reported to the MSRB for which data was disseminated to the public through TRS and RTRS, but does not include certain so-called "away from market" trades reported to the MSRB for regulatory surveillance purposes but not included in the publicly disseminated data. This exclusion is based on the view that such transactions are not useful in determining, and may in fact be a misleading indicator of, the current market value of a municipal security, either because the transaction price differs substantially from the market price or the trade is the result of a specific scenario where the trade is not a typical arms-length transaction negotiated in the secondary market. These transactions are identified by the dealer submitting the trade report and include, but are not limited to, customer repurchase agreement transactions, transactions from an accumulation account to a unit investment trust, and trades into and out of derivative trusts for tender option bond programs. Virtually all trades in municipal securities during the study period were required to be reported through TRS or RTRS, with the principal exceptions being transactions in securities without assigned CUSIP numbers and transactions in municipal fund securities (*e.g.*, investments in 529 college savings plans or local government investment pools).

[31] Identification as variable rate securities is primarily reliant on indicators included in third-party indicative data used to conduct the statistical study and is subject to the classification and quality assurance standards of the provider of such data. The study also excludes bonds that trade almost exclusively at par.

- Trades in securities identified in the full data set as taxable securities are excluded.[32] Taxable securities may trade differently from tax-exempt municipal securities in many cases, particularly because of the lack of the tax-exemption and, in the case of certain types of taxable securities (such as Build America Bonds or other direct pay bonds), may be held by an investor base that differs considerably from the typical tax-exempt municipal securities investor base. These trades are excluded to avoid potential distortive effects on the statistical study.
- Trades identified in the full data set as agency trades are excluded.[33] While transaction prices for agency trades disseminated to the public by RTRS are calculated to include a compensation component to make such agency prices comparable to principal trade prices,[34] agency transactions are excluded to avoid the potential for the results to be confounded by other differences between agency and principal transactions (for example, differences in customer confirmation disclosure requirements between principal and agency trades).

These exclusions are applied through a series of filters resulting in a final data set used in the study consisting of 43,516,748 trades (the "Study Data Set"). This filtering of the full data set to derive the Study Data Set and some basic characteristics of the resulting Study Data Set are more fully described in Figure I.A, and a comparison between certain characteristics of the full data set and the Study Data Set is included in Figure I.B.

[32] Identification as taxable securities is primarily reliant on indicators included in third-party indicative data used to conduct the statistical study and is subject to the classification and quality assurance standards of the provider of such data.

[33] Dealers are required to report to the MSRB through RTRS whether a transaction was a principal or agency trade, defined as any trade as agent for a customer not effected against the dealer's principal position.

[34] In agency transactions, dealers are required to report to the MSRB both the price of the security and the commission charged to the customer. RTRS calculates yield on agency trades using this reported information, then derives a transaction price based on this calculated yield, resulting in publicly disseminated transaction price information for agency trades that effectively incorporates a compensation component to make such agency prices comparable to principal trade prices. Normally, in principal transactions, the trade price reported to and publicly disseminated by the MSRB includes all aspects of the price, including any mark-up or mark-down that compensates the dealer for executing the transaction.

FIGURE I.A: Filtering of Full Data Set to Derive the Study Data Set

Filtering of Data	
Trades in Full Data Set	71,286,035
(First Filter)	(10,774,262)
(Second Filter)	(12,166,207)
(Third Filter)	(4,828,818)
Trades in Study Data Set	43,516,748
Composition of Study Data Set	
Dealer Buy (DB) Trades	24.0%
Dealer Sell (DS) Trades	49.1%
Inter-dealer (ID) Trades	27.0%
Time to Maturity	13.6 years
Time to Maturity or First Call	11.2 years

Figure I.A: Filtering of Full Data Set to Derive the Study Data Set — *Identifies total trades removed from the full data set and the characteristics of trades included in the Study Data Set.*[35] *Three filters are applied to remove trades from the full data set to produce the Study Data Set, as follows:*

First filter: From the full data set, 10,774,262 trades are excluded, consisting of trades in securities flagged in the full data set as variable rate securities, Build America Bonds or other taxable securities, as well as trades missing certain key descriptive data elements.

Second filter: From the full data set, 12,166,207 new issue trades, as defined above, are excluded.[36]

Third filter: From the full data set, 4,828,818 trades are excluded, consisting of trades flagged in the full data set as agency trades, trades in securities that trade almost exclusively at par, trades on non-business days, trades with defective dealer identifications, and trades missing certain key transaction data elements.[37]

[35] The cumulative total of the percentages of DB, DS and ID trades in the Study Data Set as set forth in Figure I.A is greater than 100 percent due to rounding.

[36] The number of new issue trades excluded in the second filter does not include new issue trades already excluded in the first filter and therefore is less than the total number of new issue trades reported to RTRS.

[37] The number of trades excluded in the third filter does not include trades already excluded in the first two filters.

FIGURE I.B: Comparison of Composition of Full Data Set and Study Data Set

	Full Data Set	Study Data Set
Number of distinct securities traded	1,710,000	1,091,537
Insured securities traded	50.5%	58.5%
Variable rate securities traded	2.7%	0.0%
Taxable securities traded	4.1%	0.0%
Zero-coupon securities traded	2.9%	3.6%
Callable securities traded	39.0%	38.3%
General obligation securities traded	53.2%	50.2%
Bank qualified bonds traded	36.0%	25.3%

Figure I.B: Comparison of Composition of Full Data Set and Study Data Set — *Provides a comparison between the full data set and the Study Data Set for certain basic features of the municipal securities within each data set.*

The Study Data Set is further refined for certain portions of the statistical study, as described in Section II: Methodology.

II: Methodology

The Study Data Set is used to describe the broad features of the secondary trading market in municipal securities during the study period as described in Section III: General Characteristics of Secondary Market Trading, to assess paired-trade differentials as described in Section IV: Paired-Trade Differentials of Secondary Market Trading, to assess total customer-to-customer differentials as described in Section V: Total Customer-to-Customer Differentials of Secondary Market Trading, and to assess the impact on total customer-to-customer differentials of the transition in January 2005 from next-day public dissemination of trade data under former Transaction Reporting System (TRS) to real-time public dissemination of trade data under current Real-time Transaction Reporting System (RTRS), as described in Section VI: Effect of Implementation of Real-Time Trade Reporting in Reducing Total Customer-to-Customer Differentials.

Figure II.A illustrates a small sample of the Study Data Set for a particular municipal security in chronological sequence.

FIGURE II.A: Sample of Study Data Set

Trade Date	Trade Time	Trade Price	Trade Size	Trade Type	Selling Dealer	Buying Dealer
01/13/03	14:07:00	98.5	20,000	DB	*<Customer>*	**ABC Dealer**
01/14/03	09:12:00	103.5	20,000	DS	**ABC Dealer**	*<Customer>*
01/15/03	15:08:00	100.75	55,000	DB	*<Customer>*	**123 Dealer**
01/21/03	13:58:00	104.9	55,000	DS	**123 Dealer**	*<Customer>*
03/18/03	11:43:00	101.14	20,000	DB	*<Customer>*	**XYZ Dealer**
03/20/03	08:04:00	102.61	20,000	DS	**XYZ Dealer**	*<Customer>*
06/25/04	14:29:00	96.5	10,000	DB	*<Customer>*	**543 Dealer**
06/30/04	14:22:00	97	10,000	DB	*<Customer>*	**543 Dealer**
07/02/04	15:38:00	100	10,000	DS	**543 Dealer**	*<Customer>*
07/06/04	09:36:00	100.74	10,000	DS	**543 Dealer**	*<Customer>*
11/02/04	14:38:00	99.326	35,000	DB	*<Customer>*	**PQR Dealer**
11/02/04	14:38:00	101.33	35,000	DS	**PQR Dealer**	*<Customer>*
12/28/04	14:51:00	99.25	20,000	DB	*<Customer>*	**XYZ Dealer**
01/12/05	15:41:00	100	5,000	DB	*<Customer>*	**XYZ Dealer**
01/12/05	16:49:00	101.3	5,000	DS	**XYZ Dealer**	*<Customer>*
01/19/05	09:56:59	101.28	20,000	DS	**XYZ Dealer**	*<Customer>*
04/28/05	11:42:20	100	20,000	DB	*<Customer>*	**999 Dealer**
05/02/05	09:09:21	101.15	20,000	DS	**999 Dealer**	*<Customer>*
02/22/06	15:58:00	98	15,000	DB	*<Customer>*	**QQQ Dealer**
02/22/06	15:59:14	99.26	15,000	ID	**QQQ Dealer**	**ZZZ Dealer**
02/22/06	16:05:54	100.26	15,000	ID	**ZZZ Dealer**	**JJJ Dealer**
02/23/06	11:01:34	101	15,000	DS	**JJJ Dealer**	*<Customer>*

Figure II.A: Sample of Study Data Set — *Provides a representation of a portion of the data included in the MSRB's standard trade data feeds, including the MSRB Historical Data Reports used to create the Study Data Set. "Trade date" is the date on which the trade was executed; "Trade time" is the time of trade execution, based on a 24-hour clock; "Trade price" is the price at which the trade was effected, expressed as a percentage of par amount of the securities traded; "Trade size" is the par amount of securities traded, expressed in dollars; "Trade type" indicates whether a dealer bought from a customer (a dealer buy, or DB), a dealer sold to a customer (a dealer sell, or DS), or a dealer sold to another dealer (an inter-dealer trade, or ID);[38] "Selling dealer" lists the dealer identifier for the dealer selling the security; and "Buying dealer" lists the dealer identifier for the dealer buying the security. Dealer identifiers have been modified in this report to preserve confidentiality. "<Customer>" under "Buying dealer" or "Selling dealer" indicates that a customer is the party on that side of the trade. The MSRB does not collect identifying information of customers buying and selling municipal securities, and the actual trade data feed leaves this field blank when a customer is the party.*

As noted above, the statistical study seeks, among other things, to identify paired-trade differentials for pairs of consecutive trades through a single dealer and total customer-to-customer differentials

[38] Note that this sample of the Study Data Set shows the terminology used in the trade data feeds designed for data vendors, market participants and other sophisticated users of market data. Trade data shown on the EMMA® website, which is designed to provide access to market data in a manner easily understandable by retail investors, is presented from the perspective of the customer, and therefore the EMMA® website shows a DB trade as a "customer sold" trade and a DS trade as a "customer bought" trade. In addition, an ID trade is shown on the EMMA® website as an "inter-dealer trade."

resulting from moving municipal securities from a customer selling the securities into the market through one or more dealers to a new customer purchasing the securities in the secondary market. Each customer-to-customer transaction chain consists of two or more trades, with the shortest chain being a pair of consecutive trades through a single dealer, consisting of a first trade representing a customer selling to a dealer (DB) and a second trade representing that dealer selling to another customer (DS). Customer-to-customer transaction chains are illustrated in Figure II.B.

FIGURE II.B: Illustration of Customer-to-Customer Transaction Chains

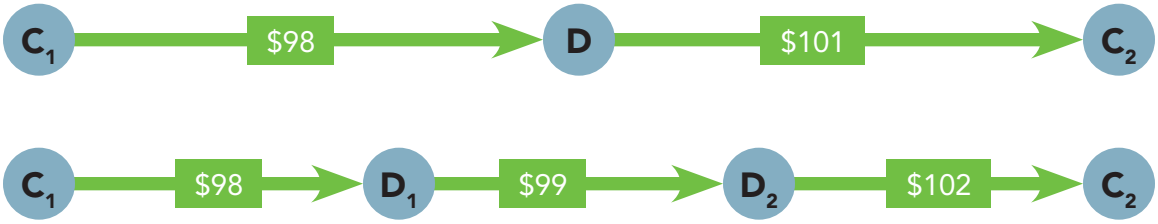


Figure II.B: Illustration of Customer-to-Customer Transaction Chains — *In the top chain, a customer (C_1) sells a municipal security to a dealer (D) at a price of $98 in the first trade, and the dealer sells the security to another customer (C_2) at a price of $101 in the second trade. In the bottom chain, a customer (C_1) sells a municipal security to a dealer (D_1) at a price of $98 in the first trade, the dealer sells the security to another dealer (D_2) at a price of $99 in the second trade, and the second dealer sells the security to another customer (C_2) at a price of $102 in the third trade.*

Each uniquely discernible customer-to-customer transaction chain in the Study Data Set is identified, within certain basic parameters. Customer-to-customer transaction chains used in the statistical study are limited to those that (i) began with a customer selling a security in a DB trade and ended with a customer purchasing a security in a DS trade, without any additional intervening customers in the chain of transactions between the selling customer and the purchasing customer, subject to the inclusion of certain re-sequenced trade pairs described below; (ii) involved no more than 10 dealers within the chain of transactions from one customer to another customer (*i.e.*, consisting of an initial DB trade, zero to nine intervening ID trades, and a final DS trade); and (iii) spanning no more than 30 days from the initial sale by a customer to the final purchase by a customer.

