Mark-up Disclosure and Trading Costs in the Municipal Bond Market

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Abstract

This paper explores the influence of the mark-up disclosure rule on trading costs. I examine the change of trading costs by effective spreads and "waterfall" mark-ups around the mark-up disclosure rule and further explore the mechanism. 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 finds that trading costs for retail investors decreased after the approval and effective date of the mark-up disclosure rule. The results suggest that the information asymmetry between broker-dealers and retail investors may have diminished as a result of this rule. To further explore the mechanism, the reduction in trading costs is more pronounced for frequently traded municipal bonds, while there is no significant change for infrequently traded bonds. This suggests that frequently traded bonds benefit more from the rule due to the easier access to a comparable fair market price.

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, various parties have dedicated significant efforts to enhancing and fortifying transparency in the municipal bond market, particularly focusing on retail investors' 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] The mark-up disclosure rule became effective in the municipal bond market on May 14, 2018. In this paper, I examine the influence of the mark-up disclosure rule on trading costs, measured by both the magnitude of effective spreads and "waterfall" mark-ups. I use the term "mark-ups" to refer to any difference between the broker-dealers' trading prices with investors and the prevailing market price on the same securities (Cuny et al., 2021). Moreover, I examine the mechanism based on the trading frequency of individual municipal bonds.

According to a report by MSRB in 2021 (Municipal Securities Rulemaking Board, 2021), individual investors hold 45.2% of the $4.2 trillion outstanding in the municipal bond market, including both direct holdings (40.4%) and indirect holdings (4.8%) through mutual funds, exchange-traded funds, and closed-end funds. Remarkably, transactions under $25,000 account for more than half of all trades, while those under $100,000 make up 87% of trades, underscoring individual investors' prominent role (Bessembinder et al., 2020). As the municipal bond market is considered reliable and safe, a recent SEC discussion disclosed that many retail investors purchasing municipal bonds were those who approach retirement with a lower level of risk tolerance. Becoming informed about mark-ups may decrease the information asymmetry between

[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.

retail investors and broker-dealers. The large amounts of individual holdings, combined 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: trading costs—measured as mark-ups and effective spreads—will decrease for retail investors' trades compared to institutional-sized trades after the mark-up disclosure rule is effective.

The introduction of the mark-up disclosure regulation could have varied implications for broker-dealers. In order to adhere to the regulation, broker-dealers may employ specific technology for the computation and presentation of mark-ups or to opt for outsourcing such services to third-party vendors. This additional process creates extra compliance costs for broker-dealers and increases trading costs for investors (Franks et al., 1997). This engenders a competing hypothesis: the trading costs associated with retail investors' trades may escalate after implementing the mark-up disclosure rule, owing to the amplified compliance expenditures borne by broker-dealers. Hence, the impact of the mark-up disclosure rule remains an open question that demands empirical answers, particularly within the municipal bond market, where retail investors conduct a higher proportion of trades and face a comparatively less liquid environment than the corporate bond market.

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 and smaller retail-sized transactions makes them less competitive with broker-dealers for better trading prices. 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, retail investors now become more informed about mark-ups on each trade's broker-dealers' confirmation page. As a result, they might be motivated to reduce their mark-ups by complaining or negotiating with current broker-dealers. Griffin et al. (2023) investigated this mechanism, analyzing mark-ups in the six weeks leading up to and following the effectiveness of the disclosure rule. However, they argue that the reduction in mark-ups was only marginal after introducing the disclosure rule. One potential explanation for this limited effect is the possibility that it may require a certain amount of time for the impact of the disclosure rule to manifest significantly within an illiquid bond market. Naturally extended from Griffin et al. (2023), my research extends over a broader temporal horizon spanning one year before and after the effectiveness of the disclosure rule. This extended duration facilitates the observation of any discernible effects that may emerge. Furthermore, I investigate the presence of any anticipatory effects after the announcement of the mark-up disclosure rule.

Additionally, my study employs two distinct metrics to evaluate trading costs. First, I measure the magnitude of effective spreads, 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, uncovers the potential impact of regulatory influence on trading costs, and examines various influences based on different bond trading frequency.

[2] Gallagher, M. (September 19, 2012). Remarks Regarding the Fixed Income Markets. Speech presented at the Conference on Financial Markets Quality, Washington D.C.

The mark-up disclosure rule took effect in the municipal bond market on May 14, 2018. Before this, broker-dealers did not separately list mark-ups for retail investors on the confirmation pages they provided. Instead, retail investors relied on the MSRB's Electronic Municipal Market Access (EMMA) website to estimate mark-ups, which offers historical bond prices. Since retail investors are considered non-sophisticated participants in the market, this creates significant hurdles for accessing pertinent information and determining prevailing market prices. In practice, although EMMA provides great information for all previous trades, it can be challenging for retail investors without substantial expertise to use it effectively. [3] These challenges include understanding calculation techniques and the ability to search for comparable prices. Without the disclosure rule, retail investors might have traded with broker-dealers at 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 result in executions at prices worse than the best available dealer quote.

