Mark-up Disclosure Rule and its Effects on Trading Costs in the Municipal Bond Market

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Abstract

In 2018, the Municipal Securities Rulemaking Board implemented a mark-up disclosure rule to strengthen post-trade transparency. Broker-dealers were required to disclose mark-ups to retail investors on the confirmation page. This paper explores the influence of the mark-up disclosure rule on trading costs. Both effective spreads and "waterfall" mark-ups are measured and analyzed. Overall, trading costs of retail-sized trades decreased after the implementation of the mark-up disclosure rule. The results suggest that the information asymmetry between broker-dealers and retail investors may have decreased after the mark-up disclosure rule. However, this pattern of results is only observed among frequently traded bonds. No significant change is found with infrequently traded bonds. The increased bargaining power of retail investors may be the main force driving the trading costs decline.

JEL Classification: G12, G18, G24

Keywords: municipal bond, regulation, retail investor, trading cost, broker-dealer, effective spreads, mark-ups, mark-downs

1. Introduction

In recent years, much effort has been made to improve and strengthen the transparency in the municipal bond market, with a particular emphasis on retail-sized trades. At the 2023 fixed income forum spring roundtable, SEC Commissioner Crenshaw said: "Perhaps the simplest way to improve investor outcomes in the fixed income markets that I would like to suggest is the expansion of mark-up and mark-down disclosures."[1] In this paper, I examine the influence of the mark-up disclosure rule on trading costs, which was measured by the magnitude of both effective spreads and "waterfall" mark-ups. I use the term "mark-ups" to refer to any difference between the broker-dealers' trading price with investors and the prevailing market price on the same securities.

Although post-trade price information is now widely available to the public, the bond markets are still relatively opaque for retail investors. The lack of expertise in bond trading as well as smaller retail-sized transactions, makes them less competitive with broker-dealers for a better trading price. In fact, many retail investors might not even know how much their trades are marked up. Daniel M. Gallagher, in his SEC speech, indicated that some retail investors are unaware of broker compensation for the transaction.[2] With the mark-up disclosure rule, however, retail investors now become more informed about mark-ups on the broker-dealers' confirmation page of each trade. As a result, they might be motivated to reduce their mark-ups by switching around broker-dealers or negotiating with broker-dealers. Griffin et al. (2023) tested this idea and measured mark-ups within six weeks before and after the disclosure rule was implemented.

[1] Crenshaw, C. (2023, March 30). Fixed Income and Options: The Other Market Structures. Speech presented at the Fixed Income Forum Spring Roundtable, Washington D.C.
[2] Gallagher, M. (2012, September 19). Remarks Regarding the Fixed Income Markets. Speech presented at the Conference on Financial Markets Quality, Washington D.C.

However, little effect was observed. One possibility to account for this weak finding is that it may take some time for the effect of the disclosure rule to become pronounced in an illiquid market, and the time frame adopted in Griffin et al. (2023) was simply too short. Naturally extended from Griffin et al. (2023), my study covers an extended time span of one year before and after the implementation of the disclosure rule, which affords the opportunity to observe any potential effect that might exist. Moreover, two measures have been adopted in the current study to assess trading costs. First, I measure the magnitude of effective spreads, which is a common and standard measure for trading costs (L. E. Harris & Piwowar, 2006; Petersen & Fialkowski, 1994). Second, following the "waterfall" process suggested by the Municipal Securities Rulemaking Board (MSRB), I compute "waterfall" mark-ups as a secondary measure to evaluate trading costs. By exploring the effect of the mark-up disclosure rule, this study sheds light on post-trade transparency in the municipal bond market and discovers the potential impact of regulation influence on trading costs.

The mark-up disclosure rule became effective in the municipal bond market on May 14, 2018. Before that, mark-ups were not listed separately to retail investors on the confirmation pages broker-dealers sent them. Instead, retail investors in the municipal bond market could only estimate the mark-ups using the Municipal Securities Rulemaking Board (MSRB)'s Electronic Municipal Market Access (EMMA) website, which provides the historical prices of the same or similar bonds. Since retail investors are considered non-sophisticated investors, this creates a high barrier for them to find relevant information and decide on the prevailing market price. In fact, it might not be even realistic to expect retail investors with any reasonable degree of expertise to use EMMA effectively.[3] Without the disclosure rule, retail investors might have traded with broker-dealers at

[3] Consumer Federation of America comment letter to the MSRB (2015, January 20).

inefficient prices compared with the prevailing market price simply because they did not know the exact magnitude of mark-ups for their transactions. Craig et al. (2018) conducted research on municipal bond markets and found that most customer trades execute at worse prices than the best available dealer quote.

According to a report by MSRB in 2021 (Municipal Securities Rulemaking Board, 2021), individual investors hold $4.2 trillion outstanding municipal bond market. These holdings account for 45.2% of all direct and indirect holdings through mutual funds, exchange-traded funds (ETFs), and closed-end funds. Interestingly, 87% of the entire municipal bond trade was accounted for transactions less than $100,000, reflecting individual investors trade most outstanding municipal bonds available in the market. As the municipal bond markets is considered reliable and safe, a recent SEC discussion disclosed that a great number of retail investors purchasing municipal bond were those who approach retirement with lower level of risk-tolerance.[4] Becoming informed about the mark-ups may motivate retail investors to switch among various broker-dealers to gain better insight into the prevailing market price. The large amounts of individual holdings, together with mark-up disclosure, therefore, give retail investors more bargaining power to achieve fair prices. This discussion leads to the main hypothesis of this paper: the trading costs – measured as mark-ups and effective spreads – will decrease after the mark-up disclosure rule for retail-sized trades compared to institutional-sized trades.

The implementation of the mark-up disclosure rule may impact the broker-dealers in a different way. To comply with the rule, the broker-dealers must utilize certain technology to calculate and present the mark-ups or to outsource related services to third-party vendors. This

[4] Crenshaw, C. (2023, March 30). Fixed Income and Options: The Other Market Structures. Speech presented at the Fixed Income Forum Spring Roundtable, Washington D.C.

additional process creates extra compliance costs for broker-dealers and leads to increased costs for investors. This results in a competing hypothesis against the one discussed above: trading costs of retail-sized trades might increase after the mark-up disclosure rule because the compliance costs of broker-dealers have increased. Therefore, theoretically, this research question is an open question that calls for empirical answers.

In this paper, I use trade-level information from MSRB beginning one year before and ending one year after the rule change to conduct my analysis. Specifically, the sample includes 20,113,124 municipal bond trades regarding 708,344 different bonds from May 7, 2017 – May 21, 2019. I examine the change in effective spreads and mark-ups in the two years around the date of implementing the mark-up disclosure rule. A retail trade is the one where the trade size is less than or equal to $100,000 (Wu & Vieira, 2019).

I create the mark-up measure following the "waterfall" process suggested by the MSRB. The "waterfall" process guides broker-dealers to a reasonable prevailing market price and states the specific price to be used in different circumstances. The benefit of using "waterfall" mark-up is that this method measures the immediate impact of mark-up regulation. In my empirical analysis, I also use effective spreads – a commonly used measure for trading cost. There is a similar change in effective spreads compared to the "waterfall" mark-up.

I further explore the mechanism of trading costs change. Previous research shows that liquidity could influence the yield spread changes and mark-ups in corporate bond market and municipal bond market (Friewald et al., 2012; Griffin et al., 2023). I examine the number of trades for each bond during the sample period and found bonds in the top 5 percentile number of trades account for more than 40 percent of total trades in the market. These bonds in the top 5 percentile are categorized as frequently traded bonds, and the rest are considered as infrequently traded bonds.

With frequently traded bonds, retail investors might find it much easier to locate an alternative broker-dealer with lower mark-ups. As a result, it is reasonable to think that mark-ups for these frequently traded bonds will decrease. However, for municipal bonds that are thinly traded, retail investors might find it much more challenging to explore other better options.

Overall, I find that trading costs of retail-sized trades decreased after the mark-up disclosure rule was implemented in the municipal bond market. This pattern is specifically observed in frequently traded bonds. Interestingly, no significant change is found with infrequently traded bonds. The mark-up disclosure rule relieves the information asymmetry between retail investors and broker-dealers which further increases the bargaining power of retail investors, at least for frequently traded bonds.

This paper contributes to the literature documenting the frictions impacting retail investors in bond markets. Retail investors' trading costs lower the efficiency in the market and lead to friction (Egan, 2019). Several studies document that corporate and municipal bonds are much more expensive for retail investors to trade than common stocks (Griffin et al., 2023; Schultz, 2012). Well-informed investors like institutional investors can take advantage of their information and ability to analyze the market price, making their trading costs much lower than those of retail investors. This paper finds that showing retail investors the mark-ups on the confirmation page may help them decrease information asymmetry and further leads to lower trading costs, at least for those frequently traded bonds. This happens because there are many other broker-dealers available in the market who can provide lower mark-ups for the same securities.