In the sample of the Study Data Set included in Figure II.A, a number of customer-to-customer transaction chains are shown, several of which are highlighted. The two blue-shaded pairs of trades represent two separate chains, each consisting of paired trades (a DB trade and a DS trade) — in the first chain, ABC Dealer bought from a customer and then sold to another customer; in the second chain, XYZ Dealer bought from a customer and then sold to another customer. The dark green quartet of trades represents a chain consisting of four trades (a DB trade, two ID trades and a DS trade) — QQQ Dealer bought from a customer, then sold to ZZZ Dealer, which then sold to JJJ Dealer, which then sold to another customer. The light green quartet in Figure II.A represents a more complicated set of trades, consisting of two DB trades and two DS trades. Two separate chains are derived from this quartet. The first chain consists of a DB trade of $20,000 (the first trade, where XYZ Dealer bought from a customer) and a DS trade of $20,000 (the fourth trade, where XYZ Dealer sold to another customer), and the second chain consists of a DB trade of $5,000 (the second trade, where XYZ Dealer bought from a customer) and a DS trade of $5,000 (the third trade, where XYZ Dealer sold to another customer). For purposes of the statistical

study, the principle of "last in, first out" (LIFO) was applied to the Study Data Set in constructing customer-to-customer transaction chains. The application of other methodologies could result in the construction of a different set of customer-to-customer transaction chains from the set used to conduct the statistical study.

Not all customer-to-customer transaction chains consist of trade sizes that remain the same throughout the entirety of the chain. For example, in many cases, a chain can begin with an investor selling a relatively large quantity of securities to a dealer in a DB trade. That dealer could, instead of selling this entire amount to a single customer in a DS trade or to another dealer in an ID trade, break up the securities into smaller pieces to sell it to two or more customers or other dealers. Such breaking up of an initial quantity of securities can result in the creation of multiple customer-to-customer transaction chains so long as the smaller trades can continue to be traced through to an ultimate DS trade to a customer. A particularly large quantity of securities, presumably sold by an institutional customer, can result in multiple tiers of customer-to-customer transaction chains as the large trade size is broken down in stages. Each of these new branches is considered a customer-to-customer transaction chain so long as it meets the parameters described above. This process of creating customer-to-customer transaction chains from an initial larger trade into smaller trades is illustrated in Figure II.C.

FIGURE II.C: Illustration of Customer-to-Customer Transaction Chains from Large Trade Size into Smaller Trade Sizes

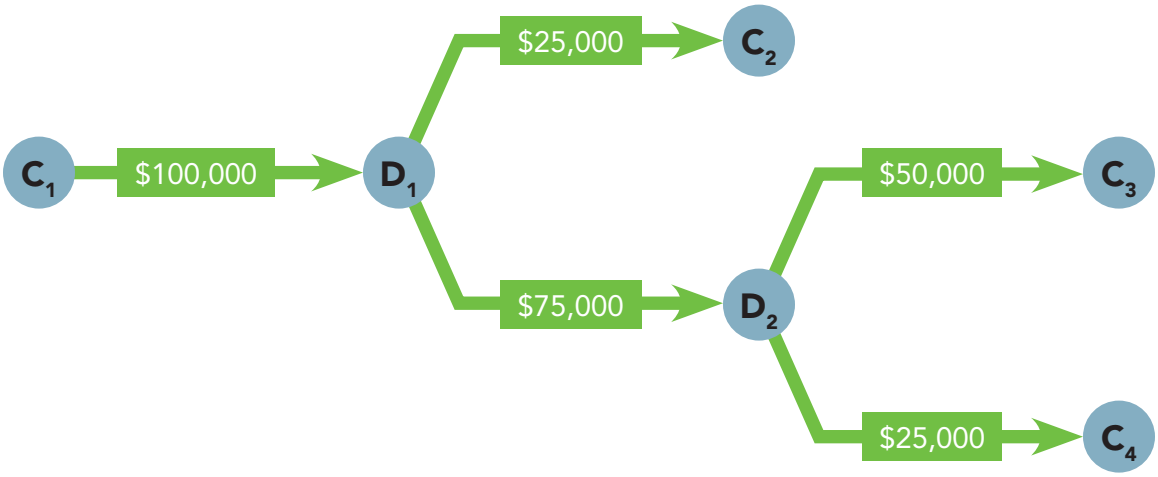


Figure II.C: Illustration of Customer-to-Customer Transaction Chains from Large Trade Size into Smaller Trade Sizes — *An initial customer (C_1) sells $100,000 of municipal securities to a dealer (D_1). D_1 then sells $25,000 of these municipal securities to a second customer (C_2), thereby completing a chain of $25,000 from C_1 to C_2. D_1 sells the remaining $75,000 of the municipal securities to a second dealer (D_2). D_2, in turn, sells $50,000 of these municipal securities to a third customer (C_3), thereby completing a second chain of $50,000 from C_1 to C_3, and sells the remaining $25,000 of these municipal securities to a fourth customer (C_4), thereby completing a third chain of $25,000 from C_1 to C_4. Thus, in total, the initial sale by C_1 of $100,000 results in three distinct customer-to-customer transaction chains for purpose of the statistical study.*

Less frequently, a dealer may acquire a municipal security in multiple smaller trades and resell such securities in a single larger trade to another dealer or a customer. Again, so long as a transaction chain meets the parameters described above, two or more customer-to-customer transaction

chains beginning with smaller DB trades can ultimately feed into a single final DS trade. This process of creating customer-to-customer transaction chains from initial smaller trades of securities into a single larger trade is illustrated in Figure II.D.

FIGURE II.D: Illustration of Customer-to-Customer Transaction Chains from Smaller Trade Sizes into Large Trade Size

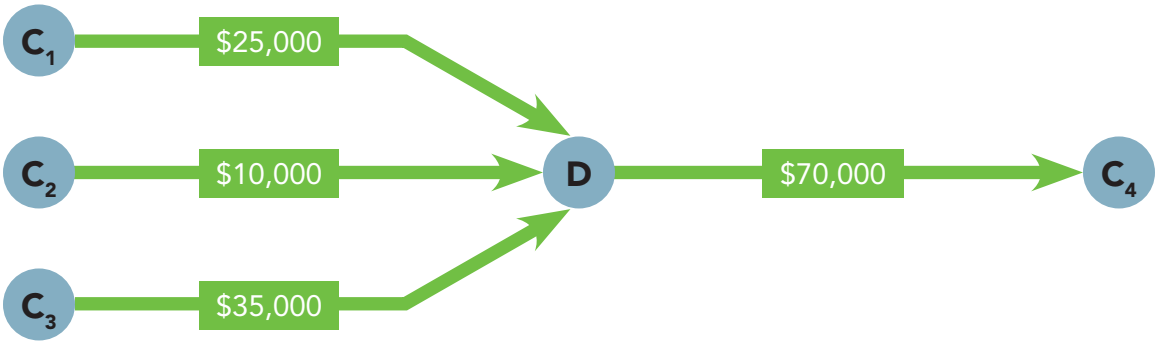


Figure II.D: Illustration of Customer-to-Customer Transaction Chains from Smaller Trade Sizes into Large Trade Size — *A customer (C_1) sells $25,000 of municipal securities to a dealer (D). A second customer (C_2) sells $10,000 of the same municipal securities to D, and a third customer (C_3) sells $35,000 of these municipal securities to D. D then sells to a fourth customer (C_4) the $70,000 of these municipal securities assembled from the three purchases from C_1, C_2 and C_3. In total, these transactions result in three distinct customer-to-customer transaction chains for purpose of the statistical study, consisting of a chain beginning with a $25,000 trade from C_1 to C_4, a second chain beginning with a $10,000 trade from C_2 to C_4, and a third chain beginning with a $35,000 trade from C_3 to C_4.*

For the entire Study Data Set, a full set of customer-to-customer transaction chains meeting the parameters described above is first derived on a systematic basis, relying on the reported trade date and time and assuming that a dealer purchases a security before reselling it. Thus, under this sequential logic, all chains would begin with a DB trade and end with a DS trade, with no more than nine ID trades (and often with no ID trade) between those two end points. Total customer-to-customer differentials are calculated by subtracting the price at which the initial customer sold the security in a DB trade at the beginning of a customer-to-customer transaction chain from the price at which the final customer purchased the security in a DS trade at the end of the chain. Thus, in Figure II.B, the total customer-to-customer differential of the first chain is $3 ($101 – $98 = $3) and the total customer-to-customer differential of the second chain is $4 ($102 – $98 = $4).

However, in some cases, a dealer with a customer seeking to sell municipal securities may identify a second customer to whom it will sell that security and may execute the sell transaction very shortly before executing the purchase transaction, or the dealer may otherwise report the trade time of the sell transaction as being prior to the trade time of the purchase transaction. If this is the case, any algorithm that relies strictly on reported trade times will fail to construct customer-to-customer chains, or trade pairs, that would otherwise be included in the analysis. To rectify this issue, certain trades are re-sequenced before the trade pairs or customer-to-customer chains are constructed. The algorithm only re-sequences trades that are within one hour of each other. The algorithm also requires that such pairs of trades be separated from other trades in the same security by at least one hour before and after the re-sequenced trades. These timing parameters represent a compromise between two considerations: (1) the assumption that the scenario described above

would normally occur within a tight timeframe, and (2) the desire to avoid potentially unmerited manipulation of the trade sequencing under circumstances where multiple transactions in the same security are occurring close in time.

Paired-trade differentials are computed as the difference in the prices of consecutive trades of a municipal security through a single dealer acting as intermediary, calculated by subtracting the price at which the initial trade of such pair was effected from the price at which the second trade of the pair was effected. Paired-trade combinations can consist of a dealer buy followed by a dealer sell (DB-DS);[39] an inter-dealer trade followed by a dealer sell (ID-DS); a dealer buy followed by an inter-dealer trade (DB-ID); and an inter-dealer trade followed by an inter-dealer trade (ID-ID). In all four of these trade pair types, the single dealer acquires bonds in the first trade, and disposes of the bonds in the second trade. Thus, in Figure II.B, the paired-trade differentials are, in the first customer-to-customer transaction chain, $3 ($101 – $98 = $3), which is also equal to the total customer-to-customer differential since the trade pair constitutes a completed customer-to-customer transaction chain, and in the second customer-to-customer transaction chain, $1 ($99 – $98 = $1) for the first paired-trade differential and $3 ($102 – $99 = $3) for the second paired-trade differential, with a total customer-to-customer differential of $4.

[39] In the case of a re-sequenced trade pair as described above, the trade pair would be represented by a DS trade followed by a DB trade based on the reported trade time. For purposes of calculating the paired-trade differential, the price at which the second reported DB trade was effected is subtracted from the price at which the first reported DS trade was effected to capture the true economics of the re-sequenced trade pair.

III: General Characteristics of Secondary Market Trading

General Characteristics. Based on the entire Study Data Set without differentiation among dealer buy (DB), dealer sell (DS) and inter-dealer (ID) trades, Figure III.A sets out the distribution of trade sizes, number of trades during the study period for each individual security, number of times per year that each individual security traded during the study period, and the number of days between each trade of an individual security.

In Figure III.A, the "50% Median" line indicates that 50% of all trades had a trade size at or below $25,000, 50% of all municipal securities traded 10 or fewer times during the eight-year study period, 50% of all municipal securities traded an average of 2.4 or fewer times each year, and 50% of all trades were accompanied by another trade in the same municipal security on the same day. This compares, for example, with the "95%" line, indicating that 5% of all trades had a trade size above $490,000 (with the remaining 95% of trades at or below $490,000), 5% of all municipal securities traded more than 143 times during the study period, 5% of all municipal securities traded an average of more than 30.6 per year, and 5% of all trades had a gap of more than 105 days between such trade and another trade in the same municipal security. Note that each column in Figure III.A is generated independently from the other columns so that a single municipal security transaction may fall within a different percentile range for each of the categories (*e.g.*, a security in the 25th percentile for trade size might be in the 90th percentile for number of trades during the study period, 50th percentile for number of trades per year, and 75th percentile for average number of days between trades).