In the baseline analysis of this study, I employ trade-level data sourced from the MSRB spanning one year before and one year after the effectiveness of the rule change. The dataset encompasses 20,113,124 municipal bond transactions involving 708,344 distinct bonds from May 7, 2017, to May 21, 2019. I investigate the fluctuations in trading costs after the mark-up disclosure rule. Retail investors' trades are defined as those with a trade size of less than or equal to $100,000 (Wu & Vieira, 2019).

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

I develop the mark-up measure following the "waterfall" process recommended by the Municipal Securities Rulemaking Board (MSRB). This "waterfall" process directs broker-dealers toward establishing a fair prevailing market price under various scenarios on the confirmation page that they disclose to investors. In my empirical analysis, I also incorporate effective spreads, a widely utilized measure for assessing trading costs. Both measures collectively indicate a decrease in trading costs for affected municipal trades after the effectiveness of the mark-up disclosure rule.

Next, I delve deeper into examining the mechanism of trading costs change. Previous research shows that trading activity 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 find that bonds in the top 5 percentile number of trades account for more than 40 percent of total trades in the market. I categorize these bonds in the top 5 percentile as frequently traded bonds and categorize the rest as infrequently traded bonds. Given the liquidity of frequently traded bonds, retail investors may find it relatively straightforward to identify the comparable prevailing market price, either through the EMMA website or other public sources. Consequently, broker-dealers would find it difficult to obscure the fair prevailing market price for these frequently traded bonds and it is plausible to anticipate a reduction in mark-ups for these frequently traded bonds. However, retail investors may encounter greater difficulty in finding alternative options for infrequently traded bonds.

Overall, my analysis indicates a decrease in trading costs for retail-sized trades subsequent to the effectiveness of the mark-up disclosure rule in the municipal bond market. This decline is particularly evident in frequently traded bonds, while infrequently traded bonds show no notable change. The mark-up disclosure rule mitigates information asymmetry between retail investors and broker-dealers, thereby augmenting the bargaining power of retail investors, especially in

frequently traded bonds. Furthermore, I uncover evidence of an anticipatory effect in the market following the announcement of the mark-up disclosure rule. This suggests that broker-dealers proactively take action to mitigate risk exposures and compete for customers.

This paper contributes to the literature documenting the frictions impacting retail investors in bond markets. Retail investors' trading costs are friction in the market and lower efficiency (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). Additionally, the trading costs associated with municipal bonds have historically been more expensive relative to corporate bonds. Well-informed investors, like institutional investors, can take advantage of their information and have the ability to analyze the market price, making their transaction price much closer to the prevailing market price than those of retail investors. This study suggests that displaying mark-ups on the confirmation page for retail investors could mitigate information asymmetry and potentially result in reduced trading costs, particularly for frequently traded bonds.

This paper also contributes to the literature documenting the benefit of regulation to investor protection in the fixed-income market. In the municipal bond market, real-time trade reporting (EMMA) was initiated on January 31, 2005, with the aim of enhancing price transparency. Nonetheless, the outcomes have been varied. 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, and the premium they pay over large investors is reduced. Results of the present work are

more in line with the latter, suggesting that implementing mark-up disclosure on confirmation pages facilitates investor protection and may enhance their power in the market.

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 on the same day. However, Harris and Mehta (2020) provided opposing evidence, indicating that mark-ups remain prominent in the corporate bond market after implementing 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 impact of the mark-up disclosure rule. Griffin et al. (2023) argue that there is limited downward impact on the mark-ups by examining a very short time window. In this paper, I explore the change in the trading costs one year before and after the implementation and announcement of the mark-up disclosure rule. I further separate the sample into frequently and infrequently traded bonds and I find that frequently traded bonds dominate the decline in trading costs.

Finally, it is valuable to study the disclosure requirements for retail investors within this unique context, where the mark-up disclosure rule is implemented simultaneously in both the municipal and corporate bond markets. Given the attractiveness and significant retail holdings in the municipal bond market, the impact of mark-up disclosure may differ from that observed 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, are sensitive 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 extremely less likely to default (Cornaggia et al., 2022).

Moreover, municipal bonds typically yield lower returns before tax compared to corporate bonds. Given this lower yield environment in the municipal bond market, retail investors may exhibit heightened sensitivity to changes in mark-up disclosure practices.

The remainder of this paper is organized as follows: Section 2 introduces the institutional background, followed by hypothesis development. Section 3 describes the sample construction, measures, and provides descriptive statistics. Section 4 presents the baseline results on the effects of the mark-up disclosure rule on trading costs. Section 5 discusses the mechanism based on trading frequency. Section 6 presents a supplemental test on the announcement effect. Finally, Section 7 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, a $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 and local taxes, the market attracts high-net-worth retail investors. Researchers find that households are the largest holders of municipal debt compared to household ownership in other large financial markets (Bagley et al., 2022) .