This paper also contributes to the literature documenting the benefit of regulation to investor protection in the fixed-income market. In the corporate bond market, Edwards et al., (2007) find that investors benefit significantly from price transparency by the implication of TRACE.

Investors may also negotiate better terms of trade once they have access to broader bond-pricing data (Goldstein et al., 2007). In the municipal bond market, real-time trade reporting started January 31, 2005 as a way to promote price transparency. However, mixed results have been reported. For instance, while Schultz (2012) found that the dispersion of purchase prices fell sharply at that time, little impact was observed on average mark-ups for most trades. On the other hand, other research has argued that having access to fundamental information enhances retail investors' bargaining power. Cuny (2018) finds that the introduction of an online disclosure repository lowers retail investors' information acquisition costs, as well as the premium they pay over large investors reduced. Results of the present work is more in line with the latter, suggesting that the implementation of mark-up disclosure on confirmation pages facilitates investor protection and may enhance bargaining power.

I directly contribute to the literature documenting changes in trading costs with an increase in required disclosure. In the corporate bond market, Cuny et al., (2021) find that customers have lower mark-ups after a similar mark-up disclosure rule is implemented in the corporate bond market on the same day. However, Harris and Mehta (2020) provided opposing evidence, indicating that mark-ups remain large in corporate bond market after the implementation of the mark-up disclosure rule. These findings make the impact of mark-up disclosure unclear. Regarding the effect of the mark-up disclosure rule in the municipal bond market, a study by the MSRB (Wu & Vieira, 2019) did not find any effect of the mark-up disclosure rule. Griffin et al., (2023) examine the mark-ups within six weeks before and after the mark-up disclosure rule. They argue that there is limited downward impact on the mark-ups. In this paper, I examine the change in the trading costs one year before and after the disclosure rule. I measure mark-ups following the "waterfall" process according to the MSRB guidance. I further separate the sample into frequently

and infrequently traded bonds to examine those bonds that might have more information that is publicly available. I find that retail investors' trading costs decrease after the mark-up disclosure rule and frequently traded bonds dominate the decline.

Finally, it is valuable to study the disclosure requirements of retail investors through this unique setting where the mark-up disclosure rule is implemented on the same day in the municipal and corporate bond markets. The attractiveness and extensive retail holdings in the municipal bond market to retail investors may create a different influence by mark-up disclosure compared to the findings in the corporate bond market. Municipal bond interest carries certain tax exemptions, while corporate bond interest is always taxed. Ang et al., (2010) find that retail investors, the most prominent municipal bond clientele, have extreme sensitivity to tax payments. Cestau et al., (2019) state that tax exemption makes municipal bonds an attractive investment for retail investors. Moreover, historical data shows municipal bonds are 100 times less likely to default than comparable corporate investment-grade bonds (Cornaggia et al., 2022). Additionally, municipal bonds generally offer lower yields than corporate bonds. Due to the lower yield in the municipal bond market, these retail investors might be more sensitive to mark-ups. By adding to this literature, we can know the different reactions to the same mark-up disclosure rule in two fixed income markets.

The rest of this paper is organized as follows. Section 2 introduces the institutional background, followed by hypothesis development. Section 3 describes the sample constructions, measures, and descriptive statistics. Section 4 presents the empirical results of the effects of mark-up disclosure rule on trading costs. Section 5 presents the mechanism. Section 6 concludes.

2. Institutional Background and Hypothesis Development

2.1 Municipal Bond Market

The municipal bond market is one of the primary sources of capital for municipal entities in the US. States, counties, city governments, or government projects issue municipal bonds to raise money. At the end of 2021, $4 trillion municipal bond market financed infrastructure such as roads, hospitals, and schools. Since the interest earned in the municipal bond market is typically exempt from federal and often state taxes, the market attracts high-net-worth individual investors. Researchers find that households are the largest holders of municipal debt compared to household ownership in other large financial markets.

The retail investors in municipal and corporate bond markets have different risk appetites and preferences due to yield, investment period, risk, and tax (Cestau et al., 2019). Historical data shows municipal bonds are 50 to 100 times less likely to default than corporate bonds with the same credit ratings. Retail investors in the municipal bond market might be more risk-averse than those in the corporate bond market. Retail investors' risk aversion and high tax sensitives (Babina et al., 2021) in the municipal bond market may lead to strong reactions to the mark-up disclosure rule since they may find that trading costs erode their profit significantly. After increasing the awareness of mark-ups after the mark-up disclosure rule, retail investors might switch to other broker-dealers or bargain with broker-dealers for better execution prices.

2.2 Mark-up Disclosure Rule

In the municipal bond market, dealers may execute orders by committing dealer capital (principal trades) or by agency trades. For example, when retail investors buy bonds from broker-dealers, the broker-dealers sell bonds from their accounts. This trading type has the broker-dealers

owning the bond for a period, even a few seconds (known as riskless principal trade). Agency trades means that broker-dealers search for a counterparty in the market to facilitate the transactions. For agency trades, broker-dealers charge a commission and disclose it to investors.

The mark-up disclosure rules became effective on May 14, 2018. The mark-up disclosure rule influences specific principal trades. When conducting principal trades, broker-dealers trade bonds with their customers and always charge a mark-up over the market price on each transaction. According to the rule, a mark-up disclosure in the municipal bond market is triggered for: "…a transaction in municipal securities with a non-institutional customer if the dealer also executes one or more offsetting principal transaction(s) on the same trading day as the customer transaction in an aggregate trading size that meets or exceeds the size of the customer trade." A non-institutional customer is a customer with an account that is not an institutional account, as defined in MSRB Rule G-8(a)(xi). That is, mark-ups must be disclosed to retail investors based on the prevailing market price when the broker-dealer trades a security with a retail investor and there are offsetting trades regarding the same security in the broker-dealers' accounts on the same day that match the size of the customer trade. A similar disclosure rule exists in the corporate bond market imposed by the Financial Industry Regulatory Authority (FINRA). That rule became effective on the same day as the municipal bond market rule. With new rule enforcement, it is essential to understand the market's reactions regarding the trading costs of retail investors in the municipal bond market.

There are several reasons that retail investors are not aware of the amount of their mark-ups or the fact that they are paying higher mark-ups than institutional investors. First, there is no pre-trade price transparency, including bid/ask quotes in the corporate and municipal bond markets (Craig et al., 2018; Wu et al., 2018), which makes it hard for these unsophisticated investors to find the accurate prevailing price. Second, retail investors have limited expertise in bond trading

and shopping around for a better price.[5] Third, mark-ups on principal trades, including riskless principal trades, are not disclosed to retail investors before the disclosure rule. Retail investors may mistakenly conclude that they are not paying any mark-ups to broker-dealers.

Moreover, previous researches indicate that retail investors find themselves in a less favorable position in the municipal bond markets. Harris and Piwowar (2006) and Edwards et al. (2007) find that trading costs for retail investors are much higher than for institutional investors in corporate bond and municipal bond markets. They also find that municipal bond retail investors incur higher trading costs when trading complex bonds than simple bonds. Retail investors are more adversely affected by bond complexity than institutional investors.

Upon the effective date of the new disclosure rule, the confirmation page sent to retail investors must include the amount of mark-up if the broker-dealer bought and sold those bonds on the same day. The displayed mark-up is a total dollar amount and a percentage of the prevailing market price of a particular bond. The mark-up disclosed on the confirmation page is the difference between the price a retail investor pays and the prevailing market price. Generally, the prevailing market price is the inter-dealer market price prevailing at the time of the retail investor transaction.[6]

There have been other required disclosures before the mark-up disclosure rule that can help retail investors find a broker-dealer to trade at a fair mark-up. Broker-dealers must include a link to the MSRB's EMMA website, where retail investors can see any other trade prices in the specific bond at or around the transaction time. Broker-dealers must report transaction information within 15 minutes of the trade to the MSRB's Real-time Transaction Reporting System (RTRS) for a

[5] Gallagher, M. (2012, September 19). Remarks Regarding the Fixed Income Markets. Speech presented at the Conference on Financial Markets Quality, Washington D.C.
[6] Municipal Securities Rulemaking Board (2017): Did I get a fair price? Retrieved from: https://www.msrb.org/sites/default/files/Did-I-Get-a-Fair-Price.pdf.

display to the public on EMMA. Retail investors can use the prices on EMMA to compare their trades to other trades. But due to the illiquidity in municipal bond market and the limited ability of retail investors to use EMMA, it would be hard for retail investors to find out mark-ups or comparable prices by themselves.

