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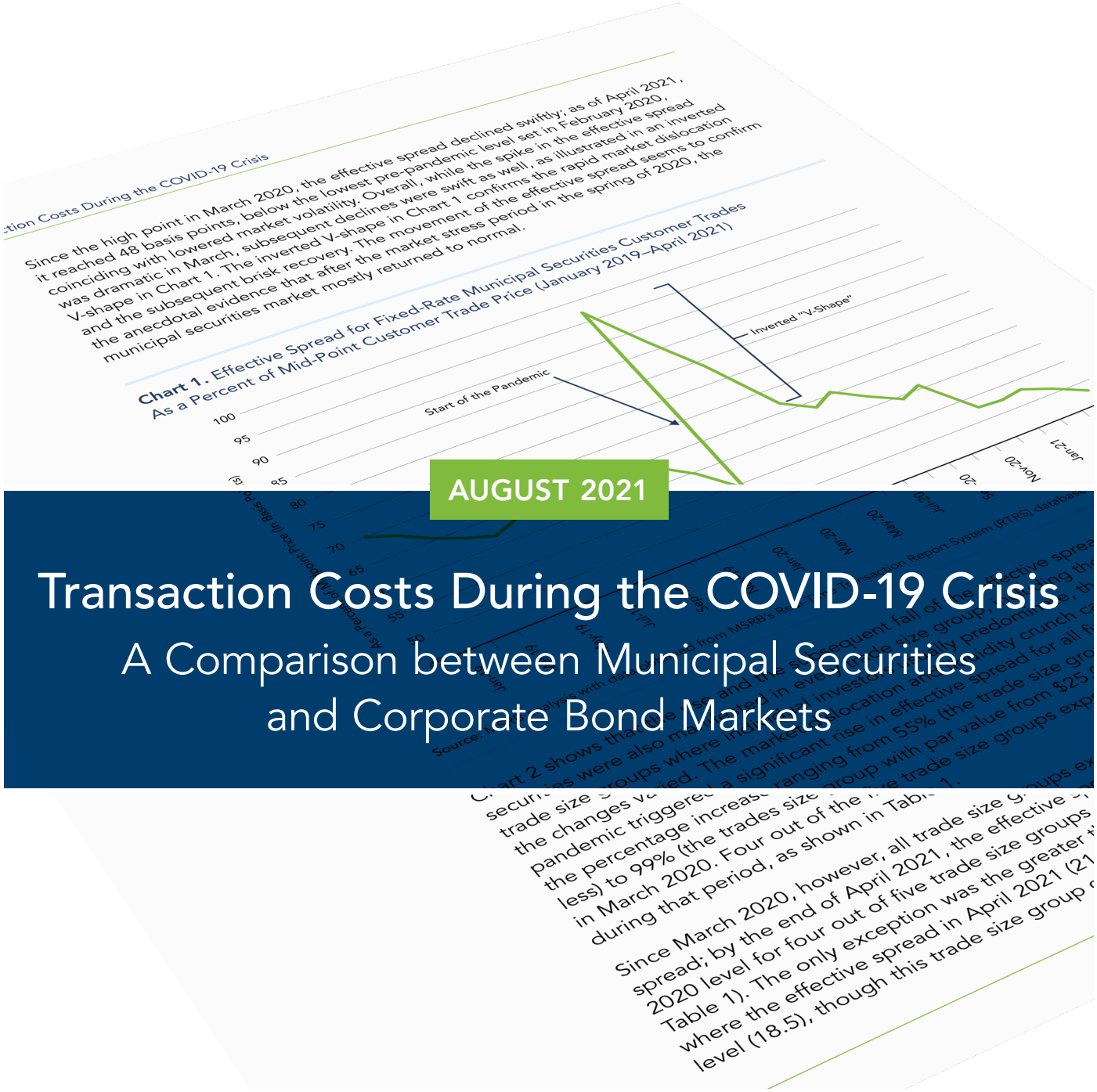

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Transaction Costs During the COVID-19 Crisis

A Comparison between Municipal Securities and Corporate Bond Markets

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Municipal Securities Rulemaking Board

CONTENTS

Abstract[1]

The COVID-19 pandemic in the early spring of 2020 created a crisis in the global financial markets. A severe liquidity crunch affected all classes of securities, including the fixed-income markets, with unprecedented volatility in financial asset pricing disrupting the normal trading environment. Transaction costs for customer trades, when measured in effective spread, spiked significantly in March 2020 for both municipal securities, which include tax-exempt and taxable municipal securities, and corporate bonds, which include investment grade and high yield corporate bonds. Since the high point in March 2020, however, the effective spread declined swiftly, though the speed of declines varied among different groups of bonds and not all bonds' effective spread returned to their pre-pandemic levels as of the end of 2020. Of note, taxable municipal securities, for example, were still trading at an elevated level. In general, corporate bonds, particularly investment grade corporate bonds, recovered from the March 2020 spike in effective spread at a faster pace than municipal securities. The disparity in the speed of recovery for effective spread also exists even after controlling for bond pools' idiosyncratic characteristics, such as coupon rate, maturity, callable status and insurance status, etc., over the period. This disparity could be attributable, at least partially, to the differential treatment by the Board of Governors of the Federal Reserve System's ("the Federal Reserve") policy initiatives during the COVID-19 crisis, where investment grade corporate bonds received both primary and secondary market support via the Federal Reserve's Primary Market Corporate Credit Facility (PMCCF) and Secondary Market Corporate Credit Facility (SMCCF) purchasing programs. By contrast, the Municipal Liquidity Facility (MLF) was only available to support primary issuance by eligible municipalities.

We caution that the conclusions from this paper are preliminary and may warrant further investigation, such as further exploring the likely impact from the Federal Reserve's primary and secondary market operations in the fixed-income securities markets during the COVID-19 crisis.

[1] The views expressed in this research paper are those of the authors and do not necessarily reflect the views and positions of the MSRB.

Introduction

The COVID-19 pandemic and the extensive economic shutdown in the spring of 2020 created unprecedented volatility on global financial asset pricing, which caused widespread market turbulence. Barely one month after reaching an all-time high on February 19, 2020, the S&P 500 Index declined nearly 34% from its peak by March 23, 2020, the speediest decline since "Black Friday" in October 1987.[2] Likewise, market disruption affected the fixed-income markets, including the corporate bond market as well as the usually placid municipal securities market, where bond prices fluctuated wildly and daily trading volume more than doubled from average levels during the two-week period from March 11 through March 26.[3] In addition, new issuance volume for both municipal securities and corporate bonds declined dramatically during the worst moment of the market stress in the weeks prior to March 23, 2020.

As the pandemic sparked an economic and financial crisis, the MSRB actively monitored the evolving situation in transaction costs for investors buying and selling municipal bonds during the market stress period.[4] Since then, the MSRB further expanded the analysis of the trading costs for municipal securities for the periods before, during and after the COVID-19 crisis and additionally used the corporate bond market as a comparison to comprehend the scope of this crisis. This research paper also extends the transaction cost analysis for dealer-to-customer trades in municipal securities from previous MSRB research conducted in 2018 ("2018 MSRB Research Paper"),[5] as well as in 2019, ("2019 MSRB Research Paper").[6]

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2 Delis, Manthos D. and Christos S. Savva, Panayiotis Theodossiou, "The Impact of the Coronavirus Crisis on the Market Price of Risk," Journal of Financial Stability, Volume 53, 2021.

3 Please refer to Wu, Simon Z. and Nicholas J. Ostroy, "COVID-19 Crisis Drives Spike in Transaction Costs for Municipal Securities," MSRB Market Commentary, May 2020. Also refer to the MSRB Municipal Market Trading Report on the COVID-19 Information page.

4 *See* Wu and Ostroy, "COVID-19 Drives Spike in Transaction Costs for Municipal Securities."

5 *See* Wu, Simon Z., "Transaction Costs for Customer Trades in the Municipal Bond Market: What Is Driving the Decline?" Research Paper, Municipal Securities Rulemaking Board, July 17, 2018.

6 *See* Wu, Simon Z. and Marcelo Vieira, "Mark-up Disclosure and Trading in the Municipal Bond Market," Research Paper, Municipal Securities Rulemaking Board, July 2019.

Data and Methodology

Why are transaction costs an important metric to monitor? First, transaction costs are important to investors because they are one of the key determinants of net investment returns, as high transaction costs would diminish returns. Additionally, market-related contributing factors to transaction costs, such as market liquidity and volatility,[7] usually affect trading costs across all municipal securities or all corporate bonds. Economists and other industry researchers therefore use transaction costs as one measure to capture a dimension of market liquidity,[8] with higher transaction costs generally suggesting deterioration in this liquidity dimension, *ceteris paribus*.[9] Consequently, analyzing transaction cost trends during a time of historic market disruption and subsequent recovery provides unique insight into the secondary market for municipal securities and corporate bonds before, during and after the COVID-19 crisis.