FIGURE III.A: General Trade Characteristics of Study Data Set

Percentile		Trade Size	Trades per Security	Trades per Calendar Year	Days between Trades
99%		2,770,000	491	107.8	469
95%		490,000	143	30.6	105
90%		200,000	77	16.6	33
75%	Q3	70,000	29	6.4	4
50%	Median	25,000	10	2.4	0
25%	Q1	15,000	4	0.9	0
10%		10,000	2	0.5	0
5%		5,000	2	0.3	0
1%		5,000	1	0.2	0

Figure III.A: General Trade Characteristics of Study Data Set — *These data show, by percentile, basic characteristics of trades during the study period.*

Trade Sizes. Figures III.B and III.C illustrate the distribution of trades by trade size during the study period based on the entire Study Data Set, without differentiation among DB, DS and ID trades.

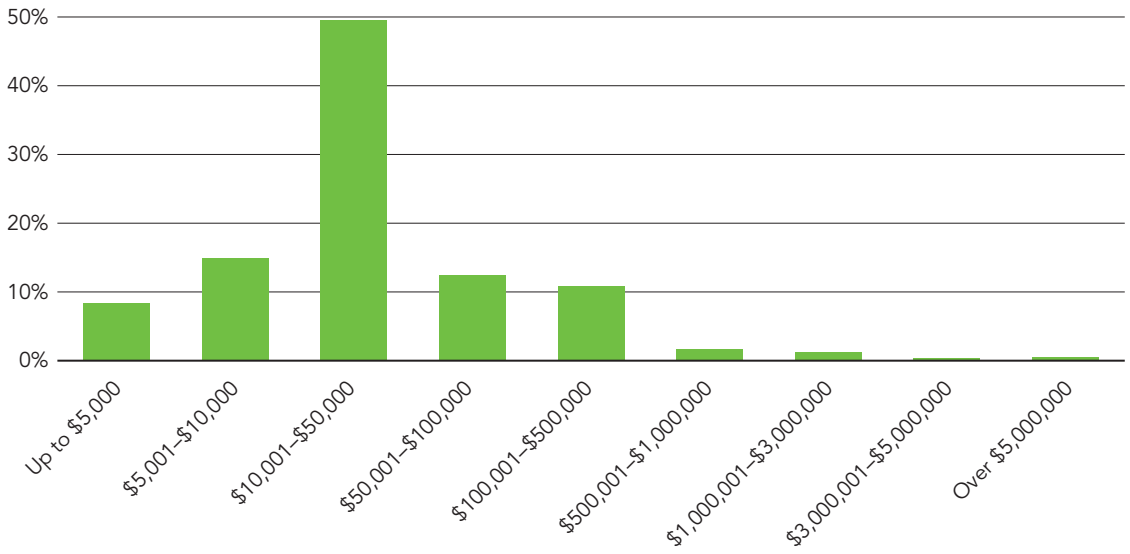
The data in Figure III.B show that 72.8% of all trades in the Study Data Set were in par amounts of $50,000 or less, with nearly a quarter of all trades (23.3%) in par amounts of less than $10,000[40] and half (49.5%) in par amounts between $10,000 and $50,000. Only 14.7% of all trades were in par amounts over $100,000 and only 2.2% were trades of over $1 million.

[40] Municipal securities typically are issued and traded in standard denomination sizes. For example, most municipal securities are issued and traded in minimum denominations of $5,000 and in $5,000 increments above the minimum denomination. In other cases, municipal securities may be issued and traded in minimum denominations of $100,000 and in $5,000 increments above the higher minimum denomination, often in conjunction with certain exemptions provided for under the SEC's Rule 15c2-12 under the Securities Exchange Act of 1934. Much less frequently, municipal securities may be issued and traded in other minimum denominations (*e.g.*, $1,000; $50,0000; $1 million), or in the case of capital appreciation bonds, they may have maturity values in standard denominations but may be expressed in terms of current accreted values that do not conform to such standard denominations. Thus, in the category of trade size up to $5,000 in Figure III.B, for example, the vast majority of those trades represent a lot size of $5,000, although a small number of trades may represent a lot size of $1,000 or a non-standard denomination below $5,000.

FIGURE III.B: Table of Distribution of Trades by Trade Size

Trade Size	Percent of Total Number of Trades
Up to $5,000	8.4%
$5,001–$10,000	14.9%
$10,001–$50,000	49.5%
$50,001–$100,000	12.5%
$100,001–$500,000	10.8%
$500,001–$1,000,000	1.7%
$1,000,001–$3,000,000	1.3%
$3,000,001–$5,000,000	0.4%
Over $5,000,000	0.5%

FIGURE III.C: Chart of Distribution of Trades by Trade Size



Figures III.B and III.C: Distribution of Trades by Trade Sizes — *The table and chart set forth the distribution of trades, by trade size, for all trades in the Study Data Set during the eight-year study period.*

Time between Trades. Figures III.D through III.G illustrate the amount of time elapsed between two consecutive trades in a particular municipal security during the study period, based on the entire Study Data Set, without differentiation among DB, DS and ID trades. Note that the subsequent trade in a particular municipal security shown in these figures can represent either a trade of the same block of securities involved in the first trade or a trade of a different block of the same security, and the parties to the first trade may be different from the parties to the subsequent trade.[41]

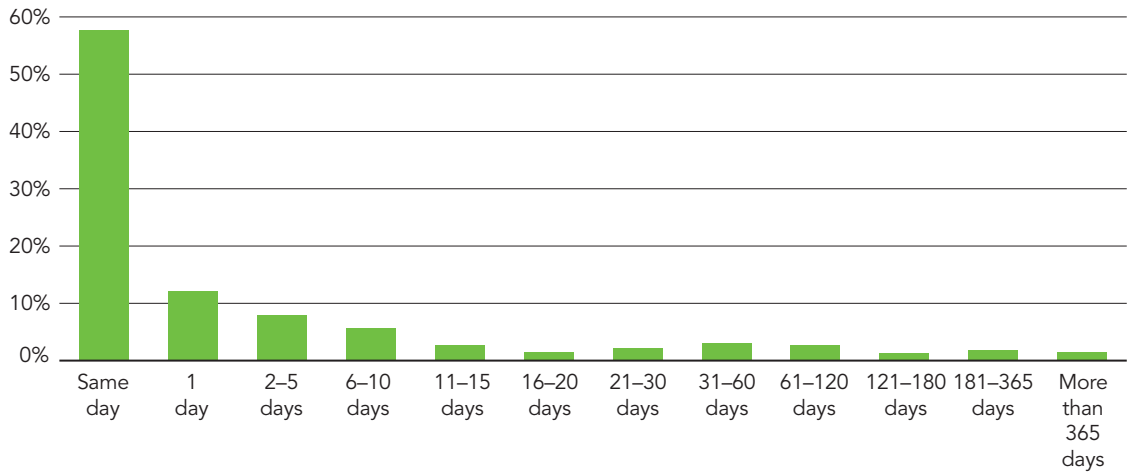
Figures III.D and III.E illustrate the distribution of trades by number of days between two consecutive trades in the same municipal security.

[41] Thus, these data are not limited solely to paired trades through a single dealer intermediary, as described above.

FIGURE III.D: Table of Distribution of Time between Trades, Measured in Number of Days

Days between Trades	Percent of Total Number of Trade Pairs
Same day	57.7%
1 day	12.2%
2–5 days	7.9%
6–10 days	5.6%
11–15 days	2.7%
16–20 days	1.4%
21–30 days	2.2%
31–60 days	3.1%
61–120 days	2.7%
121–180 days	1.3%
181–365 days	1.8%
More than 365 days	1.4%

FIGURE III.E: Chart of Distribution of Time between Trades, Measured in Number of Days



Figures III.D and III.E: Distribution of Time between Trades, Measured in Number of Days — *The table and chart set forth the distribution of trades by number of days between each trade and the next trade in the same security during the eight-year study period. Data derived from a total of 42,248,094 trade pairs.*

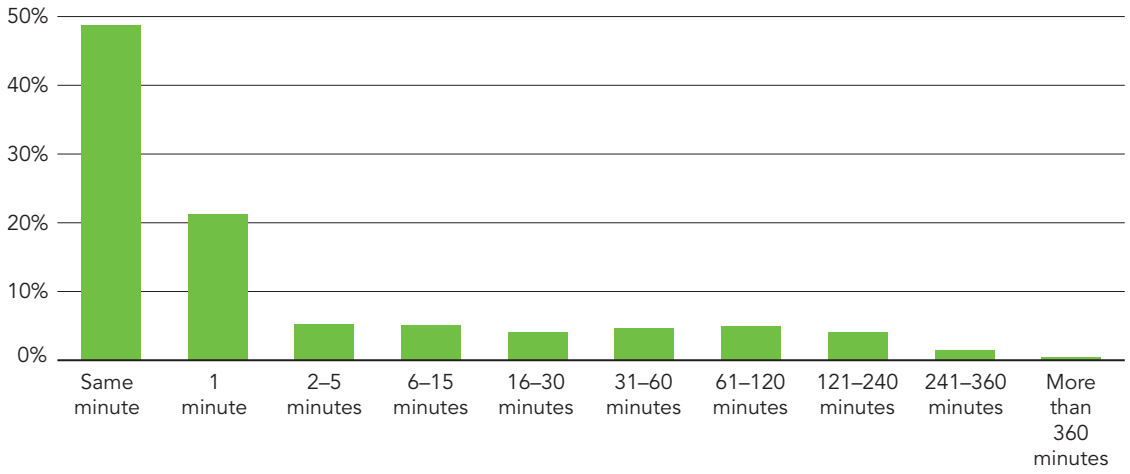
The data in Figure III.D show that 57.7% of all trades that were followed by another trade in the same municipal security had the second trade occur on the same day as the first trade, with another 12.2% having the second trade occur by the next day. By the 30th day, approximately 90% of trades included in Figure III.D had been followed by a second trade.

Figures III.F and III.G illustrate, based on a subset of the Study Data Set consisting of pairs of trades in the same municipal security occurring on the same day, the distribution of trades by number of minutes between two consecutive trades in the security.

FIGURE III.F: Table of Distribution of Time between Trades Occurring on the Same Day, Measured in Number of Minutes

Minutes between Trades	Percent of Total Number of Trade Pairs Occurring on Same Day
Same minute	48.7%
1 minute	21.2%
2–5 minutes	5.3%
6–15 minutes	5.1%
16–30 minutes	4.1%
31–60 minutes	4.7%
61–120 minutes	5.0%
121–240 minutes	4.1%
241–360 minutes	1.4%
More than 360 minutes	0.4%

FIGURE III.G: Chart of Distribution of Time between Trades Occurring on the Same Day, Measured in Number of Minutes



Figures III.F and III.G: Distribution of Time between Trades Occurring on the Same Day, Measured in Number of Minutes — *The table and chart set forth the distribution of trades by number of minutes between two consecutive trades in a municipal security for all trades that were accompanied by another trade in the same security on the same day during the eight-year study period. Data derived from a total of 43,516,748 trade pairs.*

The data in Figure III.F show that 48.7% of all trades that were followed by another trade in the same municipal security on the same day had the second trade occur within the same minute, with another 21.2% having the second trade occur by the next minute. By the 30th minute, approximately 85% of trades included in Figure III.F had been followed by a second trade.[42]

[42] Note that this intraday trade time distribution is affected by the algorithm used to reorder out-of-sequence trades, as described in Section II: Methodology.

IV: Paired-Trade Differentials of Secondary Market Trading

The analyses set forth below focus on paired-trade differentials for pairs of consecutive trades through a single dealer intermediary. Thus, for each paired trade, the buying dealer in the first trade is the same as the selling dealer in the second trade. Four types of trade pairs are analyzed: (i) a dealer buy from a customer (DB) followed by a dealer sell to a customer (DS); (ii) a DB trade followed by an inter-dealer (ID) trade; (iii) an ID trade followed by a DS trade; and (iv) an ID trade followed by an ID trade. This report does not seek to determine or otherwise control for whether identified paired trades would be viewed as so-called "riskless principal trades" or "matched trades," as such terms may be used by market participants.[43]

Paired-Trade Differentials by Paired-Trade Type. Average paired-trade differentials by paired-trade type are summarized in Figure IV.A. Figure IV.A also provides certain characteristics regarding changes in trade size between the two trades of trade pairs.