2.3 Hypothesis Development

Before mark-up disclosure, municipal bond investors could not observe the mark-up directly on their trading confirmation page. They might be able to estimate the mark-up themselves based on the market prices from EMMA website if they understand the complex system and thee calculating process. However, given the illiquid nature of the municipal bond market, recent prices presented on EMMA are not a very useful benchmark for retail investors. After the mark-up disclosure rule is implemented, the information advantages of broker-dealers are weakened and the information asymmetry between retail investors and broker-dealers decreases. Retail investors who were unaware of the magnitude of mark-up previously may reevaluate their relationship and trading costs with broker-dealers. This new information can motivate them to switch to broker-dealers that can provide a lower trading cost or to bargain for better execution. After a period of market adjustment, investors could find a better execution price with lower trading costs, and the trading costs measured as mark-ups and effective spreads should decrease to some extent for retail investors. It should be noted that, however, it may take several years for the effect of change in regulation to become pronounced (Wu & Vieira, 2019). For example, it takes a few years for the January 2005 migration of municipal bond trade reporting to transaction reporting to impact on the market. So, it is reasonable to test the effect for one year before and after the disclosure rule. This leads to the first hypothesis:

Hypothesis 1: After the mark-up disclosure rule, trading costs of retail-sized trades with same day offset decrease in the municipal bond market.

However, after the mark-up disclosure rule, broker-dealers must show mark-ups based on prevailing market prices which creates extra workloads for broker-dealers. To comply with the rule, they may need to rely on technology solutions or outsource related services to third-party vendors. Broker-dealers must conduct a robust due diligence process to ensure that the new steps and calculations adhere to the disclosure rule. These extra workloads might increase the operating costs of broker-dealers and further increase the trading costs for retail investors. This leads to the competing hypothesis:

Alternative Hypothesis 1: Trading costs of retail-sized trades might increase after the mark-up disclosure rule due to broker-dealer compliance costs.

Although the municipal bond market is relatively illiquid where it might be difficult to find a counterparty with limited market source and information, there are still frequently traded bonds. These frequently traded bonds have the top 5 percentile of number of total trades and account for roughly 40 percent of total trades in this market. For these bonds, it will be easier for the investors to shop around to find broker-dealers who can provide lower mark-ups or bargain for a better execution price. However, for infrequently traded bonds, market liquidity for these bonds can be stale or unavailable. It would be very hard for retail investors to bargain for a lower mark-up. Thus, the impact of mark-up disclosure rule on a lower trading cost might be driven by frequently traded bonds which are bonds with top 5 percentile of number of trades. This discussion leads to the second hypothesis:

Hypothesis 2: Frequently traded bonds have the most pronounced lower trading costs after the new disclosure rule when traded by retail investors, while infrequently traded bonds do not have the same feature.

3. Data

In this section, I describe my data sources, two measures of trading costs, control variables and summary statistics. I measure trading costs by the effective spreads and "waterfall" mark-ups which stick to the waterfall process suggested by MSRB. I then present descriptive statistics.

3.1 Sample

To study the impact of mark-up disclosure in the municipal bond market I collect municipal bond trade level information from MSRB. The database represents transactions by investors and dealers in the over-the-counter market for municipal securities issued by municipal entities, including states, counties, cities, and special tax districts. Key variables include CUSIP, trade type, trade date, trade time, and volume. I define retail trades as those of trade size less than or equal to $100,000. I limit the sample to one year before and after the mark-up rule. I want to examine the change in trading costs in this time span because it takes time for the rule's effects to become fully apparent. Specifically, my sample covers the period May 7, 2017 – May 21, 2019. I dropped the week before and after the rule's effective date.

Next, I clean the data using the procedure outlined by Green et al. (2010) and Li and Schürhoff (2019) to eliminate obvious data errors and obtain a clean trading sample. I drop all municipal bond trades occurring during weekends and holidays, which might be potential data errors. I drop those trades if a bond's coupon and maturity information is missing. I eliminate all bonds with coupons more than 20% or maturity of more than 100 years or negative years since

these numbers are very likely to have been incorrectly recorded. I also eliminate all transactions where the price is less than 50 (i.e., 50% of face value) or greater than 150, as these are likely to be data errors given the lack of extreme distress during the sample period. Green et al. (2007) state that newly issued bonds exhibit peculiar characteristics and high levels of price dispersion. I limit the sample to seasoned bonds traded after 90 days of issuance. Finally, I also eliminate those bonds within one year of their maturing time and trade one week around the event date following Cuny et al. (2021). These filters result in a sample of 14,932,363 municipal bond trades of 487,162 different bonds.

In Panel A of Table 1, I describe each step and report the number of trades and bonds remaining in the sample after applying each filter. Panel A also shows the trade sample used to calculate effective spreads. The sample for spreads calculation is slightly smaller because I need to drop all interdealer trades, and this leaves a sample of 487,029 bonds with 9,117,470 trades.

[Insert Table 1 here]

3.2 Measures

I utilize two different measures of trading costs to examine the impact of mark-up disclosure. The first measure is "waterfall" mark-up which sticks to the waterfall process of calculating mark-up suggested by the MSRB. The second measure is effective spreads. Effective spread is commonly used to calculate the trading costs investors pay to execute their trades.

3.2.1 "Waterfall" Mark-ups

The waterfall method to calculate the mark-up is similar to the logic that MSRB suggests for finding a reasonable prevailing market price when broker-dealers calculate the mark-ups. According to the guidelines of the MSRB, determining the prevailing market price for a municipal

security uses the following "waterfall" process. (a) A dealer that is acting in a principal capacity in a transaction with a customer and is charging a mark-up or mark-down must mark-up or mark-down the transaction from the prevailing market price. The prevailing market price for municipal security is established by referring to the dealer's contemporaneous cost as incurred or contemporaneous proceeds as obtained. (b) In instances where the dealer has established that the dealer's cost is (or, in a mark-down, proceeds are) not contemporaneous, or where the dealer has presented evidence that is sufficient to overcome the presumption that the dealer's contemporaneous cost (or proceeds) provides the best measure of the prevailing market price, the dealer must consider in the listed below: Prices of any contemporaneous inter-dealer transactions in the municipal security; prices of contemporaneous dealer purchases (sales) in the municipal security from (to) institutional accounts with which any dealer regularly affects transactions in the same municipal security; or contemporaneous bid (offer) quotations for the municipal security made through an inter-dealer mechanism, through which transactions generally occur at the displayed quotations.

I calculate bond trading prices based on same day trades since these trades are directly influenced by mark-up disclosure rule. For a specific size-bond-day observation, I set the bid price as the prevailing market price if that bond has both ask and bid prices. If that day only has the ask price and interdealer price, I set the interdealer price as the prevailing market price. If both situations do not happen and that day only has bid and interdealer prices, I put the interdealer price as the prevailing market price. In this measure, I include all interdealer trades. The benefit of using "waterfall" mark-ups directly is that this measure examines the immediate impact of the new regulation compared to the traditional measure using effective spreads. The final mark-up sample

consists of 4,760,700 observations of 451,436 bonds. Panel B lists the number of frequently traded and infrequently traded bonds. Specifically, the "waterfall" mark-up is:

① If both ask and bid prices are available, Mark-up = $(P_A - P_B)/P_B$.

② If the above situation does not occur and an ask price and an interdealer price are available, Mark-up = $(P_A - P_D)/P_D$.

③ If the above situation does not occur and both a bid price and an interdealer price are available, Mark-up = $(P_D - P_B)/P_B$.

P_A is the trade-size weighted average customer purchase price of bond i on date t. P_B is the trade-size weighted average customer sale price of bond i on date t. P_D is the trade-size weighted average interdealer transaction price of bond i on date t.

3.2.2 Effective Spreads

Effective spread is a commonly used measure to calculate the trading costs investors pay to execute their trades. To calculate effective spread, each security must have at least one customer-buy and one customer-sell trade on each trading day to have an effective spread on that specific day. The final sample to calculate effective spreads includes 9,117,470 trades regarding 487,029 different bonds after eliminating interdealer trades.