Unlike the stock market, where trading activity is primarily facilitated by an exchange, the municipal and corporate bond markets largely function as an over-the-counter marketplace where investors place their orders with dealers directly without a centralized facility. Dealers either execute orders by committing dealer capital (principal trades) or by searching for an intermediary in the market to facilitate transactions. Investors then normally pay the dealer a mark-up or a commission to compensate for services and/or for taking on and bearing principal risk.[10] Contributing factors to transaction costs generally include characteristics of individual securities, liquidity, volatility, counterparty search cost and dealer-customer bargaining power as a result of information opacity,[11] as well as other macro-environment

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7 Other contributing factors to transaction costs include individual bond characteristics, counter-party search cost and dealer-customer bargaining power as a result of information opacity. See Green, Richard, Burton Hollifield and Norman Schürhoff, "Financial Intermediation and Costs of Trading in an Opaque Market," Review of Financial Studies, Volume 20, 2007; and Harris, Larry and Michael Piwowar, "Secondary Trading Costs in the Municipal Bond Market," Journal of Finance, Volume 61, 2006.

8 Other measures of liquidity include total trading volume and price impact from a given size of a trade.

9 For more background information on transaction costs, please refer to Wu, "Transaction Costs for Customer Trades in the Municipal Bond Market: What Is Driving the Decline?"

10 *Ibid*.

11 *See* Cuny, Christine, "When Knowledge Is Power: Evidence from the Municipal Bond Market," Journal of Accounting and Economics, August 4, 2017; Green, Richard, Burton Hollifield and Norman Schürhoff, "Financial Intermediation and Costs of Trading in an Opaque Market," Review of Financial Studies, Volume 20, 2007; and Harris, Larry and Michael Piwowar, "Secondary Trading Costs in the Municipal Bond Market," Journal of Finance, Volume 61, 2006. "Search cost" is defined as the cost investors and dealers incur when seeking a counterparty to trade, while "information opacity" refers to the cost of gathering fundamental information that affects an investor's bargaining power with dealers.

factors.[12] To quantify the transaction costs paid by investors to execute their trades, financial economists and market participants use spread as a common measure, which could be based on pre-trade quote data (bid-ask spread) or actual trade data (effective spread).[13]

Similar to previous MSRB staff research papers, effective spread based on secondary market trade data is used to compute transaction costs for this analysis. This is because pre-trade quote data are not universally available or nationally consolidated for municipal securities and corporate bonds. Effective spreads are calculated daily for each fixed-rate bond (tax-exempt municipal, taxable municipal, investment grade corporate and high yield corporate) as the difference between the volume-weighted average dealer-to-customer buy and sell prices, and then averaged across bonds using equal weighting. Therefore,for each trading day, a security must have at least one customer purchase and one customer sell to be eligible for the analysis. Variable-rate municipal securities and corporate bonds were excluded in this analysis, as they are typically traded by sophisticated institutional investors at par and with no mark-up.

There are two reasons why we chose to analyze the corporate bond market for comparison against the municipal securities market when examining trading costs surrounding the COVID-19 crisis. First, the 2020 market turbulence affected all financial markets, not just the municipal securities market, so a comparison to the corporate bond market would provide a broader perspective of the impact on fixed income markets. Second, taxable municipal securities, which experienced significant growth in issuance in recent years, are more similar to corporate bonds than to tax-exempt municipal bonds in terms of the tax structure.[14] Therefore, it is of interest to compare the impact of the market crisis for taxable municipal bonds, tax-exempt municipal bonds and corporate bonds.

For the municipal securities analysis, the MSRB's Real-Time Transaction Reporting System (RTRS) database is used to derive the effective spread calculation. With a few exceptions, all municipal securities trades are reported to the MSRB's RTRS within 15 minutes of a trade.[15] In addition, MSRB's proprietary and third-party security descriptive data ("security master database"), which show an individual security's relevant characteristics, such as coupon, call feature, insurance status, type of issuance, taxable status and bond maturity date,

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12 Trades conducted as a part of a fee-based account (such as separately managed accounts) may not incur any transaction cost as the costs are typically incorporated into the account fee assessment. The databases used in this paper (MSRB's Real-Time Transaction Reporting System (RTRS) database and FINRA's Trade Reporting and Compliance Engine (TRACE) database) do carry an indicator for those trades for both municipal securities and corporate bonds and the regression analyses below account for those trades with no transaction costs.

13 In the municipal securities market, actual transaction costs incurred by investors can also include brokers' commissions for a small percentage of agency-based trades. MSRB's RTRS converts the commission amount to the same units as dollar price and computes and disseminates a net dollar transaction price to customers inclusive of commission amount. *See* "Specifications for Real-Time Reporting of Municipal Securities Transactions," Version 4.0, October 2019.

14 It should be noted that many taxable municipal securities are exempted from state income tax, while corporate bonds are subject to state income tax.

15 RTRS was first implemented by the MSRB in January 2005. Prior to 2005, the trade reporting system maintained by the MSRB, TRS, was not a real-time trade reporting system and only required dealers to submit trades to TRS by the end of a trading day.

supplement the analysis.[16] For the analysis on corporate bonds, FINRA's Trade Reporting and Compliance Engine (TRACE) database (both trade files and bond files) is used to derive the effective spread calculation and capture individual corporate bonds' characteristics.[17] Similarly, with a few exceptions, all corporate bond trades are reported to TRACE within 15 minutes of a trade. For all of the analyses below, January 2019 was selected as the starting point of the municipal and corporate bond analysis to capture the effective spread trend prior to the COVID-19 crisis, while both December 2020 and April 2021 were used as the ending point depending on the bond markets being analyzed.[18]

For more background information on the municipal securities market or a detailed description of effective spread and transaction costs, please refer to the 2018 MSRB Research Paper.[19]

Summary of Findings

This section first analyzes the movement of the effective spread exclusively for the municipal securities market before, during and after the COVID-19 crisis, with the analysis period spanning from January 2019 through April 2021. The second part of the analysis covers the period from January 2019 through December 2020 and compares the effective spread for tax-exempt municipal securities,[20] taxable municipal securities, investment grade corporate bonds and high yield corporate bonds.

Overview of Municipal Securities Market During COVID-19 Crisis

Chart 1 presents the monthly average effective spread for all municipal securities between January 2019 and April 2021. Similar to previous MSRB findings, the effective spread for municipal securities consistently trended downward from December 2008, during the peak of the financial crisis, to the March 2020 COVID-19 crisis. When measured as a percentage of daily mid-point customer trade price, the effective spread steadily declined from around 70 basis points in January 2019 to 54 basis points in February 2020, a pre-pandemic low. However, the trend drastically reversed in March 2020, when the average effective spread rose to 97 basis points, coinciding with sharp rising market volatility possibly caused by a severe liquidity crunch. The sharp rise of the effective spread was not unexpected based on previous market dislocation events in the fixed income markets.

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16 Individual bond ratings for municipal securities were not available for this analysis.

17 Introduced in July 2002, TRACE consolidates transaction data for all eligible corporate bonds.

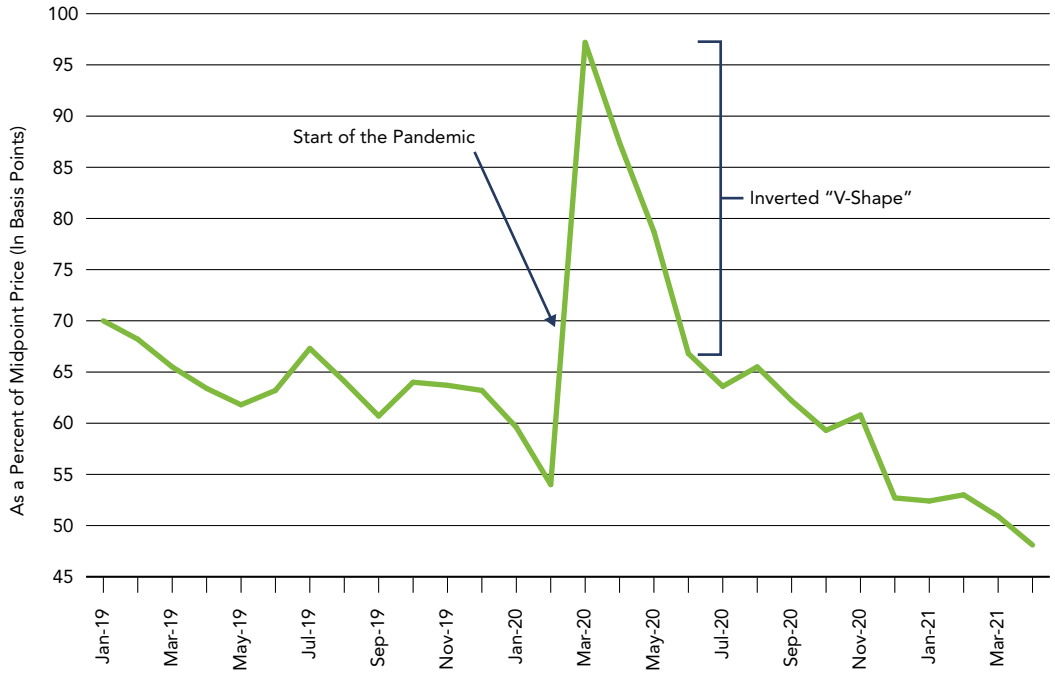
18 TRACE data for corporate bonds were only available through December 2020; therefore, for the comparison analysis, December 2020 was chosen as the end date.

19 *See* Wu, "Transaction Costs for Customer Trades in the Municipal Bond Market: What Is Driving the Decline?"

20 For the purpose of this analysis, municipal securities subject to alternative minimum tax only are lumped with tax-exempt municipal securities.