[43] *See also* the discussion of mark-ups and mark-downs in Section V: Total Customer-to-Customer Differentials of Secondary Market Trading, under the heading "Distribution of Customer-to-Customer Differentials."

FIGURE IV.A: Average Paired-Trade Differentials by Paired-Trade Type and by Changes in Trade Size

			Average Paired-Trade Differential Based on Second Trade Size vs. First Trade Size		
Paired-Trade Type (First – Second Trade)	Number of Trade Pairs	Average Paired-Trade Differential (bps)	Trade Size Becomes Smaller (bps/% of total)	Trade Size Remains the Same (bps/% of total)	Trade Size Becomes Larger (bps/% of total)
DB-DS	9,258,251	178	192 (51%)	160 (44%)	181 (5%)
ID-DS	9,133,417	146	192 (45%)	106 (52%)	135 (2%)
DB-ID	4,553,967	67	65 (31%)	64 (63%)	104 (6%)
ID-ID	4,953,737	50	57 (32%)	44 (64%)	75 (4%)
Total	**27,899,372**	**127**	**159 (43%)**	**100 (53%)**	**135 (4%)**

Figure IV.A: Average Paired-Trade Differentials by Paired-Trade Type and by Changes in Trade Size — *The data show average paired-trade differentials, in basis points (bps), during the study period by paired-trade type. In addition, the average paired-trade differential for each type is broken down into pairs in which the trade size of the second trade is smaller than the first trade, the trade size does not change from the first to the second trade, and the trade size of the second trade is larger than the first trade. The percent breakdown for each paired-trade type by these three categories of trade sizes is also shown. Data from 20,298 trade pairs with extreme differentials were excluded as outliers.*

Based on the data in Figure IV.A, a DB-DS trade pair, which also represents a full customer-to-customer transaction chain as described in Section V: Total Customer-to-Customer Differentials of Secondary Market Trading, averaged a paired-trade differential (and therefore also a total customer-to-customer differential) of 178 bps.[44] The other three trade pair types (ID-DS, DB-ID, and ID-ID) all have lower paired-trade differentials. The average ID-DS paired-trade differential is 146 bps, the average DB-ID paired-trade differential is 67 bps, and the ID-ID paired-trade differential is the lowest of the four pair types at 50 bps. Paired-trade differentials are noticeably higher when trades involve a customer, as opposed to another dealer. Using an ID-ID trade pair as a starting point, replacing either side of the trade pair with a customer trade serves to increase the paired-trade differential relative to the ID-ID pair. This is perhaps not surprising if higher costs are associated with identifying and trading with a customer versus another dealer. The other pattern associated with the trade costs is that there are higher paired-trade differentials associated with sale transactions to customers versus buy transactions from customers. Relative to an ID-ID trade pair, substituting a DB trade increases the differential by 17 bps (50 bps to 67 bps), while substituting a DS trade increases the differential by 96 bps (50 bps to 146 bps). Both patterns carry over into the other columns of the tables, which control for relative trade size, as discussed in the next paragraph.

With respect to changes in trade size that may occur between trades in a trade pair, Figure IV.A shows that both trades in the pair were of the same size 53% of the time on average, while in 43% of the pairs, the initial larger trade was followed by a smaller trade. In significantly fewer cases, the initial smaller trade was followed by a larger trade (2% to 6%). A dealer that purchased securities from one customer and sold them to another customer in a DB-DS trade pair was somewhat more

[44] A basis point, which is terminology often used by professionals in connection with the pricing of municipal securities transactions, represents 1/100 of 1%. Thus, 178 bps can also be expressed as 1.78%.

likely to effect a subsequent smaller trade (51% of the time), as compared to securities it acquired from another dealer in an ID trade for sale to either a customer (DS) (45%) or another dealer (ID) (32%), or as compared to securities it acquired from a customer (DB) for sale to another dealer (ID) (31%).

Paired-Trade Differentials for Paired Trades within 30 Minutes by Trade Type and Size. The data set forth in Figure IV.B focus on trade pairs occurring within 30 minutes of each other to analyze paired-trade differentials for specific parties to municipal securities transactions.

Figure IV.B focuses on a subset of the paired trades analyzed in Figure IV.A, consisting of those instances where the paired trades were executed within 30 minutes of each other.[45] The data in Figure IV.B for the paired trades occurring within 30 minutes show significantly lower paired-trade differentials in all categories as compared to the full set of paired trades reflected in Figure IV.A, with overall average paired-trade differential reduced from 127 bps to 80 bps, reflecting a 47 bps (or 37.0%) reduction in paired-trade differential. Focusing on specific paired-trade types, average paired-trade differentials for DB-DS pairs were 53 bps (or 29.8%) lower, ID-DS pairs were 41 bps (or 28.1%) lower, DB-ID pairs were 14 bps (or 20.9%) lower, and ID-ID pairs were 24 bps (or 48.0%) lower for those occurring within 30 minutes as compared to the broader universe of paired trades.

[45] In the case of out-of-sequence trades in which a dealer sell (DS) is closely followed by a dealer buy (DB) under the circumstances described above in Section II: Methodology, the order of the trades is reversed and the DS is treated as having occurred in the next succeeding minute after the time of execution of the DB for purposes of assessing the effect of elapsed time on paired-trade differentials.

FIGURE IV.B: Average Paired-Trade Differentials for Trades within 30 Minutes of Previous Trade by Paired-Trade Type and by Changes in Trade Size

			Average Paired-Trade Differential Based on Second Trade Size vs. First Trade Size		
Paired-Trade Type (First – Second Trade)	**Trade Pairs**	**Average Paired-Trade Differential (bps)**	**Trade Size Becomes Smaller (bps/% of total)**	**Trade Size Remains the Same (bps/% of total)**	**Trade Size Becomes Larger (bps/% of total)**
DB-DS	1,584,198	125	167 (26%)	110 (70%)	117 (4%)
0–14 min b/w trades	1,274,293	117			
15–30 min b/w trades	309,905	158			
ID-DS	4,123,835	105	152 (9%)	100 (89%)	116 (2%)
0–14 min b/w trades	3,847,086	103			
15–30 min b/w trades	276,749	133			
DB-ID	2,139,601	53	45 (2%)	53 (96%)	71 (3%)
0–14 min b/w trades	2,076,570	53			
15–30 min b/w trades	63,031	53			
ID-ID	2,267,707	26	20 (4%)	26 (94%)	25 (2%)
0–14 min b/w trades	2,131,270	25			
15–30 min b/w trades	136,437	42			
Total	10,115,341	80	140 (9%)	73 (89%)	91 (2%)
0–14 min b/w trades	9,329,219	76			
15–30 min b/w trades	786,122	127			

Figure IV.B: Average Paired-Trade Differentials for Trades within 30 Minutes of Previous Trade by Paired-Trade Type and by Changes in Trade Size — *The data show average paired-trade differentials of trade pairs in which both trades occurred within 30 minutes of each other based on the the Real-time Transaction Reporting System (RTRS) Data Set. In addition to the same categories shown in Figure IV.A, this table compares paired-trade differentials of paired trades occurring less than 15 minutes from each other with paired trades occurring between 15 minutes and 30 minutes of each other. Further, the average paired-trade differential for each type is broken down into pairs in which the trade size of the second trade is smaller than in the second trade, the trade size does not change from the first to the second trade, and the trade size of the second trade is larger than the second trade. The percent breakdown for each paired-trade type by these three categories of trade sizes is also shown. Data from 20,298 trade pairs with extreme differentials were excluded as outliers.*

Thus, completion of customer-to-customer transaction chains within 30 minutes as compared to the full 30-day window is associated with lower total customer-to-customer differentials. In addition, paired-trade differentials for DB-DS trade pairs representing the shortest possible customer-to-customer transaction chains, both for trade pairs completed within 30 minutes and for trade pairs completed within the full 30-day window, are associated with lower total customer-to-customer differentials than in the case of constructive customer-to-customer transactions chains involving additional inter-dealer steps.

In comparing paired-trade differentials for paired trades completed in less than 15 minutes with paired trades completed between 15 and 30 minutes of each other, the quicker completion of the paired trades in less than 15 minutes reflected a 51 bps lower average paired-trade differential as compared to the pairs completing more slowly, between 15 and 30 minutes (127 bps vs. 76 bps).[46] This represents a 40.2% lower average paired-trade differential for paired trades executed within less than 15 minutes over those executed between 15 and 30 minutes. In contrast, the average paired-trade differential for paired trades executed between 15 and 30 minutes of each other (127 bps) was identical to the average paired-trade differential of the broader data set of paired trades occurring within 30 days of each other (127 bps), as shown in Figure IV.A.

Both trades in paired trades occurring from 0 to 30 minutes apart were of the same size (89%), as compared to the overall 53% rate for paired trades of the same size within the broader universe, shown in Figure IV.A.

[46] As noted above, the DS trade in a re-sequenced pair of trades is treated as having occurred in the next succeeding minute after the time of execution of the DB trade and therefore all such re-sequenced pairs included in the RTRS Data Set are treated as having been executed within less than 15 minutes.

V: Total Customer-to-Customer Differentials of Secondary Market Trading

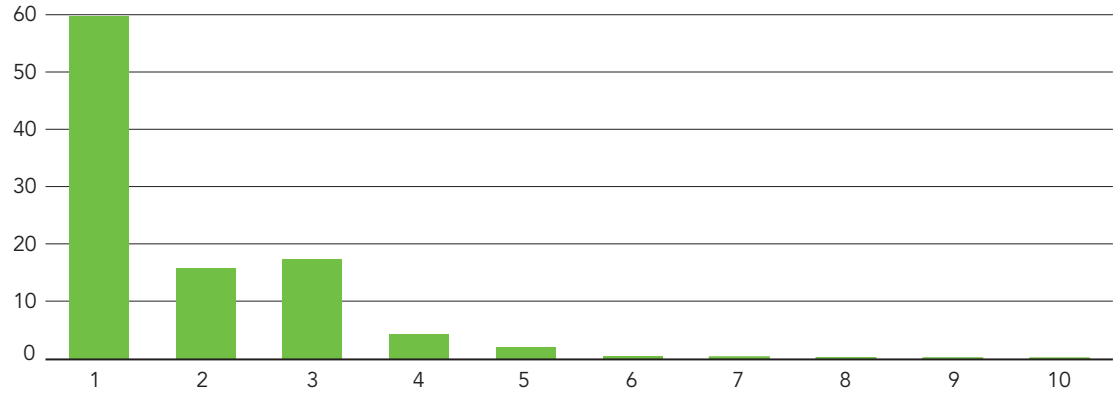
The analysis in this section focuses on how dealers conduct trades between customers in the municipal bond market. This analysis is undertaken through a review of customer-to-customer transaction chains through which municipal securities move from a customer selling the municipal securities into the market in a dealer buy (DB) trade through one or more dealers to a new customer purchasing the securities in a dealer sell (DS) trade. Certain basic characteristics of customer-to-customer transaction chains are described below. Furthermore, using the methods described in Section II: Methodology with regard to customer-to-customer transaction chains, the following data regarding total customer-to-customer differentials have been derived.

Number of Dealer Intermediaries in Customer-to-Customer Transaction Chains. The relative frequency associated with the number of dealers involved in customer-to-customer transaction chains during the study period is illustrated in Figures V.A and V.B.