Moreover, municipal and corporate bond market retail investors have different risk appetites and preferences due to yield, investment period, risk, and tax (Cestau et al., 2019). Historical data shows municipal bonds are extremely less likely to default. 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 through principal trades or agency trades. In principal trades, broker-dealers temporarily hold the bond in their inventory and then trade with investors from their inventory. When conducting principal trades, broker-dealers trade bonds with their customers and typically charge a mark-up over the market price on each transaction. Conversely, agency trades involve broker-dealers searching for a counterparty in the market to facilitate the transaction. In this scenario, broker-dealers' profit mainly comes from the commission fee. The mark-up disclosure rule influences only principal trades with same-day offset.

MSRB announced the mark-up disclosure rule to the public on November 17, 2016. The mark-up disclosure rules became effective on May 14, 2018. 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 parallel disclosure rule, enforced by the Financial Industry Regulatory Authority (FINRA), applies in the corporate bond market, becoming effective simultaneously with the rule in the municipal bond market. With the enforcement of the new rule, comprehending the market's responses to the trading costs of retail investors in the municipal bond market is imperative.

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.[4] 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 unaware of the magnitude of the mark-up they pay to broker-dealers.

Moreover, previous research indicates that retail investors find themselves in a less favorable position in the municipal bond markets. Harris and Piwowar (2006) and Edwards et al. (2007) found that trading costs for retail investors are much higher than for institutional investors in bond markets. They also found that municipal bond retail investors incur higher trading costs when trading complex bonds than simple bonds.

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

[4] Gallagher, M. (2012, September 19). Remarks Regarding the Fixed Income Markets. Speech presented at the Conference on Financial Markets Quality, Washington D.C.

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.[5]

Meanwhile, 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. Retail investors can use the prices on EMMA to compare their trades to others. However, due to the illiquidity in the municipal bond market and the limited capacity of retail investors to navigate EMMA effectively, it would be challenging for them to independently discern mark-ups or comparable prices.[6]

2.3 Hypotheses Development

Prior to the effectiveness of the mark-up disclosure rule, municipal bond investors lacked direct visibility into mark-ups. Some may estimate mark-ups based on market prices sourced from the EMMA website. However, owing to the illiquid nature of the municipal bond market, the pricing data available through EMMA might not accurately reflect current market conditions, often lagging by several weeks for illiquid municipal bonds, thereby limiting its efficacy for retail investors in assessing mark-ups. Following the effectiveness of the mark-up disclosure rule, the informational advantages held by broker-dealers are diminished, consequently reducing the information asymmetry between retail investors and broker-dealers. Retail investors who previously lacked awareness of mark-up magnitudes may reassess their relationship with broker-

[5] 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.
[6] Consumer Federation of America comment letter to the MSRB (2015, January 20).

dealers and scrutinize their trading costs. After an adjustment period in the market, investors may attain more favorable execution prices with reduced trading costs, resulting in a decrease, to some extent, in trading costs measured as mark-ups and effective spreads for retail investors. It should be noted that it may take several years for the effect of change in regulation to become pronounced (Wu & Vieira, 2019). For instance, the transition to real-time transaction reporting in 2005 took several years to manifest its impact on the municipal bond market. Therefore, examining the effects over one year preceding and following the effectiveness of the disclosure rule is logical. 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, creating extra workloads for broker-dealers. They may need to rely on technology solutions or outsource related services to third-party vendors to comply with the rule. Broker-dealers must conduct a robust due diligence process to ensure the new steps and calculations adhere to the disclosure rule. These extra workloads might increase broker-dealers' operating costs and the trading costs for retail investors. This leads to the competing hypothesis:

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

Despite the relative illiquidity of the municipal bond market, characterized by limited market sources and information availability for finding counterparties, there are notable exceptions in the form of frequently traded bonds. These bonds, which represent the top 5 percentile in terms of total trades, account for approximately 40 percent of all trades in this market. Retail investors

trading these bonds may find it easier to explore prevailing market prices through the EMMA website or other public sources, thereby making it challenging for broker-dealers to maintain high trading costs. Conversely, infrequently traded bonds may suffer from stagnant or unavailable market liquidity, posing challenges for retail investors to negotiate lower mark-ups. Consequently, the potential impact of the mark-up disclosure rule on reducing trading costs may be primarily driven by frequently traded bonds, which I define as bonds in the top 5 percentile based on the 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. In contrast, infrequently traded bonds do not have the same feature.