Since the mark-up disclosure rule only require broker-dealers disclose mark-ups to specific retail investors and prior research shows that effective spreads vary with trade size, I calculate effective spreads separately in each trading size group. Following Edwards et al. (2007) and MSRB definition, retail-sized trades have a par amount of fewer than 100,000 dollars. Others should be institutional-sized trades with a par amount larger than 100,000 dollars. Specifically, effective spreads are calculated as Effective Spread = $(P_A - P_B)/P_B$. P_A is the trade-size weighted average

customer purchase price of bond i on date t. P_B is the trade-size weighted average customer sale price of bond i on date t. This straightforward measure includes the total round-trip cost investors pay to buy and sell bond i on date t. As shown in Panel B of Table 1, there are 1,391,948 effective spreads observations of 299,325 bonds. The number of frequently traded bonds that have been covered is 24,056 which is close to the number of "waterfall" mark-up, and the number of infrequently traded bonds is 275,269.

3.2.3 Other Control Variables

Following Green et al. (2010) and Li and Schürhoff (2019), other control variables include bond age, bond maturity, the sum of par value traded for each bond on each day, the number of interdealer trades for each bond on each day, and the number of all trades in the sample period. I also winsorize all the continuous variables at 1% and 99% levels to eliminate outliers in all the above variables. I take the natural logarithms of variables other than effective spreads and "waterfall" mark-ups. I provide detailed variable definitions in the Appendix.

3.3 Descriptive Statistics

After the data construction discussed above, there are 14,932,363 trades of 487,162 different bonds in the final MSRB trade sample. Mark-up disclosure rule does not have significant impacts on the number of trading activities. The number of bonds that have been traded before and after the mark-up disclosure rule is almost the same. There are 351,384 bonds that been traded in the one year before the mark-up disclosure rule. The number of trades before the disclosure rule is 7,218,521. Meanwhile, there are 366,069 bonds that have been traded in the one year after the mark-up disclosure rule. The number of trades after the mark-up disclosure rule is 7,713,842. The number of trades is calculated based on all the trade types which includes customer purchases, sales, and interdealer trades.

Table 2 provides descriptive statistics of the sample. Panel A shows the descriptive statistics at the bond level. On average, bonds have around 30 trades in the sample period which is consistent with the illiquidity in the municipal bond market. However, the standard deviation is relatively high, with the top 5th percentile of trade numbers reaching 113, which is three times the mean value. Bonds in this top 5th percentile account for nearly half of all trades during my sample period. Retail investors trading those frequently traded bonds might obtain more bargaining power with the higher liquidity since they might find it easier to shop around to find a better executive price. I classify bonds that have been traded 113 times or more during the sample period as frequently traded bonds. Conversely, bonds with fewer than 113 trades during the sample period are classified as infrequently traded bonds. The average number of trades for frequently traded bonds is 262.67, while for infrequently traded bonds, it is 18.53. In the subsample of frequently and infrequently traded bonds, their trade numbers after the mark-up regulation consistently show a slight increase compared to the period before the mark-up disclosure rule.

Panel B and Panel C of Table 2 present descriptive statistics for the main variables based on observations of mark-ups and effective spreads, respectively. These variables exhibit similar characteristics across both measures, but the distinctions between frequently and infrequently traded bonds within this illiquid market underscore the importance of separately examining the effects of the mark-up disclosure rule on influencing mechanisms. Frequently traded bonds exhibit longer ages and maturities in comparison to infrequently traded bonds. Furthermore, they display higher trade volumes and greater trade activity, aligning with expectations. In the context of the entire sample, bonds possess an average remaining maturity of approximately 11.23 years and an average age of issuance of 5.21 years. Furthermore, I have plotted the time series changes in

effective spreads and mark-ups around the implementation of the mark-up disclosure rule in Figure 1A and Figure 1B, respectively. These figures depict a trend similar to the finding discussed above.

[Insert Table 2 here]

[Insert Figure 1 here]

4. The Effects of Mark-up Disclosure Rule on Trading Costs

4.1 Univariate Analysis

In Table 3, I analyze the difference in effective spreads between retail and institutional-sized trades before and after the implementation of the mark-up disclosure rule. As the rule only impacts the confirmation page for retail trades, I anticipate a more pronounced decrease in trading costs for retail investors compared to institutional-sized trades. Table 3 presents the univariate results for the entire sample. After the disclosure rule, effective spreads for retail trades decreased by 6.53 basis points. Prior to the rule, the difference in effective spreads between retail and institutional-sized trades was 58.89 basis points. This difference decreased to 57.53 basis points after the mark-up disclosure rule significantly. These results indicate that the trading costs of retail-sized trades decrease after the mark-up disclosure rule.

[Insert Table 3 here]

4.2 Baseline Regression

Next, I perform a baseline regression to investigate the relationship between the mark-up disclosure rule and trading costs among retail trades. In this analysis, dependent variables are effective spreads and mark-ups, respectively. Effective spreads are a common measure of trading costs. They are calculated as the weighted average ask price minus the weighted average bid price

when the bond has at least one customer buy and one customer sell trade in at least one of the trading size groups on the same day. The "waterfall" mark-up process adheres to the procedure of determining the prevailing market price, as defined and guided by MSRB regulations. Specifically, I estimate the following regression using a difference-in-difference strategy:

(1)

$$Trading\ Costs_{i,t}^{s} = \beta_0 + \beta_1 Post_t + \beta_2 Retail_{i,t}^{s} + \beta_3 Post_t \times Retail_{i,t}^{s} + \gamma Controls_{i,t} + Bond_{FE} + Year_{FE} + \varepsilon_{i,t}^{s}$$

where post is a dummy variable that equals to one if the observation is based on trades after the mark-up disclosure rule and zero otherwise, retail is a dummy variable that equals to one if the observation is set up based on retail trades. The variable of interest here is the interaction term, post × retail. $Controls_{i,t}$ is a vector of control variables discussed in Section 3.2.3. $Bond_{FE}$ denotes bond fixed effects and $Year_{FE}$ denotes year fixed effects. The inclusion of bond and year fixed effects ensures that the coefficient of interaction term captures the difference-in-difference effects. In the above regression, I predict β3, the coefficient of interaction term, to be negative based on our hypothesis.

Table 4 displays the regression results obtained from estimating equation (1). The coefficient for 'post' is omitted due to the inclusion of date fixed effects. The dependent variable in column (1) in effective spreads. The negative coefficient (-2.58bps) of the interaction term shows the difference of mark-up disclosure rule's effect on retail trades versus institutional size trades. In column (2), the dependent variable is "waterfall" mark-ups. The coefficient of interaction term post × retail is -0.42. These findings collectively suggest that the trading costs of same-day retail trades experience a more substantial reduction following the implementation of the mark-up

disclosure rule, as contrasted with institutional-sized trades. The presence of bond and date-fixed effects reinforces the robustness of these conclusions. Other control variables are consistent with prior literature. Daily trading volume is negatively related to mark-ups, and dealers' trading activities are positively related to mark-ups.

[Insert Table 4 here]

4.3 Robustness

In this section, I undertake a robustness check to reinforce the findings in the baseline regression by dividing the trades into four size tranches: those below $50,000, those between $50,000 and $100,000, those between $100,000 and $150,000, and those between $150,000 and $200,000. If only the trading costs of retail-sized trades decreased after the mark-up disclosure rule, trades with the trade size larger than $100,000 should not have any significant effects. Employing the "waterfall" process as described in Section 3.2.1, I compute bond mark-ups for each size tranche and further estimate the regression specified in equation (1).

Table 5 presents the results. For brevity, I only report the coefficients and test statistics for the main variables of interest. In Column (1), where the focus lies on mark-ups for trades within $50,000, and those between $50,000 and $100,000, I identify a statistically significant reduction of 1.35 bps for trades smaller than $50,000, as well as a notable decrease of 2.13 bps for next trade size category ($50,000 to $100,000). In columns (2) and (3), with the inclusion of larger trade size categories, I find no statistical change in mark-ups on these trades. However, the difference of retail trades remains statistically significant at the 5% level of significance. Hence, these findings support the fact that the most significant reduction in trading costs with same-day offset is observed among retail-sized trades. Such trades are likely executed by retail investors who possess limited information concerning mark-ups prior to the implementation of the mark-up disclosure rule. The

disclosure of mark-ups alleviates the information asymmetry between retail investors and broker-dealers, thereby augmenting the bargaining power of these investors.