Since the high point in March 2020, the effective spread declined swiftly; as of April 2021, it reached 48 basis points, below the lowest pre-pandemic level set in February 2020, coinciding with lowered market volatility. Overall, while the spike in the effective spread was dramatic in March, subsequent declines were swift as well, as illustrated in an inverted V-shape in Chart 1. The inverted V-shape in Chart 1 confirms the rapid market dislocation and the subsequent brisk recovery. The movement of the effective spread seems to confirm the anecdotal evidence that after the market stress period in the spring of 2020, the municipal securities market mostly returned to normal.

Chart 1. Effective Spread for Fixed-Rate Municipal Securities Customer Trades As a Percent of Mid-Point Customer Trade Price (January 2019–April 2021)



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

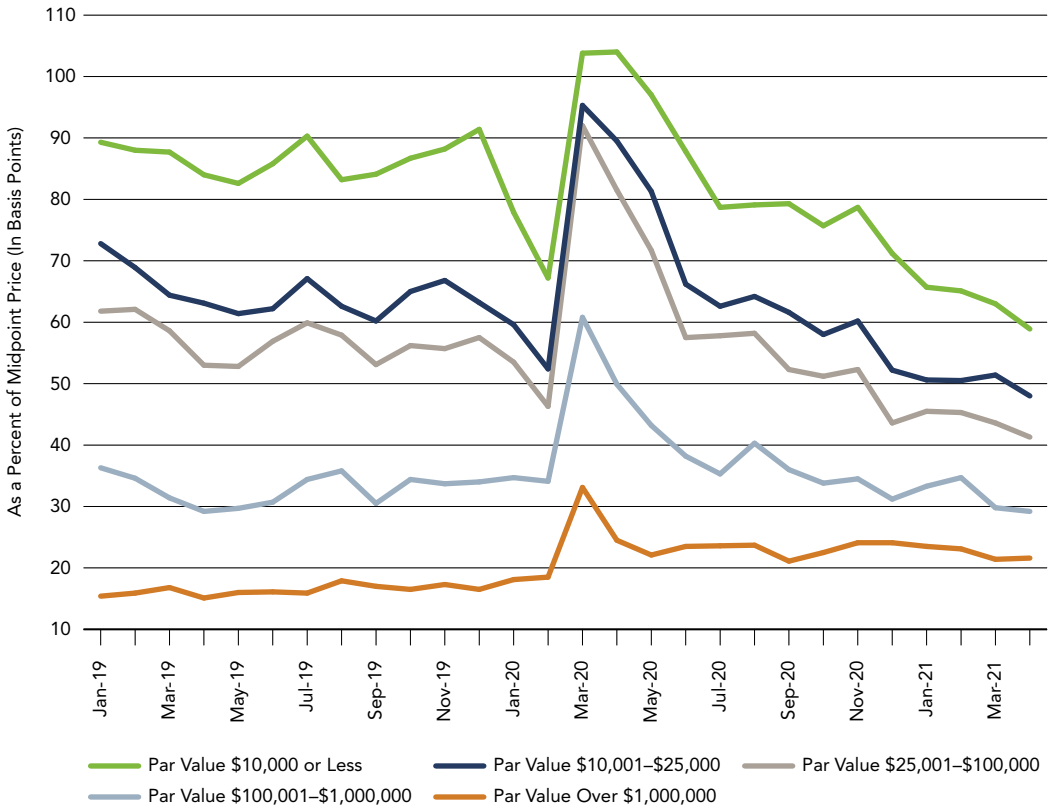
Chart 2 shows that the rise and subsequent fall of the effective spread for municipal securities were also manifested in every trade size group, including the below $100,000 trade size groups where individual investors usually predominate, though the magnitude of the changes varied. The market dislocation and liquidity crunch caused by the COVID-19 pandemic triggered a significant rise in effective spread for all five trade size groups, with the percentage increase ranging from 55% (the trade size group with par value $10,000 or less) to 99% (the trade size groups with par value from $25,000 to and including $100,000) in March 2020. Four out of the five trade size groups experienced at least a 78% increase during that period, as shown in Table 1.

Since March 2020, however, all trade size groups experienced a rapid decline in the effective spread; by the end of April 2021, the effective spread was below the pre-pandemic February 2020 level for four out of five trade size groups, ranging from 2% lower to 13% lower (see Table 1). The only exception was the greater than $1,000,000 par value trade size group, where the effective spread in April 2021 (21.6) was still 16% higher than the February 2020 level (18.5), though this trade size group continues to have lower average effective spread

than smaller trade size groups. In summary, the data indicates that smaller individual-sized trades have recovered faster than the larger institutional-sized trades. While large institution-sized trades (par value over $1,000,000) have also recovered from their peak high, they remain at a higher level than the level achieved before the pandemic.

Notwithstanding COVID-19's impact, the difference in effective spread between smaller individual-sized customer trades and larger institutional-sized customer trades continued to shrink over the past four years. The shrinkage was mostly due to the steadily declining effective spread for individual-sized customer trades, as institutional-sized customer trades had a relatively stable level of effective spread during the period. However, despite narrowing the gap over time, smaller-sized customer trades continued to be executed with a higher effective spread than larger-sized customer trades as of April 2021, with a uniformly inverse relationship between trade size and effective spread.

Chart 2. Effective Spread for Fixed-Rate Municipal Securities Customer Trades—By Trade Size, As a Percent of Midpoint Customer Trade Price (January 2019–April 2021)



Source: MSRB analysis with data obtained from MSRB's RTRS database.

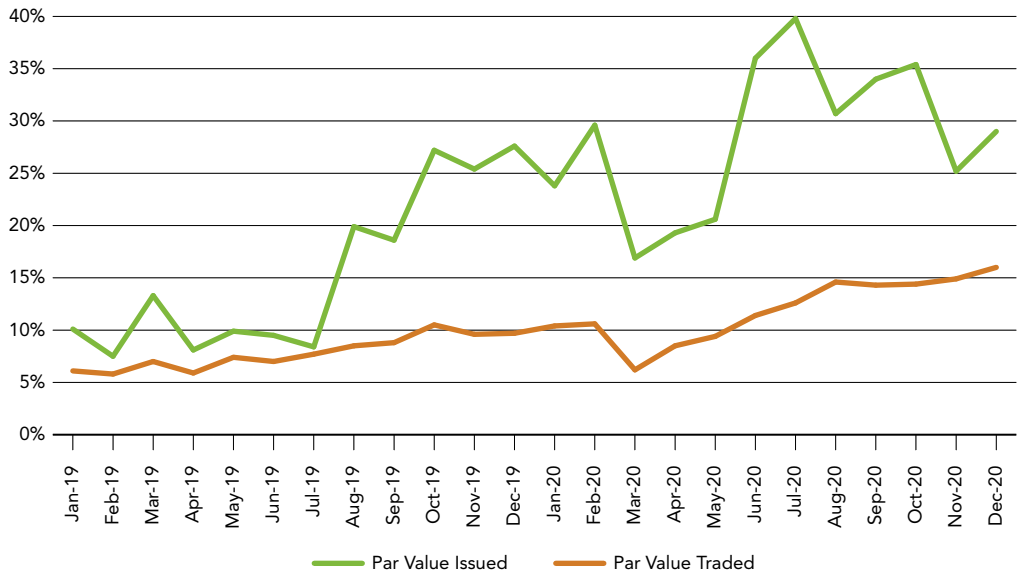
Table 1. Percentage Change in Effective Spread by Trade Size Groups

Comparison Period	Par Value $10,000 or Less	Par Value $10,001–$25,000	Par Value $25,001–$100,000	Par Value $100,001–$1,000,000	Par Value Over $1,000,000
From Feb 20 to Mar 20	54.5%	81.9%	98.8%	78.3%	79.1%
From Feb 20 to Apr 21	-6.2%	-1.9%	-5.7%	-12.7%	15.9%

Source: MSRB analysis with data obtained from MSRB's RTRS database.

Besides the trade size comparison, taxable municipal securities experienced higher-than-normal growth in issuance in recent years. The growth is in part the result of the 2018 Tax Cuts and Jobs Act, which eliminated the tax-exempt status for advance refunding issuance of municipal securities, among other changes.[21] Chart 3 below captures the market share of taxable market securities par value issued in the primary market and traded in the secondary market. Taxable municipal securities' market share of secondary market trading volume rose considerably between early 2019 and late 2020, from approximately 6% to as high as 16% in December 2020. In the meantime, primary market new issuance market share for taxable municipal securities increased even more dramatically, from an average of below 10% in early 2019 to around 30% or more in mid to late 2020. Since taxable municipal securities are more comparable to corporate bonds than to tax-exempt municipal bonds in terms of tax structure, the analysis below also compares the effective spread for those two groups of municipal securities to corporate bonds surrounding the COVID-19 crisis. This is in addition to examining the effective spread calculations for tax-exempt and taxable municipal securities separately.

Chart 3. Market Share of Taxable Municipal Securities—Par Value Issued and Traded, (January 2019–December 2020)



Source: MSRB analysis with data obtained from MSRB's RTRS database, security master database and Refinitiv.

[21] Barcena, Lorena Hernandez and David Wessel, "Why the Surge in Taxable Municipal Bonds?" *Brookings Institute Hutchins Center* December 21, 2020.