FIGURE V.A: Table of Number of Dealers in Customer-to-Customer Transaction Chains

Number of Dealer Intermediaries	Percent of Chains
1	59.80%
2	15.75%
3	17.32%
4	4.27%
5	1.97%
6	0.47%
7	0.26%
8	0.08%
9	0.05%
10	0.03%

FIGURE V.B: Chart of Number of Dealers in Customer-to-Customer Transaction Chains



Figures V.A and V.B: Number of Dealers in Customer-to-Customer Transaction Chains — *The table and chart set forth the distribution of number of dealers involved in customer-to-customer transaction chains during the eight-year study period. Data derived from a total of 15,494,020 transaction chains.*

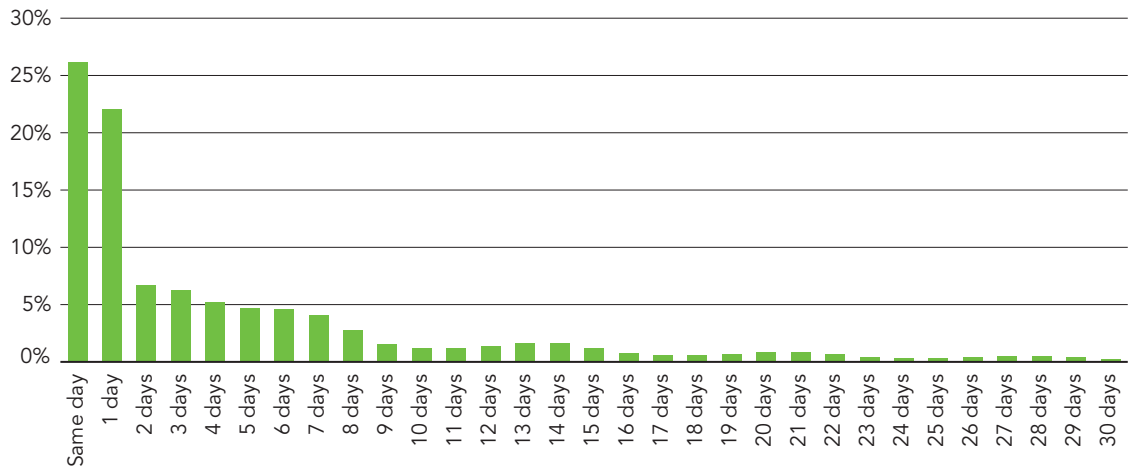
The data in Figure V.A show that nearly 60% of customer-to-customer transaction chains, consisting of a DB trade followed by a DS trade, involved a single dealer. Approximately 16% of customer-to-customer transaction chains involved two dealers (*i.e.*, one intervening inter-dealer, or ID, trade), approximately 17% of such chains involved three dealers (*i.e.*, two intervening ID trades), and approximately 6% of such chains involved four or five dealers (*i.e.*, three or four intervening ID trades). The incidence of longer customer-to-customer transaction chains was negligible. As described in Section II: Methodology, a customer-to-customer transaction chain for purposes of the statistical study does not exceed 10 dealers.

Duration of Customer-to-Customer Transaction Chains. The length of customer-to-customer transaction chains during the study period, measured in number of days, is illustrated in Figures V.C and V.D.

FIGURE V.C: Table of Length of Customer-to-Customer Transaction Chains, in Days

Number of Days	Percent of Chains	Number of Days	Percent of Chains
Same day	26.16%	16	0.72%
1	22.04%	17	0.56%
2	6.68%	18	0.59%
3	6.25%	19	0.68%
4	5.19%	20	0.82%
5	4.71%	21	0.84%
6	4.57%	22	0.63%
7	4.10%	23	0.40%
8	2.71%	24	0.32%
9	1.53%	25	0.33%
10	1.21%	26	0.39%
11	1.21%	27	0.48%
12	1.37%	28	0.51%
13	1.61%	29	0.40%
14	1.59%	30	0.26%
15	1.16%		

FIGURE V.D: Chart of Length of Customer-to-Customer Transaction Chains, in Days



Figures V.C and V.D: Length of Customer-to-Customer Transaction Chains, in Days — *The table and chart set forth the distribution of the length, in days, of customer-to-customer transaction chains during the eight-year study period. Data derived from a total of 15,494,020 transaction chains.*

The data in Figure V.C show that slightly more than one-fourth of customer-to-customer transaction chains were completed within a single day, with another 22% completed by the next day. By the fourth day after the beginning of the customer-to-customer transaction chain, approximately two-thirds of such chains had been completed. The length of the remaining one-third of customer-to-customer transaction chains trailed off gently thereafter, indicating that an appreciable number

of initial DB trades required a considerable period of time in order to find new customers. As described in Section II: Methodology, a customer-to-customer transaction chain for purposes of the statistical study does not exceed 30 days.

Distribution of Customer-to-Customer Differentials. Based on the entire Study Data Set reflecting the study period, the distribution of total customer-to-customer differentials, calculated by subtracting the price at which the initial customer sold the municipal security in a DB trade at the beginning of a customer-to-customer transaction chain from the price at which the final customer purchased the security in a DS trade at the end of the chain, is illustrated in Figure V.E.

FIGURE V.E: Distribution of Total Customer-to-Customer Differentials

Percentile		Total Customer-to-Customer Differential (bps)
99%		616
95%		429
90%		365
75%	Q3	288
50%	Median	198
25%	Q1	93
10%		25
5%		9
1%		-69

Figure V.E: Distribution of Total Customer-to-Customer Differentials — *These data show, by percentile, total customer-to-customer differentials during the study period.*

In Figure V.E, the "50% Median" line indicates that 50% of all customer-to-customer transaction chains resulted in a total customer-to-customer differential of 198 bps or less, and the other 50% resulted in a total customer-to-customer differential above 198 bps, regardless of the number of dealers (not exceeding 10) in the customer-to-customer transaction chain, the length of time (not exceeding 30 days) to complete the chain, or the trade size. This compares, for example, with the "95%" line, indicating that 5% of all customer-to-customer transaction chains resulted in a total customer-to-customer differential above 429 bps. In the case of the "1%" line, the resulting total customer-to-customer differential of -69 bps for the bottom 1% of all customer-to-customer transaction chains would indicate that the DS trade at the end of the chain had a lower price than the DB trade at the start of the chain. Customer-to-customer transaction chains falling within this basket could reflect chains during the course of which an adverse credit event or movement in market rates may have occurred. Credit events or market movements can have either positive or negative impacts in all categories, particularly since the length of time to complete customer-to-customer transaction chains could be as long as 30 days. Thus, the lower percentile figures (including the 1% figure discussed above) could be affected by customer-to-customer transaction chains during which negative credit events or market movements may have lowered the total customer-to-customer differential, and the higher percentile figures could be affected by chains during which positive credit events or market movements may have elevated the total customer-to-customer differential.

Total customer-to-customer differentials as calculated for the statistical study would not normally equate to mark-ups or mark-downs for regulatory purposes. In basic terms, a mark-down is the amount by which the price paid by a dealer to a customer selling a municipal security in a DB trade is reduced from its market value to compensate the dealer for the transaction, and a mark-up is the amount by which the price paid by a customer buying a municipal security in a DS trade is increased above its market value to compensate the dealer for the transaction, including expenses associated with the transaction and any profit (or loss) to the dealer. Using the 50% median total customer-to-customer differential from Figure V.E, a customer-to-customer transaction chain consisting of paired DB and DS trades might, hypothetically, consist of the DB trade at a price of $99.01 and a DS trade at a price of $100.99 for a total customer-to-customer differential of 198 bps ($1.98). Although the dealer would retain the full amount of the total customer-to-customer differential of 198 bps — and assuming that no credit event, general market movement or other change occurred between the times of the two trades that would affect the market value of the security — a portion of this total customer-to-customer differential generally would constitute the mark-down on the DB trade, and the remaining portion generally would constitute the mark-up on the DS trade.[47]

To extend the hypothetical example, a customer-to-customer transaction chain could instead consist of a triplet of trades, beginning with a DB trade at a price of $99.01, an ID trade at a price of $99.98, and a DS trade at a price of $100.99, resulting in a total customer-to-customer differential of 198 bps, as in the first example above. However, this chain consists of two sets of paired trades, the first being between the DB trade and the ID trade, with a paired-trade differential of 97 bps, and the second between the ID trade and the DS trade, with a paired-trade differential of 101 bps. The mark-down on the DB trade would normally be viewed as a portion of the first paired-trade differential of 97 bps, which is the amount retained in this example by the first dealer involved in the DB trade after selling the security in the ID trade to the second dealer, and the mark-up on the DS trade would normally be viewed as a portion of the second paired-trade differential of 101 bps, which is the amount retained by the second dealer involved in the DS trade after acquiring it from the first dealer in the ID trade. Paired-trade differentials are analyzed in Section IV: Paired-Trade Differentials of Secondary Market Trading.

Total Customer-to-Customer Differentials and Number of Dealer Intermediaries by Trade Size. Figures V.F through V.H set out average total customer-to-customer differentials and average number of dealer intermediaries in customer-to-customer transaction chains for various trade sizes.

[47] In the example above, market observers sometimes informally refer to the 198 bps total customer-to-customer differential as the mark-up. In general, however, this blurs the compensation components of the price received by the customer from the dealer intermediary in the DB trade and of the price paid by the customer to the dealer in the DS trade. In particular, it would be inaccurate to consider there to be both a mark-down of 198 bps paid by the customer in the DB trade and a mark-up of 198 bps paid by the customer in the DS trade since this would result in double counting the total customer-to-customer differential. In addition, as noted above, it does not take into account, in the context of a specific transaction chain, the potential for, among other things, changes in the market value of the security between the two trades, particularly as the time elapsed between the two trades increases.

FIGURE V.F: Table of Average Total Customer-to-Customer Differentials by Trade Size and Number of Dealer Intermediaries

Trade Size	Chain Type (all chains vs. chains with trade size unchanged)	Average Total Customer-to-Customer Differential, All Chains (bps)	Average Total Customer-to-Customer Differential, One Dealer Intermediary (bps)	Average Total Customer-to-Customer Differential, Two or More Dealer Intermediaries (bps)	Difference in Average Total Customer-to-Customer Differential, One Dealer vs. Two or More Dealer Intermediaries (bps and percent)	Percent of Chains with a Single Dealer Intermediary	Average Number of Dealer Interme-diaries per Chain
Up to $5,000	All chains	246	230	283	53 (23.0%)	70.3%	1.53
	Par unchanged	235	223	290	67 (30.0%)	82.2%	1.31
$5,001–$10,000	All chains	238	218	272	54 (24.8%)	62.9%	1.69
	Par unchanged	219	204	266	62 (30.4%)	76.8%	1.41
$10,001–$25,000	All chains	216	194	247	53 (27.3%)	59.8%	1.76
	Par unchanged	190	176	227	51 (29.0%)	72.8%	1.48
$25,001–$50,000	All chains	190	163	223	60 (36.8%)	55.8%	1.85
	Par unchanged	155	139	191	52 (37.4%)	70.5%	1.51
$50,001–$100,000	All chains	154	124	188	64 (51.6%)	52.8%	1.91
	Par unchanged	114	98	146	48 (49.0%)	67.9%	1.55
$100,001–$500,000	All chains	106	74	143	69 (93.2%)	53.5%	1.91
	Par unchanged	71	57	104	47 (82.5%)	69.5%	1.52
$500,001–$1,000,000	All chains	54	30	94	64 (213.3%)	62.6%	1.73
	Par unchanged	36	25	69	44 (176.0%)	76.4%	1.41
$1,000,001–$3,000,000	All chains	33	18	73	55 (305.6%)	73.6%	1.53
	Par unchanged	20	16	46	30 (187.5%)	86.0%	1.23
$3,000,001–$5,000,000	All chains	20	13	53	40 (307.7%)	82.5%	1.34
	Par unchanged	13	12	31	19 (158.3%)	91.4%	1.14
Over $5,000,000	All chains	13	11	28	17 (154.5%)	86.5%	1.26
	Par unchanged	12	11	25	14 (127.3%)	93.5%	1.10

Figure V.F: Average Total Customer-to-Customer Differentials by Trade Size and Number of Dealer Intermediaries — *The table shows the average total customer-to-customer differentials, in basis points, during the study period, broken down by trade size. The data include the average total customer-to-customer differentials for all customer-to-customer transaction chains, average total customer-to-customer differentials for chains with only one dealer intermediary* (e.g., *a DB trade followed by a DS trade), and average total customer-to-customer differentials for chains with more than one, and up to 10, dealer intermediaries* (e.g., *a DB, followed by one to nine ID trades, then completed by a DS). In addition, the table shows the difference in average total customer-to-customer differentials between chains with one dealer intermediary and chains with two or more dealer intermediaries for each trade size, as well as the percent of all chains for each trade size that consist of chains with a single dealer intermediary, and the average number of dealer intermediaries per chain for each trade size. Further, the identical data are provided for a subset of all customer-to-customer transaction chains in which the trade size does not change from the initial DB trade to the final DS trade. Data derived from a total of 15,205,658 transaction chains.*

The data in Figure V.F demonstrate that total customer-to-customer differentials show a pronounced trade size or scale effect, with average total customer-to-customer differentials dropping demonstrably as trade size increases. Trade sizes of $25,000 and smaller had average total customer-to-customer differentials above the median total customer-to-customer differential of 198 bps shown in Figure V.E, while larger trades had lower average total customer-to-customer differentials. The trade size of $25,000, which is the median trade size shown in Figure V.E, had an average total customer-to-customer differential 12.2% below the average total customer-to-customer differential of the smallest standard trade size of $5,000. Larger trade sizes experienced greater reductions in average total customer-to-customer differentials, with $100,000 trades resulting in a 28.7% lower average total customer-to-customer differential as compared to $25,000 trades, $1 million trades resulting in a 64.9% lower average total customer-to-customer differential as compared to $100,000 trades, and trades larger than $5 million resulting in a 75.9% lower average total customer-to-customer differential as compared to $1 million trades. This effect is illustrated in the chart in Figure V.G.