3. Data

In this section, I outline the data sources utilized in my analysis, introduce two metrics for assessing trading costs, delineate control variables, and provide descriptive statistics. Trading costs are quantified using effective spreads and "waterfall" mark-ups[7], following the procedural recommendations of the MSRB.

3.1 Sample

To study the impact of mark-up disclosure in the municipal bond market, I collect information on municipal bond trade levels from MSRB. Municipal Securities Transaction Data represents transactions by investors and dealers in the over-the-counter market for municipal securities. Key variables include CUSIP, trade type, trade date, trade time, and volume. I define

[7] See confirmation disclosure requirements under Rule G-15 and related PMP guidance under Rule G-30, Supplementary Material .06. For more information, refer to the MSRB Rule Book.

retail trades as those of trade size less than or equal to $100,000. I limit the sample period to one year before and after the mark-up rule. Specifically, the sample covers the period from May 7, 2017, to May 21, 2019. All bond characteristics data are sourced from the Refinitiv EIKON database.

Next, I clean the trade 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 trades within one year of maturity and one week around the event date (Cuny et al. 2021). These filters result in 14,932,363 municipal bond trades of 487,162 different bonds. In Panel A of Table 1, I outline each step and provide details on the number of trades and bonds retained in the sample after applying each filter.

[Insert Table 1 here]

3.2 Measures

I utilize two different trading cost measures to examine mark-up disclosure's impact. The first measure is "waterfall" mark-up, adhering to the method recommended by the MSRB for mark-up calculation. The second measure is effective spreads, a widely utilized measure for quantifying

trading costs. Given that the mark-up disclosure rule mandates broker-dealers to reveal mark-ups solely to designated retail investors and considering prior research indicating variations in effective spreads relative to trade size, I compute trading costs separately for each trading size category. Consistent with the definitions provided by Edwards et al. (2007) and the MSRB definition, trades with a par amount below $100,000 are classified as retail-sized, while those exceeding $100,000 are categorized as institutional-sized.

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 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 derive bond trading prices from same-day trades, as these trades are directly influenced by the mark-up disclosure rule. For a specific -bond-day observation, I set the bid price as the prevailing market price if both ask and bid prices are available. If only the ask price and interdealer price are present on a given day, the interdealer price is deemed the prevailing market price. In the absence of these scenarios and with only bid and interdealer prices available, the bid price is utilized as the prevailing market price. In this measure, I include all interdealer trades. The advantage of utilizing "waterfall" mark-ups directly lies in its ability to assess the new regulation's immediate impact compared to the conventional method employing effective spreads. Panel B of Table 1 enumerates the count of mark-up observation for frequently traded and infrequently traded bonds, respectively. The final mark-up sample consists of 4,760,700 observations of 451,436 bonds. Specifically, the "waterfall" mark-up is:

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.

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

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

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

3.2.2 Effective Spreads

Effective spread is a commonly used measure to calculate the trading costs investors pay to execute their trades. To compute 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. After eliminating interdealer trades, the final trade sample to calculate effective spreads includes 9,117,470 trades regarding 487,029 different bonds.

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 for frequently traded bonds, 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 reduce the impact of outliers. 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, the final MSRB trade sample comprises 14,932,363 trades involving 487,162 distinct bonds. Notably, the effectiveness of the mark-up disclosure rule does not exert a significant impact on trading activity, as the number of bonds traded remains relatively consistent. Specifically, 351,384 bonds were traded in the year preceding the mark-up disclosure rule, with a corresponding total of 7,218,521 trades. Subsequently, in the year subsequent to the rule's enactment, 366,069 bonds were traded, accompanied by a total of 7,713,842 trades. It's important to note that the number of trades encompasses all trade types, including customer purchases, sales, and interdealer trades.

Table 2 presents descriptive statistics of the sample. Panel A provides an overview of the statistics at the bond level. On average, bonds exhibit approximately 30 trades during the sample period, aligning with the observed illiquidity in the municipal bond market. However, the standard deviation is relatively elevated, with the top 5th percentile of trade numbers reaching 113, three times the mean value. Bonds within this top 5th percentile account for nearly half of all trades during the sample period. Retail investors trading frequently traded bonds may benefit from heightened bargaining power due to increased trading activity. This elevated trading volume may allow them to explore alternative options to secure more favorable execution prices. Bonds traded 113 times or more during the sample period are categorized as frequently traded bonds, while those with fewer than 113 trades are classified as infrequently traded bonds. The average number of trades for frequently traded bonds is 262.67, whereas, for infrequently traded bonds, it is 18.53. Notably, in the subsample of frequently and infrequently traded bonds, their trade numbers post the mark-up regulation consistently depict a slight increase compared to the period preceding the mark-up disclosure rule.