Comparison of Tax-Exempt Municipal Securities, Taxable Municipal Securities, Investment Grade Corporate Bonds and High Yield Corporate Bonds During COVID-19 Crisis

Since the COVID-19 crisis disrupted the entire financial sector, including all the fixed-income markets, this section expands the analysis of the effective spread to the corporate bond market, which serves as a comparison to the municipal securities market, illustrating how the two markets behaved relative to each other throughout the crisis period.

The effective spread calculation in this section is conducted for two groups of corporate bonds: investment grade and high yield.[22] Unlike the municipal securities market, where the vast majority of municipal bonds traded in the secondary market are investment grade bonds, the corporate bond market has a more active secondary market trading of high yield bonds.[23] Furthermore, as elaborated below, at the height of the COVID-19 crisis in March 2020, the Federal Reserve undertook an initiative to establish two facilities to support credit to large employers—the Primary Market Corporate Credit Facility (PMCCF) for new bond and loan issuance and the Secondary Market Corporate Credit Facility (SMCCF) to provide liquidity for outstanding corporate bonds and corporate bond exchange traded funds (ETFs). Both facilities, however, were only open to investment grade corporate bonds that were rated as such as of March 22, 2020.[24]

Chart 4 shows the monthly average effective spread for tax-exempt municipal securities, taxable municipal securities, investment grade corporate bonds and high yield corporate bonds between January 2019 and December 2020. The effective spread for three out of the four groups trended downward prior to the COVID-19 crisis, with the exception of high yield corporate bonds. All four groups of bonds experienced a spike in effective spread in March 2020, with tax-exempt municipal securities increasing from the February 2020 level of 53 basis points to 98 basis points in March 2020, taxable municipal securities from 64 to 80 basis points,[25] investment grade corporate bonds from 35 to 139 basis points and high yield corporate bonds from 47 to 131 basis points. The degree of the March 2020 spike varied, when measured in percentages, as shown in Table 2, with the two corporate bond groups' effective spreads rising at a significantly higher rate (298% and 180%) than the two municipal securities groups (85% and 24%) from the pre-pandemic February 2020 levels.

However, since March 2020, the effective spread declined for all four groups. By December 2020, the effective spread for both tax-exempt municipal securities (51 basis points) and investment grade corporate bonds (33 basis points) returned to the pre-pandemic level (Chart 4 and Table 2). By comparison, the effective spread for taxable municipal securities, while lower than the March 2020 peak, was still elevated (72 basis points) relative to the

[22] TRACE bond files do not contain ratings data for an individual bond; instead, an indicator showing whether a corporate bond is an investment grade or a high yield bond is provided. Similar rating indicators are not available for municipal securities.

[23] Also known as "non-investment grade" bonds or "junk" bonds. See FINRA "Corporate Bonds" https://www.finra.org/investors/learn-to-invest/types-investments/bonds/types-of-bonds/corporate-bonds.

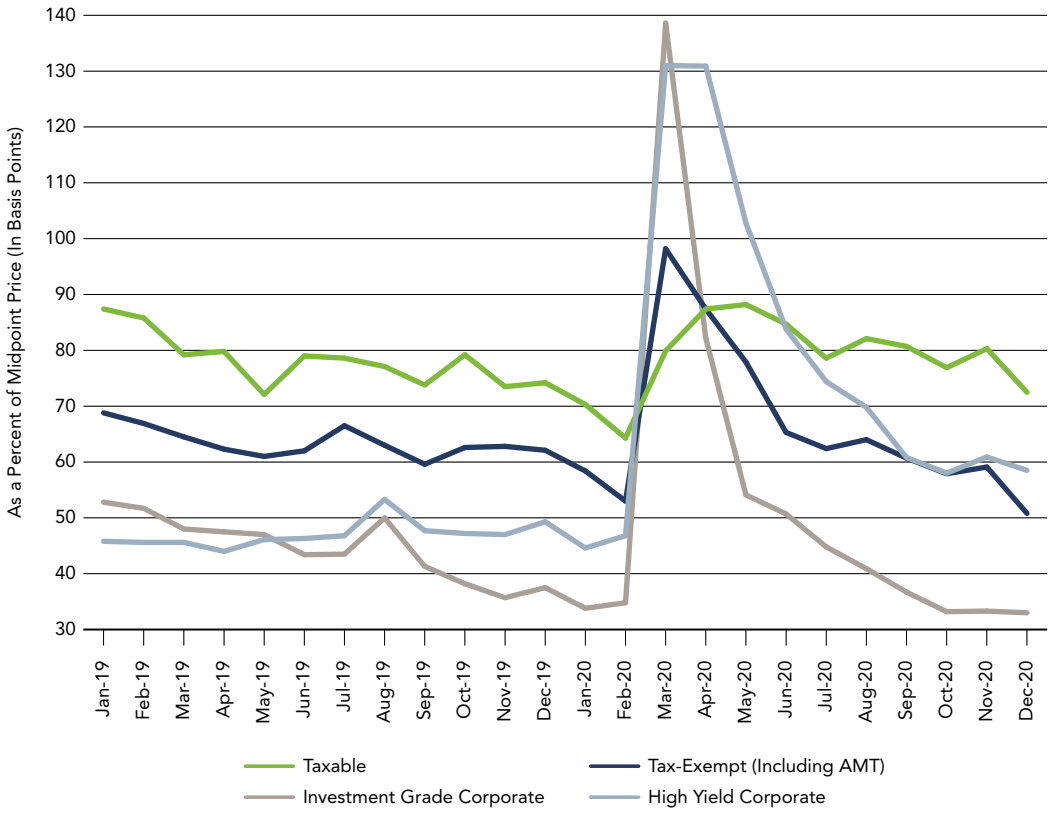
[24] *See* Federal Reserve Board - Federal Reserve announces extensive new measures to support the economy.

[25] Unlike other groups, taxable municipal securities' effective spread did not peak until May 2020, when it reached 88 basis points.

February 2020 low point achieved prior to the market stress period. For high yield corporate bonds, while the decline since the spring of 2020 was swift and drastic, the average effective spread was also still higher (59 basis points) than the pre-pandemic level in February 2020.

Overall, while all four groups experienced remarkable effective spread spikes in March 2020, albeit with varying degrees, the subsequent declines were nearly as swift, except for taxable municipal securities, illustrating an inverted V-shape for three out of four groups. When focusing on the effective spread, it appears that taxable municipal securities behaved very differently from both groups of corporate bonds; if anything, both taxable and tax-exempt municipal markets were more similar to each other than to the corporate bond market, as the effective spread for corporate bonds appeared to rise more sharply than both groups of municipal securities during the peak of the market crisis, and then also appeared to decline more swiftly to revert toward the pre-pandemic level.

Chart 4. Effective Spread for Tax-Exempt Municipal Securities, Taxable Municipal Securities, Investment Grade Corporate Bonds and High Yield Corporate Bonds (January 2019–December 2020)



Source: MSRB analysis with data obtained from MSRB's RTRS database, security master database and TRACE Data provided by FINRA's TRACE System.

Table 2. Percentage Change in Effective Spread During 2020

Comparison Periods	Tax-Exempt Municipal Securities	Taxable Municipal Securities	Investment Grade Corporate Bond	High Yield Corporate Bond
From Feb 20 to Mar 20	85.2%	24.2%	298.4%	180.0%
From Feb 20 to Dec 20	-4.2%	12.7%	-5.2%	25.1%
From Dec 19 to Dec 20	-18.1%	-2.4%	-12.1%	18.7%

Source: MSRB analysis with data obtained from MSRB's RTRS database, security master database and TRACE Data provided by FINRA's TRACE System.

There are a few possible explanations for the diverging trajectories of the effective spread movement during and after the market crisis. First, the market structure for the municipal securities market and the corporate bond market differs, as many market participants (individual trading desks at dealers, electronic trading systems and investors) may be specialized in one of the two markets, but not necessarily both. It is also true that in a normal period, the corporate bond market tends to be more liquid than the municipal securities market, as manifested in the lower average effective spread for both groups of corporate bonds between January 2019 and February 2020 in Chart 4. Second, there is a credit quality difference between the two bond markets, as on average, municipal securities have higher credit ratings than corporate bonds.[26] In fact, even among bonds with investment grade ratings, roughly two-thirds of municipal securities are rated as AAA and AA as of January 2021, compared to less than 10% of corporate bonds with similar ratings.[27] Finally, the Federal Reserve supported the corporate bond market through both the PMCCF and the SMCCF, while the MLF program for the municipal securities market was only applicable to primary issuance by eligible municipalities.[28] Could the Federal Reserve's support in the secondary market for corporate bonds result in a swifter market liquidity recovery when compared to municipal bonds?[29] Even among corporate bonds, Chart 4 illustrates that the average effective spread for investment grade bonds recovered from the March 2020 peak

[26] Cooper Howard, "Why Widespread Muni Defaults Are Unlikely to Happen," *Schwab Insights* (February 04, 2021).

[27] *Ibid.*

[28] Haughwout, Andrew, Benjamin Hyman and Or Shachar, "The Option Value of Municipal Liquidity: Evidence from Federal Lending Cutoffs during COVID-19," The Federal Reserve Bank of New York Working Paper, February 2021. The MLF program was targeting eligible investment-grade municipal securities issued by a local entity with certain population threshold and other issuance limits in the primary issuance market.