[Insert Table 5 here]

5. Mechanism

In this section, I explore the mechanism behind the reduction of trading costs among retail trades that have been impacted by the mark-up disclosure rule. After the mark-up disclosure rule, the information asymmetry between retail investors and broker-dealers decreased. The disclosure rule weakens broker-dealers' information advantage, which further leads to an increase in the bargaining power of retail investors. With the mark-up information in hand, retail investors might be able to negotiate for a lower mark-up with their current broker-dealer or find a counterparty who can provide lower mark-ups for the same securities in the municipal bond market. However, such situations might only apply to frequently traded bonds where a larger number of bonds are being traded in the market. Motivated by Friewald et al., (2012) and Griffin et al., (2023) which indicate that liquidity could influence yield spread changes and mark-ups in fixed income markets, I separate the municipal bond trading sample into two subsamples. The subsample of frequently traded bonds includes those bonds within the top 5 percentile of the number of trades, while the subsample of infrequently traded bonds consists of the rest of bonds. Frequently traded bonds represent 40% of total trades in the municipal bond market. I argue that investors have more opportunities to bargain with broker-dealers or search for a counterparty that can provide lower mark-ups for frequently traded bonds. Only in the trades of frequently traded bonds can the information asymmetry between retail investors and broker-dealers be alleviated. On the other hand, it would be difficult for retail investors who trade infrequently traded bonds to find lower

mark-ups; thus, the trading costs for infrequently traded bonds would not decrease even after the mark-up disclosure rule.

Next, I present the results of the univariate analysis. Specifically, I examine the changes in effective spreads for both frequently and infrequently traded bonds. For retail-sized trades, I find that the decrease in effective spreads for frequently traded bonds is almost double the reduction observed among infrequently traded bonds. However, I cannot observe the same situation for infrequently traded bonds. This indicates that it might be much easier for retail investors to find counterparties or negotiate better execution prices for frequently traded bonds compared to infrequently traded ones. Table 6 also reveals that trades involving retail customers incur the highest trading costs. The effective spreads of retail-sized trades are approximately four times those of institutional-sized trades. This result is consistent with the finding of Griffin et al. (2023) and Harris & Piwowar, (2006).

[Insert Table 6 here]

Next, I reexamine the baseline regression, dividing the sample into two subsamples: frequently traded bonds and infrequently traded bonds. Table 7 displays the results for two subsamples. Columns (1) and (2) present the findings for frequently traded bonds. In column (1), the dependent variable is effective spreads. Same-day retail trades of frequently traded municipal bonds experience reduced effective spreads following the implementation of the mark-up disclosure rule. Specifically, the effective spreads decrease by an additional 4.45 basis points for retail trades compared to institutional trades. In column (2), the dependent variable is mark-up. The coefficient of the interaction term is also negative after controlling for fixed effects. Retail trades' mark-ups decrease additional 2.34 basis points after the mark-up disclosure rule compared to the decrease in institutional-sized trades. However, when focusing on infrequently traded bonds,

I cannot observe the similar decrease in trading costs. Column (3) and (4) presents the results for infrequently traded bonds. The result is consistent with the previous discussion that it is difficult for investors to find information and counterparty for infrequently traded bonds in the municipal bond market. The coefficients of all control variables remain consistent with the existing literature.

Overall, I observe a reduction in trading costs for retail trades that involve same-day offset after the implementation of the mark-up disclosure rule. The primary effect of decreasing trading costs among retail trades is driven by frequently traded municipal bonds because of their liquidity. This phenomenon can be attributed to the fact that such frequently traded bonds' investors find it considerably easier to access prevailing market prices or switch to alternate broker-dealers when seeking improved execution prices. This observation aligns well with the hypothesis that the efficiency of the mark-up disclosure rule primarily pertains to frequently traded bonds, as these bonds provide retail investors with enhanced opportunities to negotiate, explore various broker-dealer options, and ultimately achieve better execution prices and reduced trading costs.

[Insert Table 7 here]

For robustness, I undertake an analysis by dividing the entire bond sample into quartiles based on the total number of trades over the two-year sample period. If only investors of frequently traded bonds can detect the prevailing market price or benchmark information, the higher the number of trades, the stronger the effect of the mark-up disclosure rule on the trading costs. Table 8 provides clear evidence that the disclosure effect on lower trading costs is stronger in those trades in the top quartile of bonds. Specifically, only within the top quartile of bonds has the most significant deduction effect in the coefficient of interaction term after the mark-up disclosure rule. This empirical evidence substantiates the notion that only investors engaged in frequently traded bonds can benefit from the mark-up disclosure rule.

[Insert Table 8 here]

6. Conclusion

This study delved into the impacts of mark-up disclosure rules on trading costs in the municipal bond market. To assess these effects, I employ two measures: effective spreads and the "waterfall" mark-ups, designed to emulate the waterfall process outlined in MSRB guidelines for determining prevailing market prices. The findings reveal a reduction in trading costs for retail investors after the implementation of the mark-up disclosure rule. The disclosure rule may have reduced the information advantage of broker-dealers and the information asymmetry between broker-dealers and retail investors which further leads to a higher bargaining power of retail investors. However, the effect is mainly driven by frequently traded municipal bonds. These frequently traded bonds account for roughly 40% of the total number of trades but they are only 5% of total bonds in the municipal bond market.

In recent decades, lots of attention and regulation including the mark-up disclosure rule has been put into the fixed-income market, but the trade transparency of municipal bond market is still not comparable to the equity market. Many retail investors put their money into the municipal bond market when they get close to retirement to seek a safe and low-volatility investment. The high trading cost in the municipal bond market negatively impacts their portfolio and transactions (Cestau et al., 2019). Low price transparency, both pre-and post-trades, contributes to the high costs of trading the municipal bond market for retail investors. Academics, regulators, and market participants should collaborate to consider possible reforms in the municipal bond market. The mark-up information should be not only disclosed to investors on the confirmation pages after the

transaction, at least from the point of this study, we should start by asking broker-dealers to disclose the mark-up to retail investors before a transaction.

Reference

Ang, A., Bhansali, V., & Xing, Y. (2010). Taxes on Tax-Exempt Bonds. *Journal of Finance*, *65*(2), 565–601.

Babina, T., Jotikasthira, C., Lundblad, C., & Ramadorai, T. (2021). Heterogeneous Taxes and Limited Risk Sharing: Evidence from Municipal Bonds. *The Review of Financial Studies*, *34*(1), 509–568. https://doi.org/10.1093/rfs/hhaa028

Cestau, D., Hollifield, B., Li, D., & Schürhoff, N. (2019). Municipal Bond Markets. *Annual Review of Financial Economics*, *11*(1), 65–84. https://doi.org/10.1146/annurev-financial-110118-123034

Cornaggia, K., Hund, J., & Nguyen, G. (2022). Investor attention and municipal bond returns. *Journal of Financial Markets*, *60*(C). https://econpapers.repec.org/article/eeefinmar/v_3a60_3ay_3a2022_3ai_3ac_3as1386418122000301.htm

Craig, L., Kim, A., & Woo, S. W. (2018). *Pre-trade Information in the Municipal Bond Market*.

Cuny, C. (2018). When knowledge is power: Evidence from the municipal bond market. *Journal of Accounting and Economics*, *65*(1), 109–128. https://doi.org/10.1016/j.jacceco.2017.11.002

Cuny, C., Even-Tov, O., & Watts, E. M. (2021). From Implicit to Explicit: The Impact of Disclosure Requirements on Hidden Transaction Costs. *Journal of Accounting Research*, *59*(1), 215–242. https://doi.org/10.1111/1475-679X.12340

Edwards, A. K., Harris, L. E., & Piwowar, M. S. (2007). Corporate Bond Market Transaction Costs and Transparency. *The Journal of Finance*, *62*(3), 1421–1451. https://doi.org/10.1111/j.1540-6261.2007.01240.x

Egan, M. (2019). Brokers versus Retail Investors: Conflicting Interests and Dominated Products. *The Journal of Finance*, *74*(3), 1217–1260. https://doi.org/10.1111/jofi.12763

Friewald, N., Jankowitsch, R., & Subrahmanyam, M. G. (2012). Illiquidity or credit deterioration: A study of liquidity in the US corporate bond market during financial crises. *Journal of Financial Economics*, *105*(1), 18–36. https://doi.org/10.1016/j.jfineco.2012.02.001

Goldstein, M. A., Hotchkiss, E. S., & Sirri, E. R. (2007). Transparency and Liquidity: A Controlled Experiment on Corporate Bonds. *The Review of Financial Studies*, *20*(2), 235–273. https://doi.org/10.1093/rfs/hhl020

Green, R. C., Hollifield, B., & Schürhoff, N. (2007). Financial Intermediation and the Costs of Trading in an Opaque Market. *The Review of Financial Studies*, *20*(2), 275–314. https://doi.org/10.1093/rfs/hhl012

Green, R. C., Li, D., & Schürhoff, N. (2010). Price Discovery in Illiquid Markets: Do Financial Asset Prices Rise Faster Than They Fall? *The Journal of Finance*, *65*(5), 1669–1702. https://doi.org/10.1111/j.1540-6261.2010.01590.x