FIGURE V.G: Chart of Average Total Customer-to-Customer Differentials by Trade Size and Number of Dealer Intermediaries

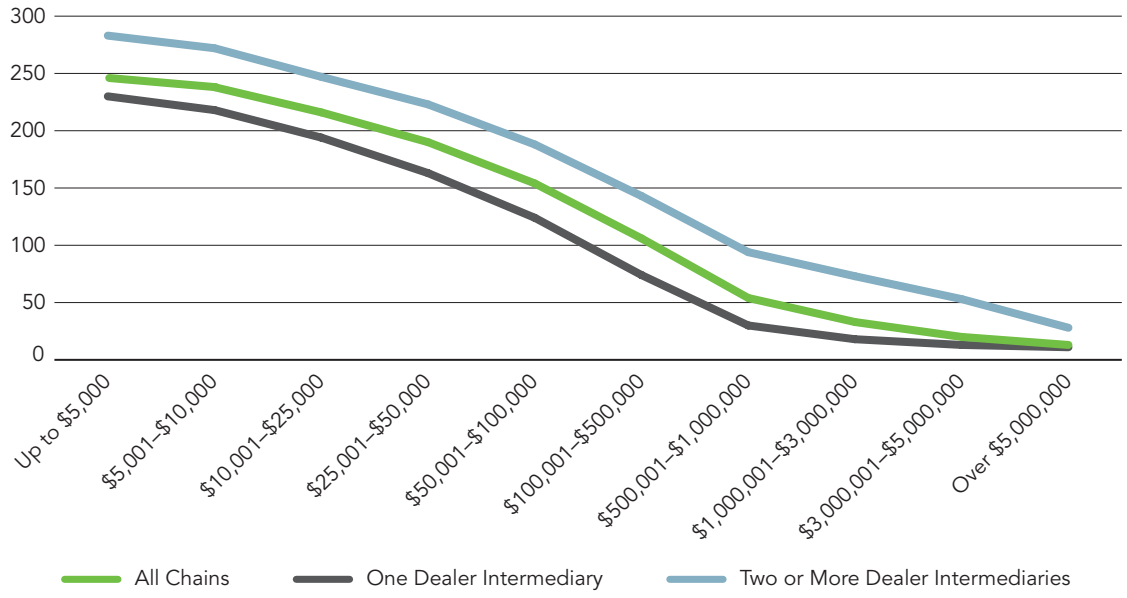


Figure V.G: Average Total Customer-to-Customer Differentials by Trade Size and Number of Dealer Intermediaries — *The chart illustrates the average total customer-to-customer differentials for all customer-to-customer transaction chains, for chains with only one dealer intermediary, and for chains with more than one, and up to 10, dealer intermediaries, broken down by trade size of the initial DB trade, based on the data in the table in Figure V.F for all chains, regardless of any change in par amount.*

Figures V.F and V.G show that, for all trade sizes, the average total customer-to-customer differential for customer-to-customer transaction chains with a single dealer intermediary (*i.e.*, a DB-DS trade pair) was consistently lower than the overall average for all chains, and the average total customer-to-customer differential for chains with two or more dealer intermediaries was consistently higher than the overall average for all chains. That is, customer-to-customer transaction chains involving more than one dealer intermediary tended to have higher average total customer-to-

customer differentials than chains involving a single dealer acting as an intermediary between two customers. For trade sizes under $3 million, the higher average total customer-to-customer differentials for chains involving more than one dealer intermediary ranged from 53 to 69 bps. The largest trades, however, consisting of those over $5 million, saw the lowest increase of all, with an increase of only 17 bps for chains with more than one dealer intermediary. The relative differences in average total customer-to-customer differentials associated with differences in the number of dealer intermediaries in a customer-to-customer transaction chain is further illustrated in the chart in Figure V.H.

FIGURE V.H: Scatter Plot of Increase in Average Total Customer-to-Customer Differentials for Multi-Dealer Customer-to-Customer Transaction Chains vs. Average Number of Dealer Intermediaries in Customer-to-Customer Transaction Chains, by Trade Size

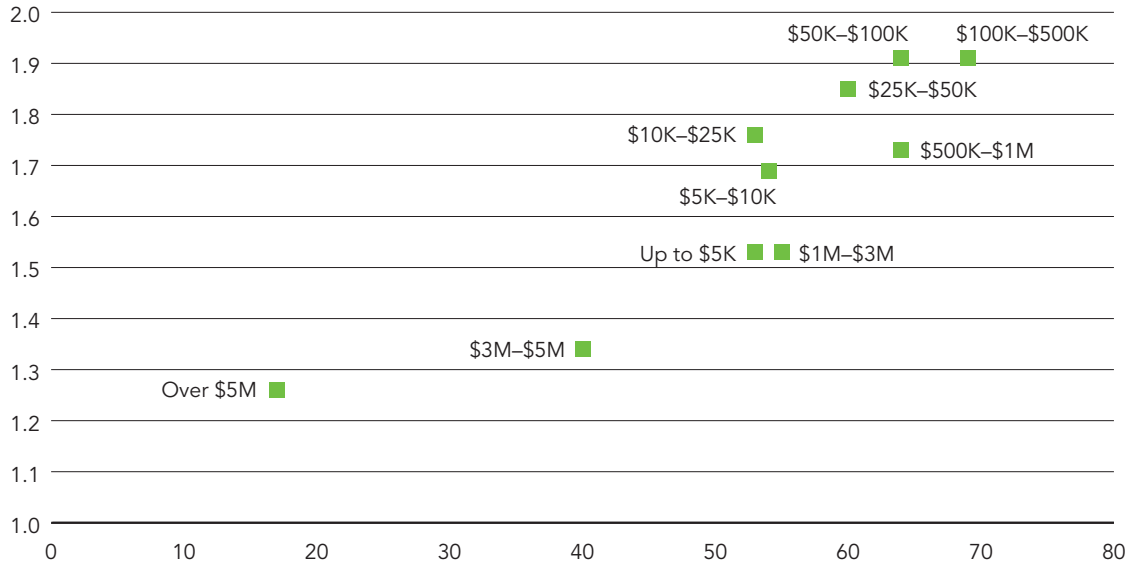


Figure V.H: Scatter Plot of Increase in Average Total Customer-to-Customer Differentials for Multi-Dealer Customer-to-Customer Transaction Chains vs. Average Number of Dealer Intermediaries in Customer-to-Customer Transaction Chains, by Trade Size — *The scatter plot shows, on the x-axis, the difference in average total customer-to-customer differentials between customer-to-customer transaction chains with one dealer intermediary and chains with two or more dealer intermediaries for each trade size against, on the y-axis, the average number of dealer intermediaries per customer-to-customer transaction chain, as shown in Figure V.F.*

The data in Figure V.F demonstrate, and the chart in Figure V.H illustrates, that trade sizes with higher average number of dealer intermediaries involved in customer-to-customer transaction chains generally are associated with larger increases in total customer-to-customer differentials for chains with more than one dealer intermediary as compared to chains with a single dealer intermediary. There is no clear association between trade size and such increases in total customer-to-customer differentials for multi-dealer chains. However, this data should be interpreted with caution since it is not possible to distinguish whether the higher total customer-to-customer differentials associated with the higher incidence of dealer intermediation is a result of, on the one hand, additional costs arising from a greater number of dealers involved in the transaction chain or, on the other hand, characteristics of the particular security that make it more difficult to

locate an appropriate investor in the marketplace and therefore require additional intermediation services.

The data in Figure V.F for the subset of all customer-to-customer transaction chains in which the trade size does not change from the initial DB trade to the final DS trade generally illustrate that the total customer-to-customer differentials for such chains are consistently lower than the total customer-to-customer differentials for chains in which the trade size changes as it moves through the chain. Furthermore, this lower total customer-to-customer differential is more pronounced in customer-to-customer transaction chains involving a single dealer intermediary as compared to chains with more than one dealer intermediary, and single dealer chains are more common for chains where trade size does not change as compared to chains where trade size changes as the municipal securities move through the chain.

Total Customer-to-Customer Differentials by Duration of Customer-to-Customer Transaction Chain and Trade Size. Figure V.I sets out average total customer-to-customer differentials for various trade sizes of municipal securities broken down by number of days to complete the customer-to-customer transaction chain and number of dealer intermediaries in the transaction chain.

FIGURE V.I: Table of Average Total Customer-to-Customer Differentials by Trade Size and Duration of and Number of Dealer Intermediaries in Customer-to-Customer Transaction Chains (in bps)

Trade Size	Number of Dealer Intermediaries in Chain	Same Day	1 Day	2 Days	3 Days	4 Days	5 Days	6–10 Days	11–15 Days	16–20 Days	21–30 Days
Up to $5,000	All chains	231	252	259	254	256	259	257	252	241	223
	1 dealer	222	239	242	239	241	241	236	227	212	192
	2–10 dealers	277	286	291	288	288	290	290	285	274	256
$5,001–$10,000	All chains	212	243	252	246	250	253	253	246	240	223
	1 dealer	200	227	231	229	232	232	229	219	208	190
	2–10 dealers	263	273	282	276	279	281	280	272	265	247
$10,001–$25,000	All chains	184	220	231	225	229	233	232	226	221	204
	1 dealer	169	204	212	208	211	213	208	197	186	167
	2–10 dealers	232	245	257	251	255	257	257	250	246	227
$25,001–$50,000	All chains	151	195	208	201	206	210	210	205	201	186
	1 dealer	133	177	185	180	184	186	181	170	158	140
	2–10 dealers	201	221	233	228	231	235	233	228	225	209
$50,001–$100,000	All chains	113	162	175	169	174	178	177	175	175	157
	1 dealer	94	141	149	145	149	150	144	134	128	104
	2–10 dealers	159	187	200	195	199	203	200	197	196	178
$100,001–$500,000	All chains	73	118	129	125	129	132	129	126	131	116
	1 dealer	56	96	98	96	100	97	88	78	71	52
	2–10 dealers	117	144	155	154	154	157	154	150	157	138
$500,001–$1,000,000	All chains	38	66	72	70	69	69	69	71	75	63
	1 dealer	28	44	35	40	36	36	25	17	16	0
	2–10 dealers	79	93	105	100	100	98	100	104	103	92
$1,000,001–$3,000,000	All chains	24	41	45	44	40	39	41	43	46	53
	1 dealer	19	26	20	22	21	16	12	4	-8	-8
	2–10 dealers	58	71	81	80	71	75	75	76	87	91
$3,000,001–$5,000,000	All chains	17	29	29	36	20	24	23	12	15	18
	1 dealer	15	21	14	18	13	16	4	-6	-11	-31
	2–10 dealers	50	62	68	81	43	46	55	38	44	57
Over $5,000,000	All chains	12	22	23	24	17	25	11	5	-1	-4
	1 dealer	12	19	14	20	12	14	1	-8	-17	-19
	2–10 dealers	24	37	61	45	34	59	34	24	18	7

Figure V.I: Table of Average Total Customer-to-Customer Differentials by Trade Size and Duration of and Number of Dealer Intermediaries in Customer-to-Customer Transaction Chains — *The table shows the average total customer-to-customer differentials, in basis points, during the study period, broken down by trade size and number of days to complete the customer-to-customer transaction chain. For each trade size, average total customer-to-customer differentials are shown, first for all chains regardless of number of dealer intermediaries (*i.e., *from one to 10 dealer intermediaries with a DB, followed by zero to nine ID trades, then completed by a DS), then for only those customer-to-customer transaction chains involving a single dealer intermediary (*i.e., *a DB-DS trade pair), and then for chains with two to 10 dealer intermediaries. Data derived from a total of 15,487,185 transaction chains.*

The data in Figure V.I demonstrate several patterns. For all trade sizes, customer-to-customer transaction chains completed within the same day reflected lower average total customer-to-customer differentials than did chains completed one day after they began. However, average total customer-to-customer differentials for trade sizes of $500,000 and under displayed a markedly different pattern from those for trade sizes larger than $500,000. For trade sizes up to $500,000, the average total customer-to-customer differential remained elevated for customer-to-customer chains with up to 10 dealer intermediaries for as long as 20 days, although chains with only a single dealer intermediary remained at an elevated average total customer-to-customer differential for a shorter time (generally four or five days). In contrast, the average total customer-to-customer differentials for trade sizes larger than $500,000 were reduced from their peak much more quickly, particularly for customer-to-customer transaction chains involving a single dealer, which peaked by the first day after the start of the chain and showed reductions from the peak average total customer-to-customer differential for chains completed two or more days after they began. The largest trade sizes of $3 million or more also showed quicker reductions from the peak average total customer-to-customer differential even for customer-to-customer transaction chains involving up to 10 dealer intermediaries, with such drop-off occurring for chains of more than five days. Single dealer chains always showed lower total customer-to-customer differentials than multi-dealer chains for all combinations of trade sizes and duration of chain.