[29] The Federal Reserve's earlier announcements on initiatives in the corporate bond market on March 23, 2020 could also have had an impact on the speedier retreating of the effective spreads for corporate bonds when compared to the municipal securities market. However, it should be noted that even before the establishment of the MLF on April 9, 2020, the Federal Reserve began accepting short-term municipal bonds purchased from mutual funds as collateral for lending to banks on March 20, 2020 through the re-launched Money Market Mutual Fund (MMLF), which made municipal securities more attractive to hold by banks. *See* Federal Reserve Board expands its program of support for flow of credit to the economy and Federal Reserve announces extensive new measures to support the economy. As a result, there was a rebound of asset pricing thereafter for municipal securities.

quicker than the effective spread for high yield bonds, which may support the hypothesis that the Federal Reserve's secondary market corporate credit facility added liquidity to the market, as only investment grade corporate bonds were eligible for Federal Reserve's purchase, with some exceptions.[30]

Regression Analysis

The comparison of post-March 2020 months to the February 2020 pre-pandemic levels in Table 2 above does not control for the respective pre-pandemic trend line for each of the four groups of bonds that would likely have continued had the pandemic crisis not taken place and disrupted the financial markets. To test the diverging speed of effective spread recovery from the peak spike in March 2020 among the four groups of bonds statistically, a regression approach is used to compare each group of bonds' actual effective spread between March 2020 and December 2020 with its model-projected effective spread for the same period based on pre-pandemic data (January 2019–February 2020). Essentially, for each of the four groups of bonds, the model-projected effective spread represents the "would-have-been" effective spread in the absence of the COVID-19 crisis. The difference between the actual effective spread and the model-projected effective spread therefore signifies the deviation between March 2020 and December 2020 because of the COVID-19 crisis.[31] The benefits of performing a regression analysis are manifold. For this analysis, one benefit is the ability to compare the effective spread for each of the four groups of bonds by controlling for idiosyncratic characteristics of the aggregate pool of bonds traded over the period.[32] Another benefit is to capture the pre-pandemic trend line of the effective spread for each group of bonds so that the post-March 2020 actual effective spread can be compared to the projected effective spread based on the pre-pandemic trend.

Two regression model specifications were examined for each of the four groups of bonds. One model specification ("Times Series Model") uses an ordinary least-square regression approach for daily average (across bonds) time-series data points to test the relationship between the dependent variable of effective spread and independent variables such as trade size, coupon rate, issue type (e.g., general obligation or revenue), yield, insurance status, maturity, age, callable bond status, non-transaction-based compensation (NTBC), original offering amount and time trend. The other model specification ("Panel Data Model") uses a panel data regression approach for pooled cross-sectional and time-series data points (with no averaging) to test the relationship between the same set of dependent and

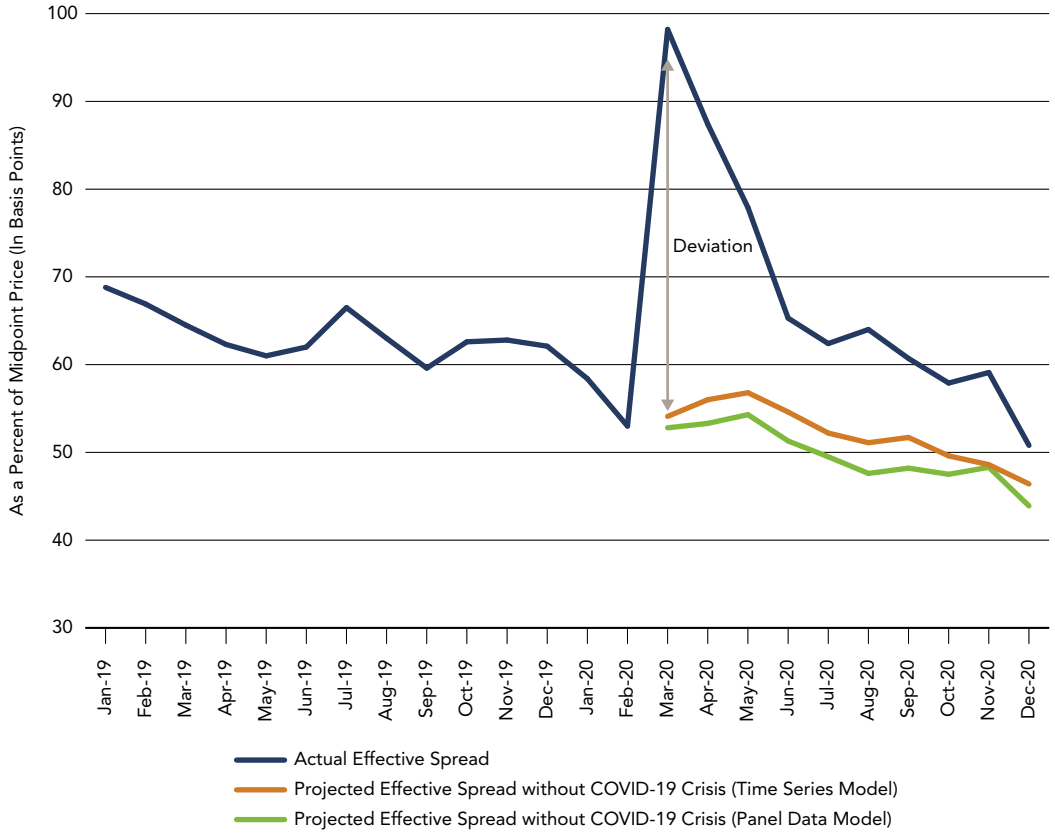
[30] Other research papers seem to corroborate this conclusion. *See* Boyarchenko, Nina, Anna Kovner and Or Shachar, "It's What You Say and What You Buy: A Holistic Evaluation of the Corporate Credit Facilities," The Federal Reserve Bank of New York Staff Report No. 935, July 2020 (Revised November 2020).

[31] This approach is similar to an "event-study" analysis used by financial economists for securities pricing. *See* MacKinlay, A. Craig. "Event Studies in Economics and Finance." *Journal of Economic Literature* 35, no. 1 (1997): 13-39.

[32] One benefit is to be able to measure the correlation between one variable (dependent variable) and many other variables (independent variables or factors) simultaneously and statistically test the estimated impact for each factor while controlling for all other factors. Essentially, the estimated impact from each independent variable is conditioned on the economic principal of "all else being equal."

independent variables.[33] The two model specifications, however, show similar projected values for effective spread for all four groups of bonds between March 2020 and December 2020, as illustrated in Chart 5 for tax-exempt municipal securities. For similar charts related to the other three groups of bonds—taxable municipal securities, investment grade corporate bonds and high yield corporate bonds—please refer to Appendix B.

Chart 5. Comparison of Actual Effective Spread and Model-Projected Effective Spread Using Pre-Pandemic Inputs—Tax-Exempt Municipal Securities
(January 2019–December 2020)



Source: MSRB analysis with data obtained from MSRB's RTRS database and security master database.

[33] The panel data regression model used both the ordinary least-square approach and the fixed-effect approach and found that the fixed-effect approach generally fit better between the two approaches.

Since the panel data regression model generally fit better overall, only the panel data model results are presented in this paper. The panel data model is specified as follows:[34]

Panel Data Model for Municipal Securities Groups (Tax-Exempt and Taxable)

$$\begin{aligned} Effective\ Spread_{it} &= \alpha + \beta_1\ Trade\ Size_{it} + \beta_2 Coupon\ Rate_{it} + \beta_3 Issuance\ Type_{it} + \beta_4\ Yield_{it} \\ &+ \beta_5\ Insurance\ Status_{it} + \beta_6 Maturity_{it} + \beta_7\ Age_{it} + \beta_8 Call\ Status_{it} \\ &+ \beta_9\ NTBC\ Status_{it} + \beta_{10}\ Original\ Offer\ Size_{it} + \beta_{11} Time\ Trend_t + +\varepsilon_{it} \end{aligned}$$

Panel Data Model for Corporate Bonds Groups (Investment Grade and High Yield)

$$\begin{aligned} Effective\ Spread_{it} &= \alpha + \beta_1 Trade\ Size_{it} + \beta_2\ Coupon\ Rate_{it} + \beta_4\ Yield_{it} \\ &+ \beta_5\ Convertible\ Status_{it} + \beta_6\ Maturity_{it} + \beta_7\ Age_{it} + \beta_8\ Rule144A\ Status_{it} \\ &+ \beta_9\ Trade\ Remuneration\ Status_{it} + \beta_{11}\ Time\ Trend_t + +\varepsilon_{it} \end{aligned}$$

All variables are specified in percentage change except for issuance type, insurance status, call status, NTBC status and time trend in the municipal securities model and convertible status, Rule 144A status, trade remuneration status and time trend in the corporate bond model;[35] subscript i corresponds to a particular security and subscript t corresponds to a particular trading date. Time trend is specified as a running count of calendar days from January 1, 2019, through the trading date of each trade. Among the other independent (control) variables, trade size is expressed as par value, maturity measures the life span of a security at the time of its trade, and age measures the time elapsed since the bond issuance. In addition, several of the independent variables are indicator variables, essentially a yes-or-no test:[36] issuance type (general obligation bond), insurance status, call status and NTBC flag in the municipal securities model and convertible status, Rule 144A status and trade remuneration status in the corporate bond model.