Griffin, J. M., Hirschey, N., & Kruger, S. (2023). Do Municipal Bond Dealers Give Their Customers "Fair and Reasonable" Pricing? *The Journal of Finance*, *78*(2), 887–934. https://doi.org/10.1111/jofi.13214

Harris, L. E., & Piwowar, M. S. (2006). Secondary Trading Costs in the Municipal Bond Market. *The Journal of Finance*, *61*(3), 1361–1397. https://doi.org/10.1111/j.1540-6261.2006.00875.x

Harris, L., & Mehta, A. (2020). Riskless Principal Trades in Corporate Bond Markets. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3681652

Li, D., & Schürhoff, N. (2019). Dealer Networks. *The Journal of Finance*, *74*(1), 91–144. https://doi.org/10.1111/jofi.12728

MSRB-Brief-Trends-Bond-Ownership.pdf. (n.d.). Retrieved July 12, 2022, from https://www.msrb.org/msrb1/pdfs/MSRB-Brief-Trends-Bond-Ownership.pdf

Petersen, M. A., & Fialkowski, D. (1994). Posted versus effective spreads: Good prices or bad quotes? *Journal of Financial Economics*, *35*(3), 269–292. https://doi.org/10.1016/0304-405X(94)90034-5

Schultz, P. (2012). The market for new issues of municipal bonds: The roles of transparency and limited access to retail investors. *Journal of Financial Economics*, *106*(3), 492–512. https://doi.org/10.1016/j.jfineco.2012.07.004

Wu, S. Z., Bagley, J., & Vieira, M. (2018). *Analysis of Municipal Securities Pre-Trade Data from Alternative Trading Systems*.

Wu, S. Z., & Vieira, M. (2019). *Mark-up Disclosure and Trading in the Municipal Bond Market*. 23.

Appendix. Variable Definitions

Variables	Description
Effective Spreads	Effective spread is calculated as the difference between trade-size weighted average ask price and trade-size weighted average bid price scaled by trade-size weighted average bid price for a specific bond on a trading day. The unit of effective spreads is basis point.
Mark-ups	Mark-up is calculated based on waterfall analysis as below: trade-size weighted average ask price minus trade-size weighted average bid price; trade-size weighted average ask price minus trade-size weighted average interdealer price; trade-size weighted average interdealer price minus weighted average ask price. The unit of mark-ups is basis point.
Post	This is a binary variable that equals to 1 if the trade occurs after May 14, 2018. Otherwise, the binary variable equals to 0 if the trade occurs before May 14, 2018.
Retail	This is a binary variable that equals to 1 if the trade size is less than or equal to $100,000 in par value; otherwise, the variable equals to 0 if the trade size is larger than $100,000 in par value.
Maturity	The natural logarithm of the years remaining to maturity on the date of the trade.
Age	The natural logarithm of the years between the date of trade and the bond's initial issuance date.
Trade Volume	The natural logarithm of the total par value of all trades in bond i on date t.
No. of Interdealer Trades	The natural logarithm of the number of interdealer trades in bond i on date t.
No. of Trades	The natural logarithm of the number of trades in bond i on date t.
No. of All Trades	The number of all trades counted from the two-year sample period for bond i.

Figure 1A

Time Series of Effective Spread Changes around Mark-up Disclosure Rule

This figure plots the time series change of average monthly effective spreads from May 2017 to May 2019. The average effective spread is plotted in four categories: frequently traded institutional-sized trades; frequently traded retail-sized trades; infrequently traded institutional-sized trades; infrequently traded retail-sized trades. Frequently traded bonds are those municipal bonds which have the top 5 percentile number of trades across the sample period. Infrequently traded bonds are the rest. Retail-sized trades are defined as those trades smaller than $100,000 par value. Variable definitions can be found in the Appendix.

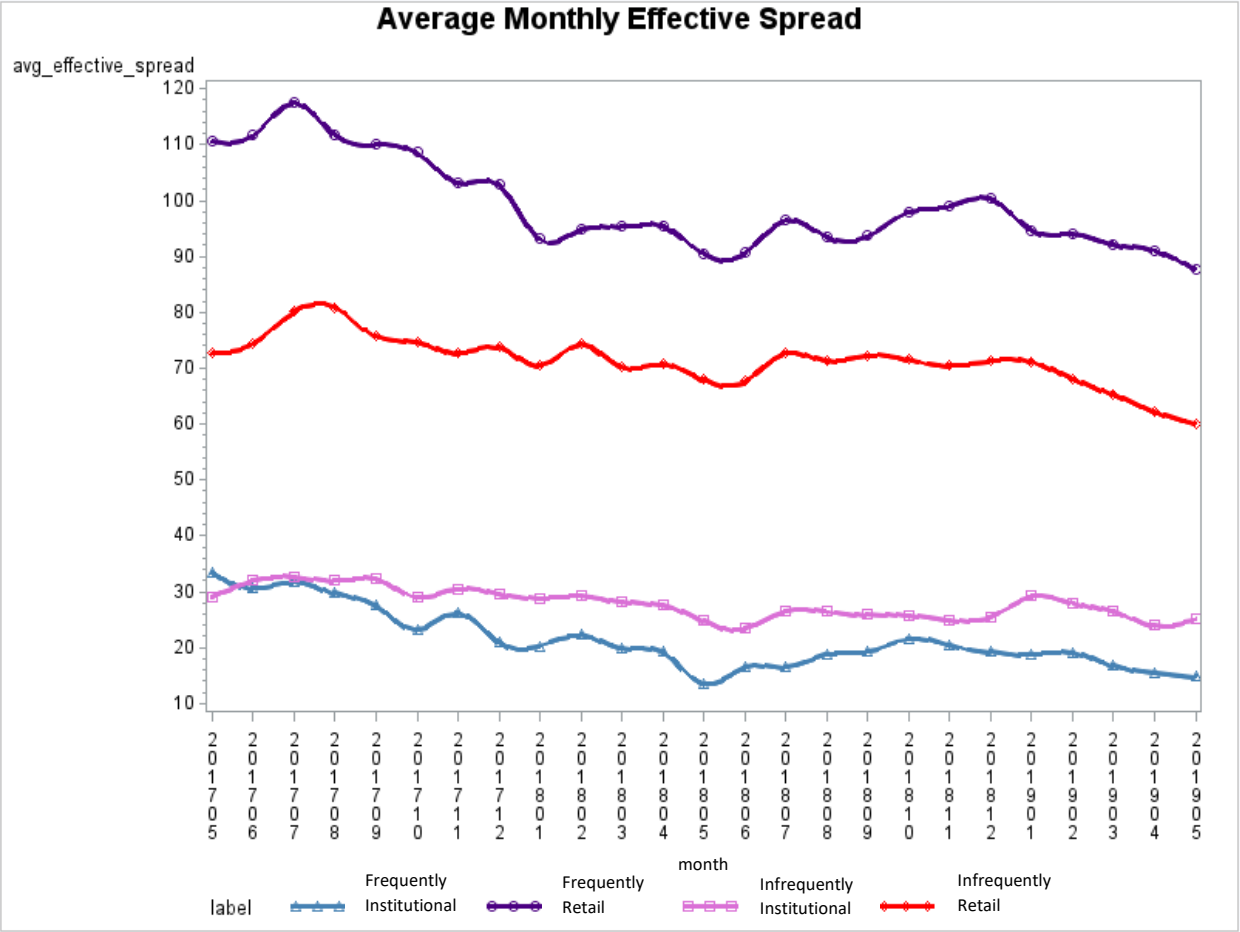

Figure 1B

Time Series of Mark-up Changes around Mark-up Disclosure Rule

This figure plots the time series change of average monthly mark-up from May 2017 to May 2019. The average effective spread is plotted in four categories: frequently traded institutional-sized trades; frequently traded retail-sized trades; infrequently traded institutional-sized trades; infrequently traded retail-sized trades. Frequently traded bonds are those municipal bonds which have the top 5 percentile number of trades across the sample period. Infrequently traded bonds are the rest. Retail-sized trades are defined as those trades smaller than $100,000 par value. Variable definitions can be found in the Appendix.