Customer-to-customer transaction chains for trade sizes larger than $500,000 involving a single dealer intermediary also differed from chains for smaller trade sizes in that they generally resulted in lower average total customer-to-customer differentials for the longest chains as compared to chains completed in a single day, typically beginning with chains of six to 10 days or longer. A similar pattern for multi-dealer chains was less pronounced and only generally appeared for trade sizes larger than $3 million. In some cases for trades larger than $1 million, the longest single dealer chains resulted in total customer-to-customer differentials that were negative, meaning that the final sale to a customer at the end of the chain was at a price below the initial purchase price from a customer at the start of the chain.

Figures V.J and V.K illustrate the patterns of average total customer-to-customer differentials based on duration of customer-to-customer transaction chain for selected trade sizes.

FIGURE V.J: Chart of Average Total Customer-to-Customer Differentials by Duration of Customer-to-Customer Transaction Chains for Selected Retail Trade Sizes

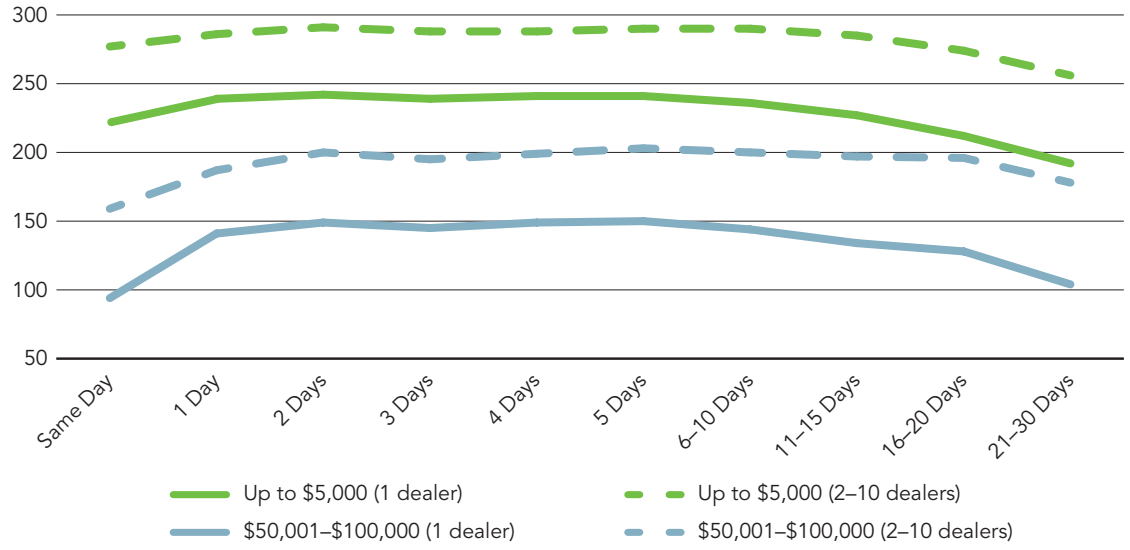
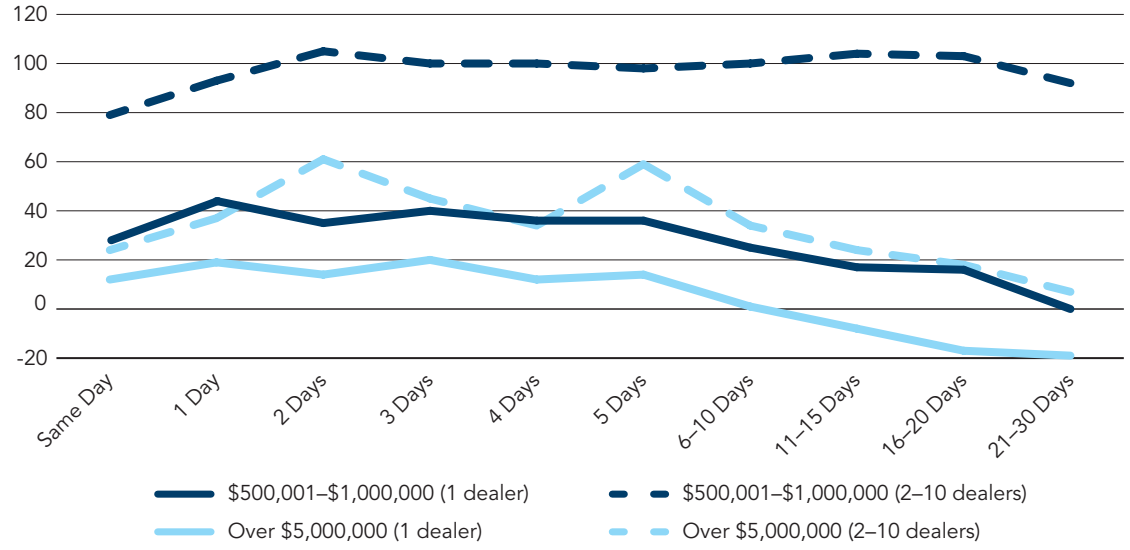


FIGURE V.K: Chart of Average Total Customer-to-Customer Differentials by Duration of Customer-to-Customer Transaction Chains for Selected Institutional Trade Sizes



Figures V.J and V.K: Average Total Customer-to-Customer Differentials by Duration of Customer-to-Customer Transaction Chains for Selected Retail and Institutional Trade Sizes — *These charts are based on data included in Figure V.E for selected trade sizes. The charts show the pattern of average total customer-to-customer differentials for selected trade sizes based on the number of days between the initial DB trade and the final DS trade of a customer-to-customer transaction chain, with average total customer-to-customer differentials shown both for chains involving a single dealer intermediary and for all chains regardless of number of dealer intermediaries up to 10 dealers. The data for the four selected trade sizes are illustrated in separate charts because the significant differences in the scale of the y-axis, reflecting average total customer-to-customer differentials in basis points would mask the patterns of each individual series if presented in the same chart.*

Figures V.J and V.K illustrate that longer durations for customer-to-customer transaction chains were associated with larger reductions in average total customer-to-customer differentials in the case of chains completed by a single dealer, as compared to chains in which municipal securities passed through more than one dealer. For the smaller trade sizes shown in Figure V.J — which often are considered to be retail-sized, although, in reality, institutional investors sometimes trade in such small trade sizes — the average total customer-to-customer differential for the smallest trade of $5,000 appeared to drop to a much larger extent than did the larger trade size of up to $100,000 as the position aged in a single dealer's inventory. The drop in average total customer-to-customer differential over time was much less pronounced for $5,000 trades of municipal securities through more than one dealer, possibly reflecting that the securities were moving to dealers that were better positioned to find customers to purchase them. In contrast, trades of up to $100,000 largely retained the higher level of average total customer-to-customer differential as the securities moved through more than one dealer, perhaps because of the movement of the securities to dealers that were better positioned to find an interested customer and because the larger trade size could be broken down into varying lot sizes that would potentially appeal to a broader array of customers.

The average total customer-to-customer differentials shown in Figure V.K for the trade size of up to $500,000, which might consist of a mix of smaller institutional trades and trades with wealthier or more sophisticated individual investors, and for the largest institutional trade size of over $5 million, dropped at roughly equivalent rates as the positions aged in a single dealer's inventory. However, in the case of the largest trade size, that drop resulted in a negative average total customer-to-customer differential for municipal securities held in inventory for more than 10 days and a larger degree of negative average total customer-to-customer differential than for the trade size of up to $500,000. The drop in average total customer-to-customer differential over time was much less pronounced for trades over $5 million that moved the securities through more than one dealer, as compared to securities held in a single dealer's inventory, presumably reflecting that the securities were moving to dealers that were better positioned to find customers to purchase them. Nonetheless, the more limited range of potentially interested customers for trades of such large size (*i.e.*, larger institutional customers) may be one cause for the negative average total customer-to-customer differentials of securities positions that aged in the market, even as they moved from dealer to dealer. In contrast, trades of up to $500,000 retained their higher level of average total customer-to-customer differential as the securities moved through more than one dealer, perhaps because of the movement of the securities to dealers that were better positioned to find an interested customer and because trades of that size appealed to a broader range of investors — including institutional investors of all sizes, as well as wealthier individual investors. A dealer unable to find another dealer willing to purchase securities might be induced to sell the securities to a customer at a loss.

VI: Effect of Implementation of Real-Time Trade Reporting in Reducing Total Customer-to-Customer Differentials

As previously noted, through the end of January 2005, prices of transactions in municipal securities were made available to the public by the MSRB on the next day after the trade date under the former Transaction Reporting System (TRS). Beginning on January 31, 2005, prices for most trades of municipal securities became available to the public on a real-time basis upon reporting by dealers to the current Real-time Transaction Reporting System (RTRS) within 15 minutes after trade execution. The average total customer-to-customer differentials for the calendar years 2005 through 2010 are illustrated in Figure VI.A.[48]

[48] The results in Figure VI.A and in the regressions in Appendix A only use chains of 2 dealers or less.

FIGURE VI.A: Average Total Customer-to-Customer Differentials by Calendar Year

Calendar Year	Average Total Customer-to-Customer Differential
2003	213 bps
2004	208 bps
2005	178 bps
2006	160 bps
2007	166 bps
2008	202 bps
2009	225 bps
2010	208 bps

Figure VI.A: Average Total Customer-to-Customer Differentials by Calendar Year — *These data show, by year, the average total customer-to-customer differentials during the study period. While average total customer-to-customer differentials dropped from an average of 208 bps in calendar year 2004 to 178 bps in calendar year 2005, marking the period during which RTRS was implemented, they rose sharply from an average of 166 bps in calendar year 2007 to 202 bps in calendar year 2008, marking the period during which most of the major municipal bond insurers were first downgraded, and continued to rise into 2009, although the average total customer-to-customer differential began to drop in 2010.*

The year-to-year average total customer-to-customer differentials shown in Figure VI.A reflect the various transformative changes occurring to municipal securities trading during the study period. As previously noted, these include the January 2005 transition in price transparency from next-day to 15-minute public dissemination of trade prices to market professionals, as described below. In addition, the financial crisis in 2007 and its immediate aftermath resulted in a number of dislocations in the municipal markets. These included, among others, the effective de-commoditization of the AAA-insured segment of the market and the unwinding of significant municipal holdings by key institutional investors such as mutual funds and sponsors of tender option bond programs and similar structured holdings. Such dislocations have been broadly viewed as negatively affecting liquidity for an extended period of time. On the other hand, some perceive the introduction by the MSRB of its EMMA® website in March 2008 — which, for the first time, made the MSRB's real-time trade data available for free through a centralized site easily accessible by all segments of the marketplace, including retail investors and the financial press — as potentially having had a partially mitigating impact on the negative effects of the market dislocations during this period.

To test the extent to which the move from next-day transparency under former TRS to real-time transparency under current RTRS, rather than other factors, may have influenced average total customer-to-customer differentials, a number of regressions were conducted controlling for factors that could, to varying degrees, have an impact on average total customer-to-customer differentials, using both ordinary least squares (OLS) regressions and fixed effects regressions. The regression testing conducted in connection with the study is particularly important to make a reasonable estimate of any impacts on the average total customer-to-customer differentials resulting from the 2005 implementation of RTRS in light of the negative effects on the municipal securities market of the financial crisis. The full results of these regression tests are included in Appendix A to this report.