Table 3 shows the difference between the actual effective spread in March 2020 and the panel data model-projected effective spread based upon pre-pandemic data and confirms the significantly higher deviation rates for the two groups of corporate bonds than the two groups of municipal bonds (see Chart 4 above) even after controlling for the idiosyncratic characteristics of each bond pool.[37] The results imply that the corporate bond secondary market trading was more severely impacted by the COVID-19 crisis than the municipal securities market at the worst moment of the market stress and dislocation, with investment grade corporate bonds having by far the highest deviation rate among the four groups. These findings from the regression analysis are consistent with the analysis above when comparing to the actual February 2020 pre-pandemic level, as recapitulated in Table 3 for comparison. The higher deviation rate of investment grade corporate bonds when compared to high yield corporate bonds in March 2020 may be surprising given the general perception

[34] Please refer to Appendix C for detailed regression analysis results.

[35] This analysis uses the natural log difference as a proxy for percentage difference for all variables in the equation.

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

[37] The deviation rate is calculated as (actual effective spread-model-projected effective) / model-projected effective spread.

that high yield bonds are less liquid and more volatile than investment grade bonds. One possible explanation is the enormous outflow of money from fixed-income mutual funds, which precipitated a large selloff of bond positions in the marketplace during the depth of the crisis. It appears that the selloff in corporate bonds disproportionately concentrated in bonds with investment grades,[38] which may have worsened the liquidity for these bonds and amplified their trading costs.

Table 3. Peak Spike of Effective Spread Relative to Model-Projected Effective Spread in March 2020 and Actual Effective Spread in February 2020 (In Basis Points)

Comparison	Taxable Municipal	Tax-Exempt Municipal	Investment Grade Corporate	High Yield Corporate
Actual Effective Spread in March 2020	79.9	98.2	138.6	131.0
Model-Projected Effective Spread for March 2020	63.5	52.8	35.5	49.6
Percentage Deviation Rate	**25.7%**	**86.1%**	**290.5%**	**164.3%**
Actual Effective Spread in February 2020	64.3	53.0	34.8	46.8
Percentage Change From February 2020	**24.2%**	**85.2%**	**298.4%**	**180.0%**

Source: MSRB analysis with data obtained from MSRB's RTRS database, security master database and TRACE Data provided by FINRA's TRACE System.

While the corporate bond market was more affected by the COVID-19 crisis than the municipal securities market at the initial peak stage, the two groups of corporate bonds recovered from the spike in effective spread quicker than the municipal securities market after March 2020, particularly when compared to taxable municipal securities. Chart 6 illustrates the relative deviation rate of effective spread for each of the four groups of bonds. The relative deviation rate was calculated as follows: For each month between April 2020 and December 2020, the deviation rate between the actual effective spread and the model-projected effective spread was adjusted as a percentage of the March 2020's "peak deviation rate," with the March 2020 peak deviation rate set to 100%. For example, hypothetically if the actual effective spread was 90 basis points in March 2020 and 80 basis points in April 2020, while the model-projected effective spread was 50 basis points in March 2020 and 48 basis points in April 2020, the relative deviation rate for April 2020 would be ((80/48)-1) / ((90/50)-1) = 83%. The relative deviation rate essentially measures the pace of recovery from the peak spike in March 2020, with a 100% relative deviation rate indicating no recovery at all and a 0% relative deviation rate indicating a total recovery. Additionally, the model-projected effective spread would capture any pre-pandemic trend. Since there was a downward trend in effective spread for three out of the four groups of bonds prior to the pandemic, with the exception for high yield corporate bonds, which had a relatively stable effective spread, the differences between the actual effective spread and the model-projected effective spread for those three groups are expected to be wider than the actual differences in effective spread (as shown in Chart 4 and Table 2 above) between February 2020 and the post-March 2020 months.

[38] *See* Figure 1, McCauley, Robert, "The Federal Reserve Needs the Power to Buy Corporate Bonds," August 26, 2020. Also see the estimated long-term mutual fund flows data provided by Investment Company Institute (ICI). https://www.ici.org/statistics.

Of the four bond groups, Chart 6 shows taxable municipal securities as an outlier, because the effective spread for this group not only did not recover from the March 2020 peak spike but also moved even higher relative to the model-projected effective spread (relative deviation rates higher than 100%). Part of the reason for being an outlier was because the peak spike for the taxable municipal securities group seemed to be delayed relative to other groups of bonds, with the peak set in May 2020, rather than in March 2020 as for other groups.[39] In addition, as Chart 3 above illustrates, not only was there a significant increase in the issuance volume for taxable municipal securities during 2020 relative to the issuance volume for tax-exempt municipal securities, with the market share (and the actual issuance volume) rising *more than three times* from the early 2019 level,[40] the increase even outpaced the noticeable rise in the market share of secondary market trading for taxable securities. This suggests there is a possibility that in order for the secondary market to absorb the enormous increase in the primary issuance volume of taxable municipal securities in 2020,[41] a higher effective spread (and thus, a higher yield) resulted than otherwise may have been expected for taxable municipal securities.

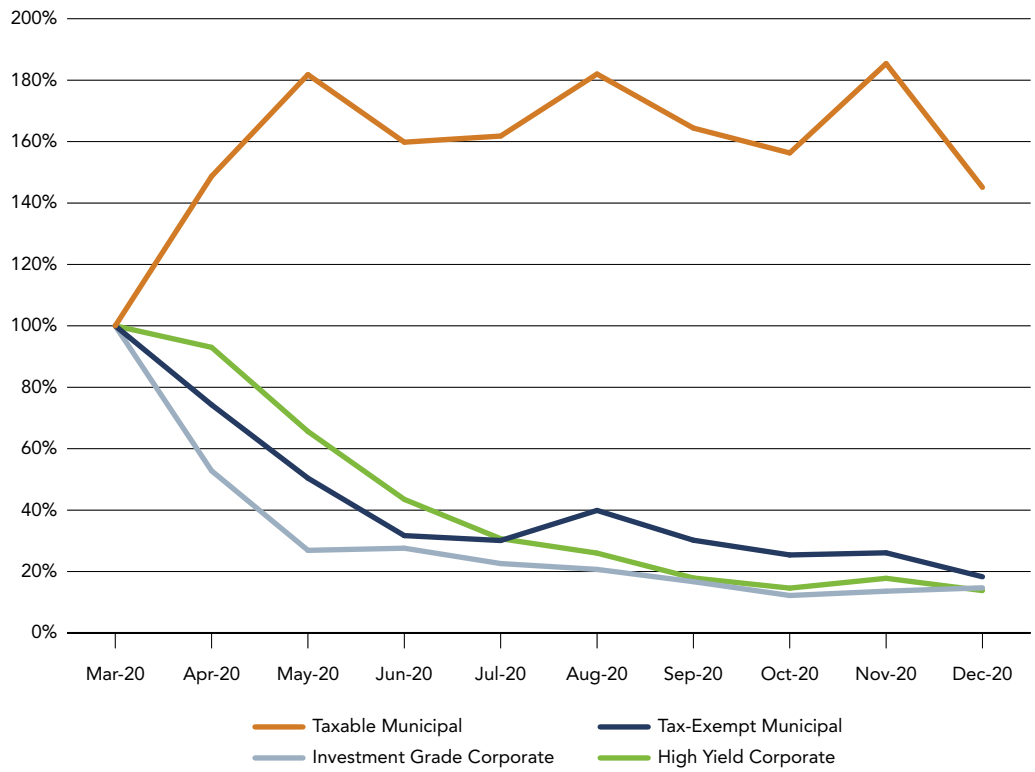
Aside from taxable municipal securities, the other three groups of bonds behaved as expected, with the relative deviation rates declining steadily between April 2020 and December 2020. Comparatively, investment grade corporate bonds outperformed all other groups and consistently led the recovery throughout the period, even though investment grade corporate bonds were more adversely impacted by the COVID-19 crisis than the other three groups of bonds in March 2020. High yield corporate bonds and tax-exempt municipal securities were close to each other in terms of the relative deviation rate of the effective spread.

[39] Appendix D illustrates a version of the relative deviation rates of effective spread with May 2020's deviation rate set to be 100% (peak deviation rate) as opposed to March 2020's. While the differences in the deviation rates between taxable municipal securities and the other three groups of bonds are narrowed for the months between May 2020 and December 2020, taxable municipal securities still had higher relative deviation rates than the other three groups.

[40] In comparison, investment grade corporate bonds had only a brief period of dramatic increase in issuance during the spring of 2020, presumably related to the lending policy per the Federal Reserve's PMCCF program, before tapering off in the second half of 2020, with the issuance volume close to the early 2019 level. Also, high yield corporate debt issuance saw a steadier increase toward the end of 2020, representing a 60% rise from the early 2019 level.

[41] Anecdotal evidence suggested there was an increase in demand for both tax-exempt and taxable municipal securities in the latter half of 2020. However, on the supply side, the percentage increase in the primary issuance of taxable municipal securities outpaced that of the issuance of tax-exempt municipal securities in the second half of 2020.

Chart 6. Comparison of Relative Deviation Rate of Effective Spread
March 2020 Deviation Rate Set to 100% (March 2020–December 2020)



Source: MSRB analysis with data obtained from MSRB's RTRS database, security master database and TRACE Data provided by FINRA's TRACE System.