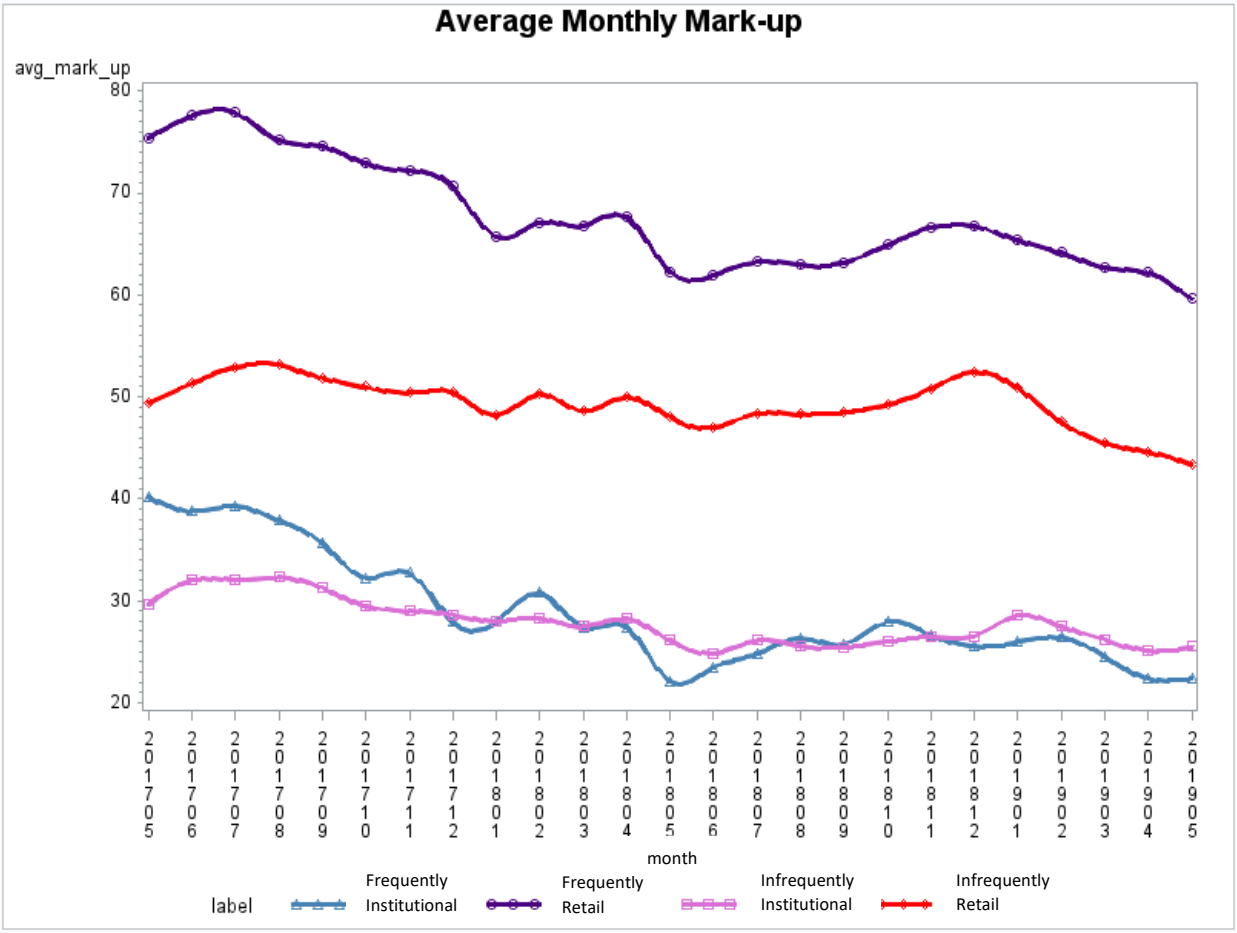

Table 1

Sample Construction

The following table summarizes sample and main variable availability. Panel A shows all the selection process of the municipal bond trade level data in this paper. The table shows the steps to clean data error and ensure each variable's availability. The number of bonds and trades that have been left after each step is also listed. See Section 3 for a detailed description of the sample construction. Panel B shows the number of observations and bonds that have been used in the sample. These numbers are listed separately by full sample, frequently traded bonds, and infrequently traded bonds. All variable definitions can be found in the Appendix.

Panel A:

Step of Trade Sample Selection	No. of Bonds	No. of Trades
Full MSRB sample	708,344	20,113,124
Drop trades on weekends and holidays	708,313	20,106,905
Drop trades with data error regarding maturity or coupon	703,755	19,999,367
Drop trades with data error regarding dollar prices	702,093	19,798,725
Drop newly issued bonds and maturing bonds	488,549	15,209,037
Drop trades one week around the event date	487,162	14,932,363
Trades used for mark-ups calculation	487,162	14,932,363
Drop interdealer trades	487,029	9,117,470
Trades used for effective spreads calculation	487,029	9,117,470

Panel B:

	Mark-ups		Effective Spreads	
	No. of Observations	No. of Bonds	No. of Observations	No. of Bonds
Full Sample	4,760,700	451,436	1,391,948	299,325
Frequently Traded Bond	1,873,108	24,190	598,642	24,056
Infrequently Traded Bond	2,887,592	427,246	793,306	275,269

Table 2

Descriptive Statistics

This table shows the descriptive statistics of the sample. Panel A shows the number of all trades in the sample period at the bond observation level. The panel shows the number for the whole sample, frequently traded bonds, and infrequently traded bonds respectively. Panel B shows the descriptive statistics at the mark-up observation level. Panel C shows the descriptive statistics at the effective spreads observation level. These variables include two measures of trading costs – mark-ups and effective spreads, retail (trade), maturity, age, daily trading volume, and number of daily trades. Detailed definition can be found in the Appendix.

Panel A: Number of Trades at the Bond Observation Level

Time Period	No. of Bonds	Mean	SD	$P^{25\%}$	$P^{50\%}$	$P^{75\%}$	$P^{95\%}$
All Bonds:							
Total	487,162	30.65	80.12	5.00	11.00	28.00	113.00
Pre-disclosure	351,384	14.82	42.61	0.00	5.00	14.00	58.00
Post-disclosure	366,069	15.83	45.00	1.00	5.00	15.00	61.00
Frequently Traded Bonds:							
Total	24,190	262.67	253.23	140.00	186.00	285.00	653.00
Pre-disclosure	23,504	128.97	140.88	64.00	94.00	147.00	339.00
Post-disclosure	23,838	133.70	151.18	68.00	98.0	152.00	343.00
Infrequently Traded Bonds:							
Total	462,972	18.53	21.08	5.00	10.00	24.00	67.00
Pre-disclosure	327,880	8.85	12.54	0.00	4.00	12.00	35.00
Post-disclosure	342,231	9.68	13.15	0.00	5.00	13.00	37.00

Panel B: Descriptive Statistics at the Mark-ups Observation Level

	Mean	SD	$P^{25\%}$	$P^{50\%}$	$P^{75\%}$
All Bonds (N = 4,760,700):					
Mark-ups (bps)	52.2	68.65	4.97	20.02	75.62
Retail	0.85	0.35	1.00	1.00	1.00
Maturity	11.23	7.56	5.13	9.58	16.21
Age	5.21	4.05	2.10	4.41	7.47
Trade Volume (,000)	696	4067	40	80	225
No. of Trades	3.50	3.39	2.00	3.00	4.00
Frequently Traded Bonds (N = 1,873,108):					
Mark-ups (bps)	61.31	77.18	4.97	25.03	95.49
Retail	0.83	0.37	1.00	1.00	1.00
Maturity	14.29	8.27	7.17	13.40	20.84
Age	5.77	4.44	2.29	5.07	8.16
Trade Volume (,000)	1168	5810	45	100	330
No. of Trades	4.22	4.86	2.00	3.00	5.00
Infrequently Traded Bonds (N = 2,887,592):					
Mark-ups (bps)	46.36	62.66	4.97	17.44	63.69
Retail	0.87	0.34	1.00	1.00	1.00
Maturity	9.24	6.32	4.21	7.95	12.91
Age	4.84	3.72	1.98	4.04	6.97
Trade Volume (,000)	389	2267	40	75	185
No. of Trades	3.04	1.76	2.00	3.00	3.00

Panel C: Descriptive Statistics at the Effective Spreads Observation Level

	Mean	SD	$P^{25\%}$	$P^{50\%}$	$P^{75\%}$
All Bonds (N = 1,391,948):					
Effective Spreads (bps)	70.75	87.18	9.62	30.09	103.29
Retail	0.79	0.41	1.00	1.00	1.00
Maturity	11.29	7.70	5.16	9.47	16.48
Age	5.37	4.19	2.08	4.55	7.89
Trade Volume (,000)	1350	6412	50	100	320
No. of Trades	3.63	3.61	2.00	3.00	4.00
Frequently Traded Bonds (N = 598,642):					
Effective Spreads (bps)	81.00	98.46	8.73	38.03	126.89
Retail	0.76	0.43	1.00	1.00	1.00
Maturity	14.10	8.28	7.01	12.99	20.65
Age	6.03	4.59	2.36	5.31	8.59
Trade Volume (,000)	2243	8799	55	135	540
No. of Trades	4.31	5.08	2.00	3.00	5.00
Infrequently Traded Bonds (N = 793,306):					
Effective Spreads (bps)	63.02	77.21	9.85	26.63	90.74
Retail	0.81	0.39	1.00	1.00	1.00
Maturity	9.17	6.47	4.07	7.70	12.84
Age	4.88	3.80	1.88	4.01	7.24
Trade Volume (,000)	677	356	45	90	240
No. of Trades	3.13	1.67	2.00	3.00	4.00