Panel C and Panel D of Table 2 provide descriptive statistics for the primary variables based on observations of mark-ups and effective spreads, respectively. These variables demonstrate similar characteristics across both measures. However, the distinction between frequently and infrequently traded bonds within this illiquid market underscores the importance of separately investigating the effects of the mark-up disclosure rule on each category's influencing mechanisms. Frequently traded bonds exhibit extended ages and maturities compared to infrequently traded bonds, alongside higher trade volumes and greater trade activity, which aligns 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 illustrated the time series changes in effective spreads and mark-ups surrounding the effectiveness of the mark-up disclosure rule in Figure 1A and Figure 1B, respectively. These figures illustrate a trend consistent with the previously discussed finding.

[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 examine the disparity in effective spreads between retail and institutional-sized trades pre and post the effectiveness of the mark-up disclosure rule. Given that the mark-up disclosure rule exclusively affects the confirmation page for retail trades, I anticipate a more pronounced reduction in trading costs for retail investors compared to institutional ones. Table 3 presents the univariate findings for the entire sample. Following the effectiveness of the disclosure rule, effective spreads for retail trades witnessed a decline of 6.53 basis points. Prior to the rule,

the discrepancy in effective spreads between retail and institutional-sized trades stood at 58.89 basis points. This difference notably diminished to 57.53 basis points post the mark-up disclosure rule. These findings suggest a reduction in trading costs for retail-sized trades after implementing 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, the dependent variables are effective spreads and mark-ups, respectively. Specifically, I estimate the following regression using a difference-in-difference specification:

$$Trading\ Costs_{i,t} = \beta_0 + \beta_1 Post_t + \beta_2 Retail_{i,t} + \beta_3 Post_t \times Retail_{i,t} + \gamma Controls_{i,t} + Bond_{FE} + Date_{FE} + \varepsilon_{i,t} \quad (1)$$

Where Post is a dummy variable that equals one if the observation is based on trades after the mark-up disclosure rule and zero otherwise, Retail is a dummy variable that equals one if the observation is based on retail investors' trading costs. 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 $Date_{FE}$ denotes date fixed effects. Including bond and date fixed effects ensures that the coefficient of interaction term captures the difference-in-difference effects. In the above regression, I anticipate β3, the interaction term coefficient, exhibiting a negative value if the trading costs decrease after the mark-up disclosure rule is implemented.

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) is effective spreads. The negative coefficient -2.58 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 effectiveness 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 groups: 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 trades decreased after the mark-up disclosure rule, trades with the largest trade sizes 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 in retail trades remains statistically significant at the 5% level of significance. Hence, these findings support 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 before implementing 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. Examining Trading Frequency as a 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. By mandating mark-up disclosure, the rule diminishes broker-dealers' ability to conceal significant trading costs. Additionally, this disclosure may bolster the bargaining power of retail investors. However, these dynamics are likely more pronounced for frequently traded bonds, where a larger volume of bonds is actively traded, allowing retail investors to more readily ascertain prevailing market prices on platforms like the EMMA website, unlike infrequently traded bonds.

5.1 Univariate Tests by Trading Frequency

Motivated by Friewald et al. (2012) and Griffin et al. (2023), which indicate that liquidity could influence yield spread changes and mark-ups in the 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 the bonds. Frequently traded bonds represent 40% of total trades in the municipal bond market. I contend that investors possess more information on prevailing market prices and trading costs for frequently traded bonds, making it challenging for broker-dealers to conceal high trading costs. This mark-up disclosure helps alleviate the information asymmetry between retail investors and broker-dealers specifically in trades involving frequently traded bonds. Conversely, retail investors trading infrequently traded bonds may struggle to find comparable prevailing market prices, resulting in trading costs that may not decrease even after the implementation of the mark-up disclosure rule. Table 2 Panel B illustrates that by categorizing municipal bond trades with same-day offset and focusing on frequently traded bonds and retail-sized trades, 28.51% of municipal bond trades might be influenced by the mark-up disclosure rule according to this hypothesis.

Next, I present the results of the univariate analysis. 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 effect 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]

5.2 Comparison of Bond Characteristics by Trading Frequency

Understanding the distinctive features of frequently traded bonds versus infrequently traded bonds provides valuable insights into market dynamics and investor preferences. In this section, I comprehensively compare various bond characteristics between these two categories, shedding light on the general profile of bonds that experience high trading activity. The analysis uses bond-level data to explore the characteristics of frequently and infrequently traded bonds. It computes the percentage distribution for various bond features, including callable status, sinkable status, tax status, bank qualification status, coupon type, and coupon frequency. To maintain clarity and focus, categories representing less than 0.1% of the total are excluded from the analysis.