The fact that there was a persistent gap in the speed of recovery even among the two corporate bond groups, especially during the first few months after the March 2020 peak, may imply that the market structure difference does not alone explain the divergence in the speed of recovery. One possible explanation is the Federal Reserve's policy initiatives during the COVID-19 crisis, where the Federal Reserve supported the corporate bond market through both primary market issuance and secondary market trading for eligible investment grade corporate bonds, with some exceptions.[42] In particular, the Federal Reserve's SMCCF, which went live on March 23, 2020, may have added liquidity to the market, and therefore may have reduced the effective spread from the peak spike more swiftly than otherwise would have been, as neither high yield corporate bond nor municipal securities (tax-exempt and taxable) were eligible for the SMCCF.[43]

[42] Investment grade as of March 22, 2020.

[43] *See* Boyarchenko, Kovner and Shachar, "It's What You Say and What You Buy: A Holistic Evaluation of the Corporate Credit Facilities."

Conclusion

The effective spread significantly increased as a result of the COVID-19 crisis, though not unexpectedly given the severe market volatility, the likely liquidity crunch in fixed-income markets and the uncertainty surrounding financial asset pricing in general at the peak of the crisis. In the municipal securities market, the effective spread consistently trended downward prior to the COVID-19 crisis in March 2020, but the trend was drastically reversed in March 2020 when the average effective spread rose to 97 basis points from 54 basis points prior to the pandemic. Following the high point in March 2020, the effective spread declined swiftly, reaching 48 basis points in April 2021, below the lowest pre-pandemic level set in February 2020. However, not all municipal securities returned to normal in terms of the effective spread, as taxable municipal securities and municipal securities with trade size above $1,000,000 par value continued to trade at an elevated level.

The result for taxable municipal securities was particularly interesting, as bonds with similar tax structures, such as corporate bonds (investment grade and high yield), recovered from the March 2020 spike in effective spread at a much faster pace. The huge disparity in the speed of recovery exists even after controlling for each bond pool's idiosyncratic characteristics over the period. The difference in the recovery path for the four bond groups at least partially could be attributable to the differential treatment by the Federal Reserve's policy initiatives during the COVID-19 crisis, where only investment grade corporate bonds received secondary market support via the Federal Reserve's corporate credit facility bond purchasing program. Furthermore, there is a possibility that for the secondary market to absorb the enormous increase in primary issuance volume for taxable municipal securities in 2020, a higher effective spread (and thus, a higher yield) resulted than otherwise may have been expected for taxable municipal securities.

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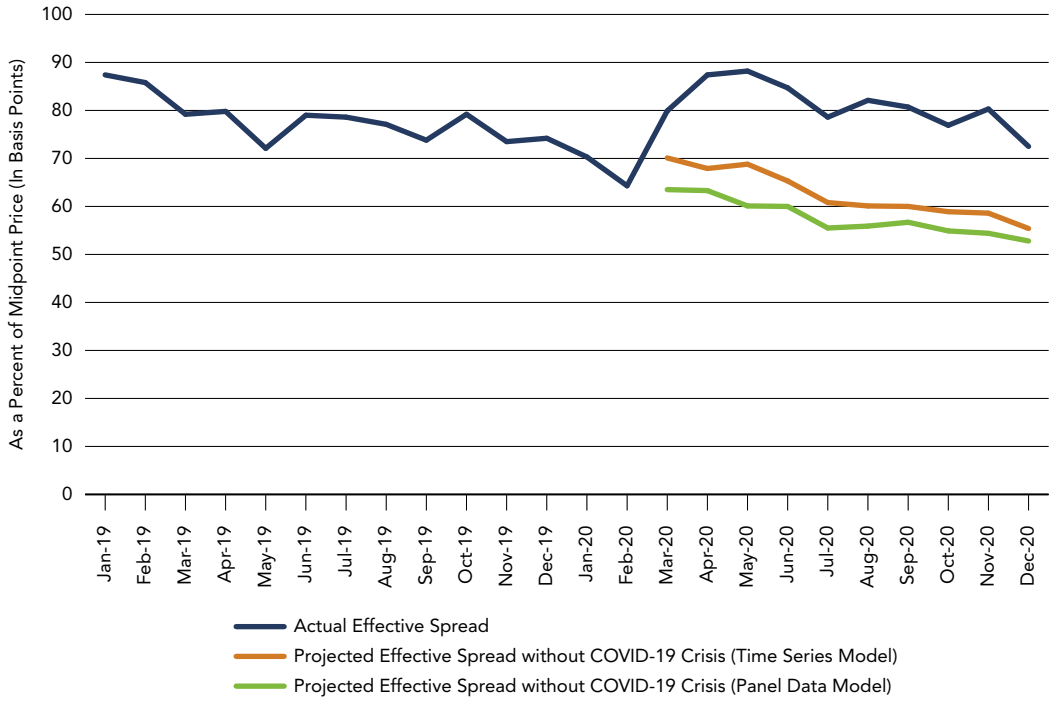
Appendix A—Authors

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

Nicholas Ostroy, Senior Market Structure Specialist—Mr. Ostroy is a Senior Market Structure Specialist for the Municipal Securities Rulemaking Board. Mr. Ostroy supports the work of the Chief Economist in addition to work on MSRB's market transparency products and programs. After joining the MSRB as Product Operations Representative in 2012, Mr. Ostroy worked with external users to enhance interactions with MSRB systems, including the Electronic Municipal Market Access (EMMA®) website. Mr. Ostroy has a master's degree in international affairs from American University and a bachelor's degree from State University of New York at Plattsburgh.

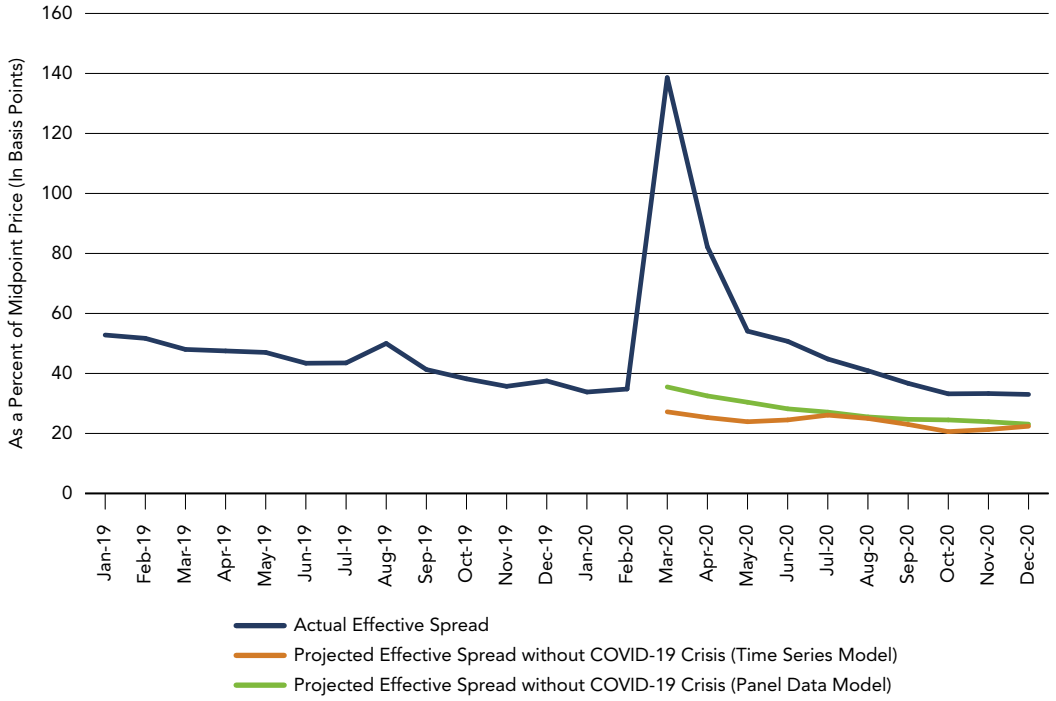
Appendix B—Comparison of Actual Effective Spread and Model-Projected Effective Spread Using Pre-Pandemic Inputs

Taxable Municipal Securities



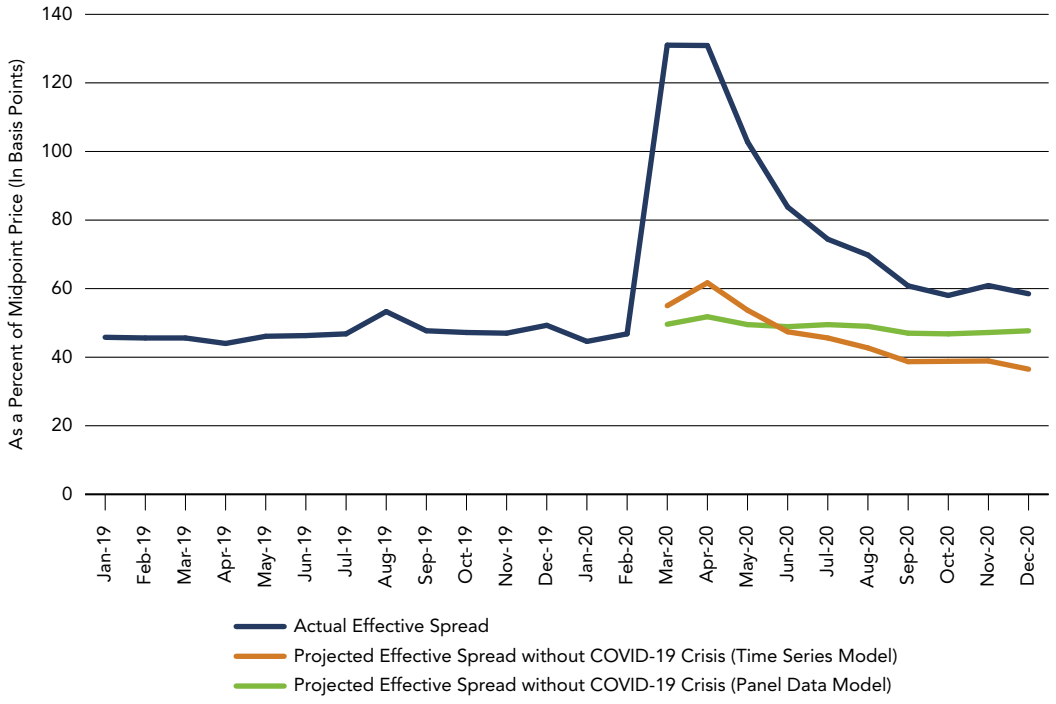
Source: MSRB analysis with data obtained from MSRB's RTRS database and security master database.