Table 3

Univariate Analysis of Changes in Trading Costs around Mark-up Disclosure Rule

This table shows the univariate results of comparing the effective spreads around the implementation date of mark-up disclosure rule. This table shows the comparison for the whole sample. The key comparison here is the difference between column (a) and column (b). Appendix defines all variables. T-values are reported in parentheses. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

		Pre (a)	Post (b)	Difference (a) - (b)
Retail-sized Trades	(i)	86.14	79.61	6.53***
Institutional-sized Trades	(ii)	27.24	22.08	5.16***
Difference	(i) - (ii)	58.89***	57.53***	1.37***
No. of Observations		708,596	683,352	

Table 4

Trading Costs Change around Mark-up Disclosure Rule

This table examines the changes in trading costs around the disclosure rule. I examine baseline regression by using effective spread as dependent variable. Column 2 examines baseline regression by using mark-up as dependent variable. The variable of interest is Post * Retail. Appendix defines all variables. T-values are reported in parentheses. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

	(1) Effective Spreads	(2) Mark-ups
Retail	27.61***	18.35***
	(54.58)	(110.91)
Post × Retail	-2.58***	-0.42**
	(-4.38)	(-2.12)
Maturity	-20.78***	-10.88***
	(-12.84)	(-22.36)
Age	12.50***	2.80***
	(18.90)	(13.48)
Trade Volume	-6.07***	-2.46***
	(-48.11)	(-62.97)
No. of Interdealer Trades	36.17***	14.45***
	(102.70)	(128.05)
No. of Trades	2.40***	15.83***
	(4.27)	(110.38)
Constant	150.66***	61.65***
	(36.99)	(53.08)
Date FEs	YES	YES
Bond FEs	YES	YES
No. of Observations	702,646	4,108,798
Adjusted R^2	0.50	0.32

Table 5

Cross-sectional Variation in Mark-up Changes, by Trade Size Group

This table shows the mark-up change around mark-up disclosure rule period by examining the impact of different trade size groups. Trade sizes are separated into four different groups as 0-50K, 50K-100K, 100K-150K, and 150K-200K, respectively. The sample that been examined in this table is frequently traded municipal bonds. The variable of interest is Post * Small Trade. Post is a binary variable which equals one if the trade happens after the mark-up disclosure rule. All other control variables are also included. All columns control for date and bond fixed effects. T-values are reported in parentheses. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

	Dependent Variable: Mark-up		
	(1)	(2)	(3)
Post × 0−50K	-1.35***	-1.29***	-1.57***
	(-3.76)	(-3.13)	(-3.36)
Post × 50K−100K	-2.13***	-2.07***	-2.36***
	(-4.63)	(-4.12)	(-4.29)
Post × 100K−150K		0.17	-0.12
		(0.23)	(-0.16)
Post × 150K−200K			-1.06
			(-1.18)
Controls	YES	YES	YES
Date FEs	YES	YES	YES
Bond FEs	YES	YES	YES
No. of Observations	714,178	714,178	714,178
Adjusted R^2	0.24	0.24	0.24

Table 6

Univariate Analysis of Changes in Trading Costs around the Mark-up Disclosure Rule, by Trading Frequency

This table shows the univariate results of comparing the effective spreads around the implementation date of mark-up disclosure rule. This table shows the comparison for the subsample of frequently traded bonds and subsample of infrequently traded bonds. The key comparison here is the difference between column (a) and column (b). Appendix defines all variables. T-values are reported in parentheses. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

		Pre (a)	Post (b)	Difference (a) - (b)
Frequently Traded Bonds:				
Retail-sized Trades	(i)	102.1	93.11	8.97***
Institutional-sized Trades	(ii)	24.22	17.94	6.27***
Difference	(i) - (ii)	77.86***	75.16***	2.70***
No. of Observations		300,492	298,150	
Infrequently Traded Bonds:				
Retail-sized Trades	(i)	72.26	67.65	4.62***
Institutional-sized Trades	(ii)	29.75	25.86	3.89***
Difference	(i) - (ii)	42.52***	41.79***	0.73
No. of Observations		408,104	385,202	

Table 7

Trading Costs Changes around Mark-up Disclosure Rule, by Trading Frequency

This table examines the mark-up changes around the disclosure rule. The dependent variable in Columns 1 and 3 is effective spreads. The dependent variable in Columns 2 and 4 is mark-ups. Columns 1 and 2 examine the subsample of frequently traded bonds. Columns 3 and 4 examine the subsample of infrequently traded bonds. The variable of interest is Post * Retail. Appendix defines all variables. T-values are reported in parentheses. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

	Frequently Traded Bond		Infrequently Traded Bond	
	(1)	(2)	(3)	(4)
Dependent Variable:	Effective Spreads	Mark-ups	Effective Spreads	Mark-ups
Retail	37.49***	25.01***	10.72***	11.64***
	(57.77)	(98.37)	(14.71)	(52.44)
Post × Retail	-4.45***	-2.34***	0.77	1.50***
	(-5.91)	(-7.64)	(0.90)	(5.74)
Maturity	-28.58***	-16.06***	-10.63***	-7.98***
	(-11.36)	(-16.37)	(-5.06)	(-13.85)
Age	12.50***	3.20***	9.64***	2.78***
	(14.03)	(9.30)	(10.69)	(10.55)
Trade Volume	-5.26***	-2.55***	-6.55***	-2.55***
	(-33.02)	(-41.99)	(-34.05)	(-49.19)
No. of Interdealer Trades	36.43***	15.27***	29.61***	13.76***
	(85.80)	(89.00)	(50.99)	(89.89)
No. of Trades	-0.80	15.73***	8.05***	15.83***
	(-1.24)	(73.53)	(8.10)	(78.75)
Constant	168.28***	79.77***	132.25***	55.73***
	(25.66)	(31.88)	(25.77)	(42.45)
Date FEs	YES	YES	YES	YES
Bond FEs	YES	YES	YES	YES
No. of Observations	355,414	1,630,406	347,232	2,478,392
Adjusted R^2	0.46	0.28	0.53	0.34

Table 8

Cross-sectional Variation in Trading Costs Changes, by Number of Trades

This table shows the cross-sectional variation in mark-up changes by separating all the bonds into quartiles based on their total number of trades across the sample period. Dependent variable is mark-up. The variable of interest is Post × Retail. Column 1 uses the sample of bonds in the first quartile. Column 2 uses the sample of bonds in the second quartile. Column 3 uses the sample of bonds in the third quartile. Column 4 is the result using bonds in the top quartile. All columns control for date and bond fixed effects. Appendix defines all variables. T-values are reported in parentheses. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

	Dependent Variable: Mark-up			
	(1)	(2)	(3)	(4)
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Retail	-4.60	4.03***	9.40***	20.38***
	(-1.00)	(5.41)	(21.93)	(109.24)
Post × Retail	10.14*	2.47***	2.48***	-0.98***
	(1.88)	(2.90)	(4.91)	(-4.37)
Maturity	107.96***	-3.50*	-3.59***	-12.98***
	(6.90)	(-1.66)	(-3.23)	(-22.17)
Age	14.85**	5.32***	3.43***	2.74***
	(2.44)	(5.21)	(6.60)	(11.56)
Trade Volume	-7.62***	-4.10***	-2.82***	-2.35***
	(6.28)	(-21.35)	(-27.39)	(-53.68)
No. of Interdealer Trades	-15.38***	0.31	9.86***	15.62***
	(-4.61)	(0.53)	(31.99)	(124.45)
No. of Trades	55.85***	32.36***	19.52***	14.58***
	(9.97)	(39.61)	(47.00)	(92.34)
Constant	-115.07***	50.85***	46.69***	68.06***
	(-4.00)	(11.34)	(18.89)	(47.34)
Date FEs	YES	YES	YES	YES
Bond FEs	YES	YES	YES	YES
No. of Observations	79207	293,223	665,107	3,071,258
Adjusted R^2	0.29	0.25	0.24	0.30