Table 7 shows the comparison of bond characteristics. Callable bonds are more likely to be frequently traded compared to non-callable bonds (6.18% vs. 3.24%), indicating a preference for bonds with call provisions among active market participants. There is also a notable difference in the prevalence of sinkable bonds between frequently traded and infrequently traded categories. Sinkable bonds are more likely to be frequently traded compared to non-sinkable (12.80% vs. 3.72%). Bonds with different tax statuses do not show significant differences in trading frequency. Bank-qualified bonds are less likely to be frequently traded compared to non-bank-qualified bonds (0.05% vs. 6.10%). Frequently traded bonds are more likely to feature variable-rate coupons and less likely to have fixed-rate coupons compared to infrequently traded bonds. Additionally, there is a significant difference in coupon frequency: bonds with coupon frequencies of 4, 12, or 52 payments per year are more likely to be frequently traded compared to those with semi-annual payments.

[Insert Table 7 here]

The comparison of bond-issuing states between frequently traded and infrequently traded bonds, as presented in Table 8, further elucidates the differences between these categories. Bonds from Connecticut (CT), District of Columbia (DC), Maryland (MD), and New York (NY) are more likely to be frequently traded. Notably, 11.26% of municipal bonds from NY are frequently traded, compared to the average of approximately 5%. Bonds issued by most states do not exhibit significant deviations in trading frequency categories compared to other states.

In summary, the comparison between two trading frequencies provides a comprehensive overview of bond characteristics and state distribution across different trading frequencies. The observed differences in bond characteristics and state distribution between frequently traded and infrequently traded bonds offer valuable insights into market dynamics and investor behavior. These findings underscore the importance of considering bond features and regional differences in understanding the impact of market disclosure rules on trading behavior and market trends.

[Insert Table 8 here]

5.3 Reexamine the Baseline Regression by Trading Frequency

Next, I reexamine the baseline regression, dividing the sample into two subsamples: frequently traded bonds and infrequently traded bonds. Table 9 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 effectiveness 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 an additional 2.34 basis points after the mark-up disclosure rule compared to the decrease

in institutional-sized trades. However, I do not observe a similar decrease in trading costs when focusing on infrequently traded bonds. Columns (3) and (4) present the results for infrequently traded bonds. The result is consistent with the previous discussion that it is difficult for investors to find information and counterparties 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-sized trades that involve same-day offset after the effectiveness 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 reduce trading costs.

[Insert Table 9 here]

5.4 Robustness

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 could 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 10 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 10 here]

6. Examining Announcement Effects

After having explored the impact of the effectiveness date by trading frequency, I turn my attention to examining announcement effects. This shift in focus is motivated by the recognition that market reactions to regulatory announcements often precede the actual effectiveness, thereby influencing trading behaviors and costs. A recent study by Hendricks et al. (2023) find that financial institutions respond ahead of the implementation of the Basel III rule change to reduce their exposure to the proposed rule. Broker-dealers in municipal bond markets could act ahead instead of waiting until the effectiveness date. Firms might lose the benefits of early adoption by waiting until the effectiveness date. Taking some initial steps when they know the regulations change might give them additional time to make the required changes and spreading the compliance costs over an extended period (Bernanke, 1983; Dixit & Pindyck, 1994).

In this section, I investigate the change in trading costs surrounding the approval of the mark-up disclosure rule, which is November 17, 2016. Employing the same methodology as the baseline regression, I shift the event date to November 17, 2016, to capture this anticipatory market response. Figure 2 depicts the time series analysis of trading costs around the announcement day of the mark-up disclosure rule. The outcomes of the primary regression are detailed in Table 11. When the event date is shifted to the announcement date, the result shows a persistent negative coefficient in the interaction term within the group of frequently traded bonds, even after controlling for all fixed effects. This finding not only reinforces the hypothesis that frequently

traded bonds experience reduced trading costs due to the disclosure rule but also underscores the presence of forward-looking behaviors within the market, wherein market participants anticipate regulatory changes and adjust their strategies accordingly.

[Insert Figure 2 here]

[Insert Table 11 here]

7. Conclusion

This study examines the effects of mark-up disclosure regulations on trading costs within the municipal bond market. Utilizing two key metrics, effective spreads and "waterfall" mark-ups, aligned with MSRB guidelines, the analysis reveals a reduction in trading expenses for retail investors following the effectiveness of mark-up disclosure rules. This reduction suggests a potential decrease in the information advantage held by broker-dealers and the resultant information asymmetry between broker-dealers and retail investors, thereby enhancing the bargaining power of the retail investors. Notably, this effect is predominantly driven by frequently traded municipal bonds, constituting approximately 40% of total trades despite representing only 5% of the overall municipal bonds in the market. Furthermore, market participants exhibit anticipatory behavior surrounding the announcement of mark-up disclosure rules, indicating proactive risk mitigation strategies.

In recent decades, lots of attention and regulation, including the mark-up disclosure rule, has been put into the fixed-income market. However, the trade transparency of the municipal bond market is still not comparable to the equity market. Low price transparency, both pre- and post-trades, contributes to the high costs of trading the municipal bond market for retail investors. The high trading cost in the municipal bond market negatively impacts retail investors' portfolios and

transactions (Cestau et al., 2019). Academics, regulators, and market participants should collaborate to consider possible reforms in the municipal bond market. The mark-up information should not only be disclosed to investors on the confirmation pages after the transaction, but 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.