Investment Grade Corporate Bonds



Source: MSRB analysis with data obtained from TRACE Data provided by FINRA's TRACE System.

High Yield Corporate Bonds



Source: MSRB analysis with data obtained from TRACE Data provided by FINRA's TRACE System.

Appendix C—Regression Analysis Results

Panel Data Model for Municipal Securities

$$Effective\ Spread_{it} = \alpha + \beta_1\ Trade\ Size_{it} + \beta_2 Coupon\ Rate_{it} + \beta_3 Issuance\ Type_{it} + \beta_4\ Yield_{it} + \beta_5\ Insurance\ Status_{it} + \beta_6 Maturity_{it} + \beta_7\ Age_{it} + \beta_8 Call\ Status_{it} + \beta_9\ NTBC\ Status_{it} + \beta_{10}\ Original\ Offer\ Size_{it} + \beta_{11} Time\ Trend_t + +\varepsilon_{it}$$

Tax-Exempt Municipal Securities

Variable	Parameter Estimate	Standard Deviation	T-Value	Statistically Significant at 5% Level?
Coupon Rate	(0.9005)	0.0086	(105.12)	Yes
Insurance Status	0.1059	0.0080	13.30	Yes
Issuance Type	(0.0296)	0.0126	(2.35)	Yes
Call Status	0.2151	0.0042	51.44	Yes
NTBC Status	(0.9009)	0.0054	(168.35)	Yes
Age	0.0273	0.0017	16.04	Yes
Maturity	0.4319	0.0017	249.68	Yes
Trade Size	(0.2846)	0.0011	(269.10)	Yes
Yield	0.3400	0.0063	53.71	Yes
Original Offer Size	(0.0145)	0.0025	(5.85)	Yes
Time Trend	(0.0002)	0.0000	(11.11)	Yes
R-Square	0.4986			

Source: MSRB analysis with data obtained from MSRB's RTRS database and security master database.

Taxable Municipal Securities

Variable	Parameter Estimate	Standard Deviation	T-Value	Statistically Significant at 5% Level?
Coupon Rate	(0.2401)	0.0384	(6.25)	Yes
Insurance Status	0.0716	0.0301	2.38	Yes
Issuance Type	0.0889	0.0872	1.02	No
Call Status	0.2490	0.0175	14.24	Yes
NTBC Status	(0.7525)	0.0195	(38.54)	Yes
Age	0.0035	0.0088	0.40	No
Maturity	0.3669	0.0078	47.04	Yes
Trade Size	(0.2807)	0.0034	(82.85)	Yes
Yield	0.3724	0.0251	14.82	Yes
Original Offer Size	0.0285	0.0104	2.74	Yes
Time Trend	(0.0001)	0.0000	(2.14)	Yes
R-Square	0.4532			

Source: MSRB analysis with data obtained from MSRB's RTRS database and security master database.

Panel Data Model for Corporate Bonds

$$Effective\ Spread_{it} = \alpha + \beta_1 Trade\ Size_{it} + \beta_2\ Coupon\ Rate_{it} + \beta_4\ Yield_{it} + \beta_5\ Convertible\ Status_{it} + \beta_6\ Maturity_{it} + \beta_7\ Age_{it} + \beta_8\ Rule144A\ Status_{it} + \beta_9\ Trade\ Remuneration\ Status_{it} + \beta_{11}\ Time\ Trend_t + +\varepsilon_{it}$$

Investment Grade Corporate Bonds

Variable	Parameter Estimate	Standard Deviation	T-Value	Statistically Significant at 5% Level?
Coupon Rate	(0.0237)	0.0085	(2.78)	Yes
Trade Remuneration Status	(0.4277)	0.0057	(75.46)	Yes
Rule 144A Status	(0.1425)	0.0175	(8.13)	Yes
Convertible Bond Status	0.5387	0.0406	13.26	Yes
Age	0.1175	0.0016	71.62	Yes
Maturity	0.4327	0.0041	106.70	Yes
Trade Size	(0.1549)	0.0009	(174.85)	Yes
Yield	0.3300	0.0153	21.59	Yes
Time Trend	(0.0007)	0.0000	(31.70)	Yes
R-Square	0.3633			

Source: MSRB analysis with data obtained from TRACE Data provided by FINRA's TRACE System.

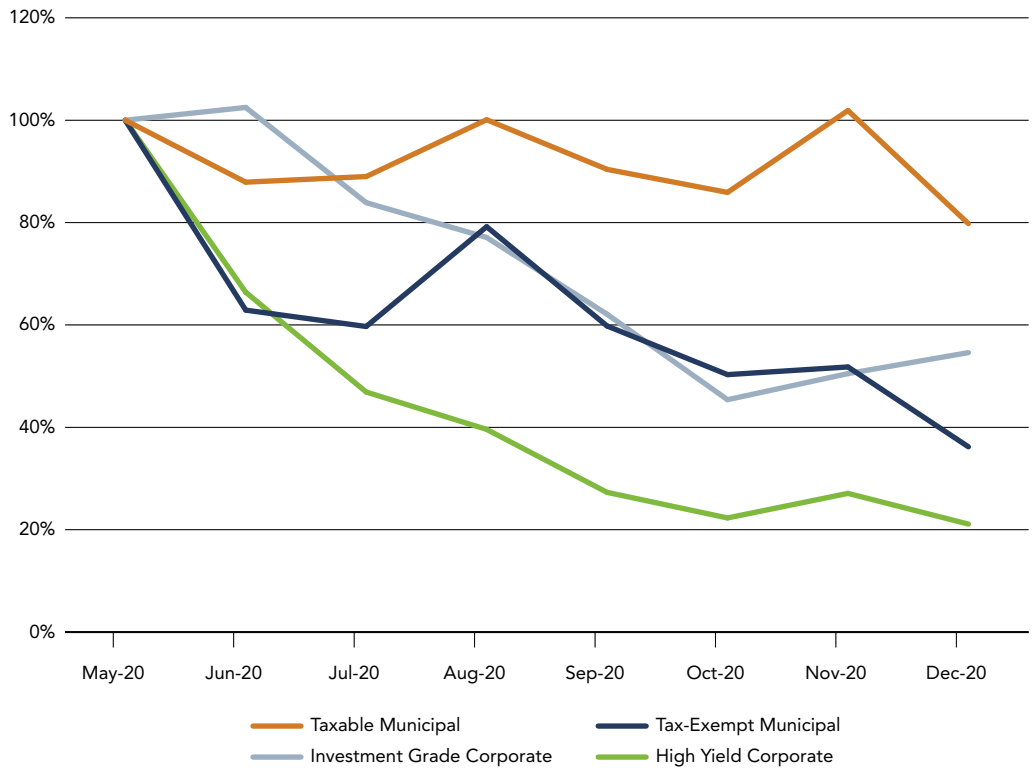
High Yield Corporate Bonds

Variable	Parameter Estimate	Standard Deviation	T-Value	Statistically Significant at 5% Level?
Coupon Rate	(0.0531)	0.0083	(6.37)	Yes
Trade Remuneration Status	(0.5497)	0.0066	(83.61)	Yes
Rule 144A Status	(0.1664)	0.0101	(16.41)	Yes
Convertible Bond Status	0.2192	0.0242	9.07	Yes
Age	0.0865	0.0023	38.01	Yes
Maturity	0.4134	0.0024	172.04	Yes
Trade Size	(0.2318)	0.0010	(225.98)	Yes
Yield	0.2779	0.0057	48.69	Yes
Time Trend	(0.0002)	0.0000	(18.45)	Yes
R-Square	0.5077			

Source: MSRB analysis with data obtained from TRACE Data provided by FINRA's TRACE System.

Appendix D—Comparison of Relative Deviation Rate of Effective Spread

May 2020 Deviation Rate Set to 100% (May 2020–December 2020)



Source: MSRB analysis with dwata obtained from MSRB's RTRS database, security master database and TRACE Data provided by FINRA's TRACE System.

ABOUT THE MSRB

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

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