The regressions undertaken in connection with the study generally showed that the implementation of current RTRS resulted in a reduction in average total customer-to-customer differentials, even after controlling for other relevant factors that could plausibly affect the price differentials. When considering trades occurring within the six-month periods before and after implementation of RTRS (a total of one year of trades), the average total customer-to-customer differential was reduced, all other relevant factors being equal, by 11 bps.[49] By extending the data set to the full one-year periods before and after implementation of RTRS (a total of two years of trades), the average total customer-to-customer differential was further reduced to a total reduction of 19 to 20 bps, depending on which factors were controlled.[50] By further extending the data set to the full eight-year study period, the average total customer-to-customer differential was further reduced to a total reduction potentially ranging from 34 bps to 59 bps, depending on which factors were controlled and the type of regression test conducted.[51] These results suggest that the effects of implementation of RTRS were not immediate but took time to be realized, presumably as dealers became accustomed to the new reporting and transparency paradigm, market participants learned to take advantage of the availability of real-time pricing data, and regulatory examination and enforcement of the new reporting requirements took effect.

The MSRB hopes that market participants and the academic community will find the information provided in this report useful for their market-related and research purposes. The MSRB encourages further studies by third parties of the data available in the municipal securities market, including data and disclosure materials available from the MSRB's market transparency systems, whether in connection with matters covered by this report or in areas excluded from the scope of this report. The data and disclosures are available for general public use, at no charge, through the MSRB's EMMA® website at emma.msrb.org. In addition, these data and disclosures are available in a format suitable for formal analysis through the MSRB's subscription products.[52]

[49] See Figure APP.F in Appendix A for regression statistics and control variables.

[50] See Figures APP.D and APP.E in Appendix A for regression statistics and control variables.

[51] See Figures APP.A through APP.C in Appendix A for regression statistics and control variables.

[52] A complete list of data and disclosure subscription products available from the MSRB, as well as subscription specifications, pricing, and third-party licensing requirements, are available at www.msrb.org/Market-Disclosures-and-Data/Subscription-Services-and-Products.aspx.

Appendix A

REGRESSION TESTS RELATING TO EFFECT OF IMPLEMENTATION OF RTRS

To test the extent to which the move from next-day transparency under former Transaction Reporting System (TRS) to real-time transparency under current Real-time Transaction Reporting System (RTRS), rather than other factors, may have influenced the level of average total customer-to-customer differentials compared to what they would have been without implementation of RTRS, a number of regressions were conducted controlling for factors that could, to varying degrees, have an impact on total customer-to-customer differentials, using both ordinary least squares (OLS) regressions and fixed cost regressions. The results of such regressions are set forth in Figures APP.A through APP.F, and the control variables are described in Figure APP.G.

FIGURE APP.A: Ordinary Least Squares (OLS) Regression of Change in Average Total Customer-to-Customer Differential from Before to After Implementation of RTRS

Variable	Parameter Estimate	t-value	Standard Error
Intercept	1.79268	365.4	0.00491
Size of trade	-3.83E-08	-152.06	2.52E-10
General obligation security	-0.31223	-346.05	0.00090227
15-minute reporting	***-0.5904***	***-378.31***	***0.00156***
Insured security	0.03744	44.75	0.00083666
Number of dealers trading security	0.00362	347.71	0.0000104
Log of total volume	0.0009978	3.15	0.00031628
Days since last trade	-0.00023705	-99.04	0.00000239
Time	0.11203	395.69	0.00028313
Adjusted R^2	.053		

Figure APP.A: Ordinary Least Squares (OLS) Regression of Change in Average Total Customer-to-Customer Differential from Before to After Implementation of RTRS — *This OLS regression found a 59 bps lower cost for customer-to-customer transaction chains following implementation of RTRS compared to customer-to-customer transaction chains prior to RTRS. Variables considered, together with parameter estimates, t-values, and standard errors of regression, as well as the adjusted R-squared, are included in Figure APP.A. This regression seeks to control for trade size, security type (e.g., general obligation bonds vs. revenue bonds, and insured vs. uninsured bonds), number of dealers that traded in such security, total volume of trading in the security, days between trades of such security and the passage of time.*

FIGURE APP.B: Ordinary Least Squares (OLS) Regression of Change in Average Total Customer-to-Customer Differential from Before to After Implementation of RTRS, with Additional Dealer Characteristics

Variable	Parameter Estimate	t-value	Standard Error
Intercept	2.60699	220.59	0.01182
Size of trade	-9.56E-09	-37.61	2.54E-10
General obligation security	-0.28802	-322.51	0.00089307
15-minute reporting	***-0.56545***	***-366.76***	***0.00154***
Insured security	0.03591	43.19	0.00083145
Number of dealers trading security	0.00249	238.31	0.00001047
Log of total volume	0.0398	124.5	0.0003197
Days since last trade	-0.00015312	-64.59	0.00000237
Log of dealer trading volume	-0.08018	-155.69	0.00051498
Level of dealer's retail business	1.15445	399.28	0.00289
Level of dealer's municipal business	6.84E-07	123	5.56E-09
Geographic scope of dealer's business	0.00494	28.85	0.00017136
Time	0.09743	346.41	0.00028125
Adjusted R^2 .077			

Figure APP.B: Ordinary Least Squares (OLS) Regression of Change in Average Total Customer-to-Customer Differential from Before to After Implementation of RTRS, with Additional Dealer Characteristics — *This OLS regression found a 57 bps lower cost for customer-to-customer transaction chains following implementation of RTRS compared to customer-to-customer transaction chains prior to RTRS. Variables considered, together with parameter estimates, t-values, and standard errors of regression, as well as the adjusted R-squared, are included in Figure APP.B. In addition to the variables controlled for in the OLS regression shown in Figure APP.A, further variables include volume of trading in the security undertaken by dealers that had traded in such security, the degree to which such dealers engaged in retail-sized transactions in such security, and the degree to which such dealers traded municipal securities in general and securities from the same state as the security traded.*

FIGURE APP.C: Fixed Effects Regression of Change in Average Total Customer-to-Customer Differential from Before to After Implementation of RTRS (Full Sample)

Variable	Parameter Estimate	t-value	Standard Error
Trade size	-3.91E-08	-156.92	0
15-minute reporting	***-0.344765076***	***-233.17***	***0.00147861***
Days since last trade	0.000117252	36.98	0.00000317
Log of dealer trading volume	-0.124196139	-245.86	0.00050515
Level of dealer's retail business	0.63649793	216.65	0.00293795
Level of dealer's municipal business	1.1342E-06	207.04	0.00000001
Geographic scope of dealer's business	0.011190365	69.26	0.00016156
Time	-0.038049644	-126.22	0.00030144
Adjusted R^2	.389		

Figure APP.C: Fixed Effects Regression of Change in Average Total Customer-to-Customer Differential from Before to After Implementation of RTRS (Full Sample) — *This fixed effect regression found a 34 bps lower cost for customer-to-customer transaction chains following implementation of RTRS compared to customer-to-customer transaction chains prior to RTRS. Variables considered, together with parameter estimates, t-values, and standard errors of regression, as well as the adjusted R-squared, are included in Figure APP.C. This regression seeks to control for trade size, days between trades of such security, the volume of trading in the security undertaken by dealers that had traded in such security, the degree to which such dealers engaged in retail-sized transactions in such security, the degree to which such dealers traded municipal securities in general and securities from the same state as the security traded, and the passage of time.*

FIGURE APP.D: Fixed Effects Regression of Change in Average Total Customer-to-Customer Differential from Before to After Implementation of RTRS (One Year Either Side of RTRS Implementation)

Variable	Parameter Estimate	t-value	Standard Error
Trade size	-6.5E-08	-100.18	0
15-minute reporting	***-0.1984451***	***-115.23***	***0.00172212***
Days since last trade	8.1951E-05	6.86	0.00001194
Log of dealer trading volume	-0.0478549	-32.87	0.00145601
Level of dealer's retail business	1.04924958	143.04	0.00733556
Level of dealer's municipal business	7.33E-07	49.03	0.00000001
Geographic scope of dealer's business	0.01252257	26.53	0.00047205
Adjusted R^2 .532			

Figure APP.D: Fixed Effects Regression of Change in Average Total Customer-to-Customer Differential from Before to After Implementation of RTRS (One Year Either Side of RTRS Implementation) — *This fixed effect regression found a 20 bps lower cost for customer-to-customer transaction chains following implementation of RTRS compared to customer-to-customer transaction chains prior to RTRS. Variables considered, together with parameter estimates, t-values, and standard errors of regression, as well as the adjusted R-squared, are included in Figure APP.D. This regression seeks to control for trade size, days between trades of such security, the volume of trading in the security undertaken by dealers that had traded in such security, the degree to which such dealers engaged in retail-sized transactions in such security, and the degree to which such dealers traded municipal securities in general and securities from the same state as the security traded. As compared to the fixed effects regression in Figure APP.C, the data analyzed are limited to one year prior to implementation of RTRS and one year following implementation of RTRS.*

FIGURE APP.E: Fixed Effects Regression of Change in Average Total Customer-to-Customer Differential from Before to After Implementation of RTRS (One Year Either Side of RTRS Implementation, No Dealer Characteristics)

Variable	Parameter Estimate	t-value	Standard Error
Trade size	-3.61E-08	-45.47	0
15-minute reporting	***-0.1916288***	***-96.89***	***0.0019779***
Days since last trade	7.3593E-05	4.48	0.00001644
Adjusted R^2 .728			

Figure APP.E: Fixed Effects Regression of Change in Average Total Customer-to-Customer Differential from Before to After Implementation of RTRS (One Year Either Side of RTRS Implementation, No Dealer Characteristics) — *This fixed effect regression found a 19 bps lower cost for customer-to-customer transaction chains following implementation of RTRS compared to customer-to-customer transaction chains prior to RTRS. Variables considered, together with parameter estimates, t-values, and standard errors of regression, as well as the adjusted R-squared, are included in Figure APP.E. This regression seeks to control for trade size and days between trades of such security. This fixed effects regression is similar to the regression shown in Figure APP.D except that it eliminates controls related to dealer characteristics.*

FIGURE APP.F: Fixed Effects Regression of Change in Average Total Customer-to-Customer Differential from Before to After Implementation of RTRS (Six Months Either Side of RTRS Implementation)

Variable	Parameter Estimate	t-value	Standard Error
Trade size	-7.3E-08	-60.92	0
15-minute reporting	***-0.1118112***	***-41.85***	***0.00267153***
Days since last trade	9.6353E-05	4.45	0.00002165
Log of dealer trading volume	-0.0449358	-19.41	0.0023147
Level of dealer's retail business	0.92700203	81.02	0.01144227
Level of dealer's municipal business	7.117E-07	30.11	0.00000002
Geographic scope of dealer's business	0.01061431	14.25	0.00074504
Adjusted R^2 .566			

Figure APP.F: Fixed Effects Regression of Change in Average Total Customer-to-Customer Differential from Before to After Implementation of RTRS (Six Months Either Side of RTRS Implementation) — *This fixed effect regression found an 11 bps lower cost for customer-to-customer transaction chains following implementation of RTRS compared to customer-to-customer transaction chains prior to RTRS. Variables considered, together with parameter estimates, t-values, and standard errors of regression, as well as the adjusted R-squared, are included in Figure APP.F. This regression seeks to control for trade size, days between trades of such security, the volume of trading in the security undertaken by dealers that had traded in such security, the degree to which such dealers engaged in retail-sized transactions in such security, and the degree to which such dealers traded municipal securities in general and securities from the same state as the security traded. As compared to the fixed effects regressions in Figures APP.C and APP.D, the data analyzed are limited to the six-month period prior to implementation of RTRS and the six-month period following implementation of RTRS.*

FIGURE APP.G: Description of Control Variables

Size of trade: the par value of the bonds in the trade
General obligation security: an indicator variable equal to 1 if the bond is a general obligation bond, and 0 otherwise
15-minute reporting: an indicator variable equal to 1 if the trade is after January 31, 2005, and 0 otherwise
Insured security: an indicator variable equal to 1 if the bond is insured, and 0 otherwise
Number of dealers trading security: the total number of different dealer IDs that make at least one trade in the security
Log of total volume: the log of the average total annual dollar volume in the bond
Days since last trade: the number of days since the last trade in the bond occurred
Log of dealer trading volume: the log of the $ total volume of the dealer's trading
Level of dealer's retail business: The fraction of a dealer's total trading volume that is done in retail size
Level of dealer's municipal business: the number of different bonds in which a dealer trades
Geographic scope of dealer's business: the number of different states or territories in which the dealer has done at least one trade
Time: a time trend variable

Appendix B

INDEX OF FIGURES

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