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Appendix. Variable Definitions

Variables	Description
Effective Spreads	Effective spread is calculated as the difference between the trade-size weighted average ask price and trade-size weighted average bid price scaled by the trade-size weighted average bid price for a specific bond on a trading day. The unit of effective spreads is the basis point.
Mark-ups	The 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 the basis point.
Post	This binary variable equals 1 if the trade occurs after the implementation date of May 14, 2018, and 0 if the trade occurs before May 14, 2018. Similarly, this mirrors the setup for trades both before and after the announcement date.
Retail	This binary variable equals 1 if the trade size is less than or equal to $100,000 in par value; otherwise, the variable equals 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 1

Time Series Analysis of Trading Cost Changes Surrounding the Implementation of the Mark-up Disclosure Rule

Figure 1A displays the time series analysis of weekly trading cost changes surrounding the Mark-up Disclosure Rule effective date, using effective spreads as the measure. Figure 1B contrasts this by utilizing weekly mark-ups as the measure. The red line in the figure indicates the implementation date. Trading costs are categorized into four groups: frequently traded institutional-sized trades, frequently traded retail-sized trades, infrequently traded institutional-sized trades, and infrequently traded retail-sized trades. Frequently traded bonds represent the top 5th percentile in trading frequency, while infrequently traded bonds encompass the remainder. Retail investors' trades are defined as those below $100,000 par value. Variable definitions are provided in the Appendix.

Figure 1A: Effective Spreads Analysis

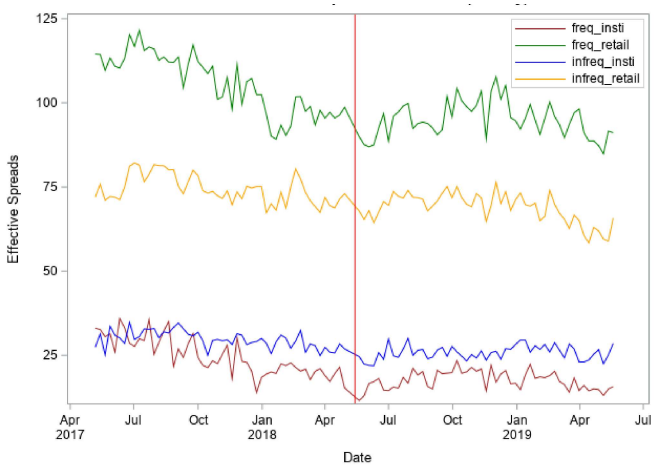

Figure 1B: Mark-up Analysis

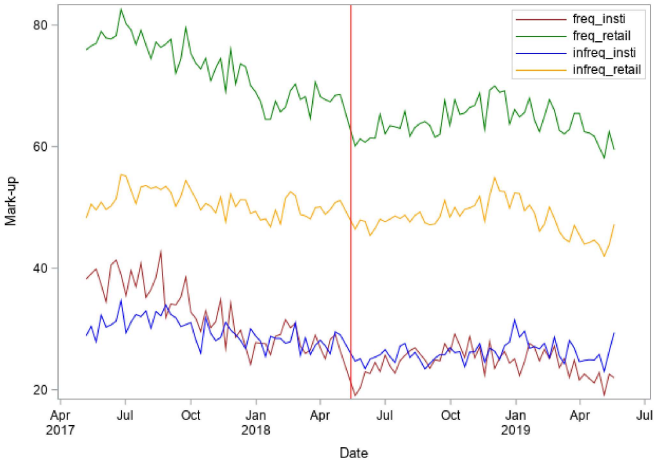

Figure 2

Time Series Analysis of Trading Cost Changes Surrounding the Announcement Date of the Mark-up Disclosure Rule

This figure illustrates the time series analysis of changes in weekly trading costs surrounding the Mark-up Disclosure Rule announcement date. The analysis spans 1 year around the announcement date, employing effective spreads as the measure in Figure 2A and mark-ups as the measure in Figure 2B. The red line in the figure indicates the effective date. Trading costs are categorized into four groups: frequently traded institutional-sized trades, frequently traded retail-sized trades, infrequently traded institutional-sized trades, and infrequently traded retail-sized trades. Frequently traded bonds represent the top 5th percentile in trading frequency, while infrequently traded bonds encompass the remainder. Retail investors' trades are defined as transactions below $100,000 par value. Variable definitions are provided in the Appendix.

Figure 2A: Effective Spreads Analysis

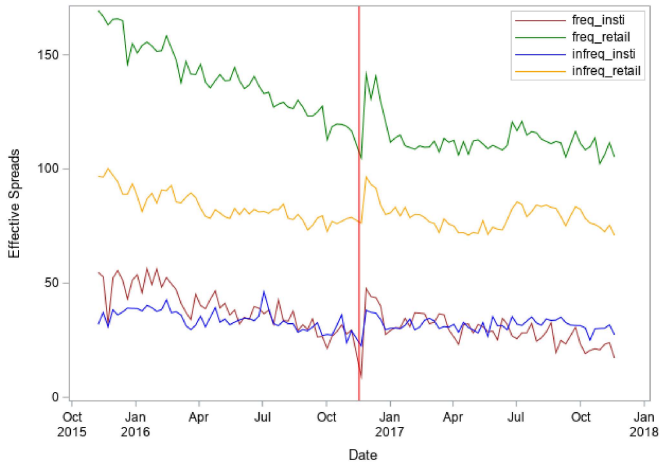

Figure 2B: Mark-up Analysis

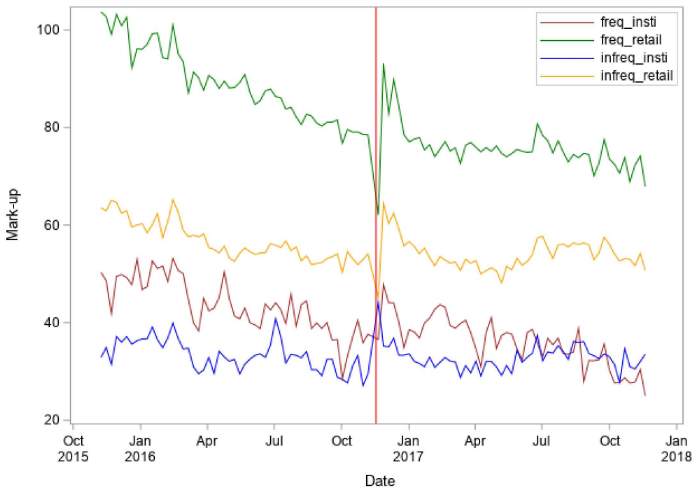

Table 1

Sample Construction

The following table summarizes the sample and main variable availability. Panel A details the cleaning processes applied to the municipal bond trade-level data in this study, outlining the steps taken to rectify data errors and ensure the availability of each variable. It also presents the count of bonds and trades remaining after each cleaning step. For a comprehensive description of the sample construction, please refer to Section 3. Panel B displays the number of observations for both trading costs measure and bonds included in the sample, categorized by the full sample, frequently traded bonds, and infrequently traded bonds. Definitions of all variables 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

The following table presents descriptive statistics of the sample. Panel A displays the total number of trades during the sample period at the bond observation level, categorized by the entire sample, frequently traded bonds, and infrequently traded bonds. Panel B presents the distribution of bond trades by trade type and liquidity. Panel C provides descriptive statistics at the mark-up observation level, while Panel D presents descriptive statistics at the effective spreads observation level. These variables encompass two measures of trading costs – mark-ups and effective spreads – as well as variables such as retail (trade), maturity, age, daily trading volume, and number of daily trades. Further details regarding variable definitions are available 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: Distribution of Bond Trades by Trade Type and Liquidity

	Trades of Frequently Traded Bonds (%)	Trades of Infrequently Traded Bonds (%)
Interdealer Trades	38.62	39.18
Dealer Purchase	26.24	25.88
Dealer Sell	35.13	34.94
Total	100	100
Retail Sized Trades	19.01	85.14
Institutional Sized Trades	80.98	14.86
Total	100	100

Panel C: 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 D: 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 Effective Date

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

		Pre (a)	Post (b)	Difference (b) - (a)
Retail Trades	(i)	86.14	79.61	-6.53***
Institutional 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 Effective Date

This table examines the changes in trading costs around the mark-up disclosure rule effective date. Column 1 examines baseline regression using the effective spread as the dependent variable. Column 2 examines baseline regression using mark-up as the dependent variable. The variable of interest is Post * Retail. The 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 around Effective Date, by Trade Size Group

This table shows the mark-up change around the mark-up disclosure rule effective date by examining the impact of different trade size groups. Trade sizes are separated into four different groups: 0-50K, 50K-100K, 100K-150K, and 150K-200K, respectively. The sample that has been examined in this table is frequently traded municipal bonds. The variable of interest is Post * Small Trade. Post is a binary variable that 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 Effective Date, by Trading Frequency

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

		Pre (a)	Post (b)	Difference (b) - (a)
Frequently Traded Bonds:				
Retail investors' 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 investors' 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

Comparison of Bond Type by Trading Frequency

This table provides a detailed comparison of key features between frequently traded and infrequently traded bonds. The analysis includes characteristics such as callable status, sinkable status, tax status, bank qualification, coupon type, and coupon frequency. The table showcases the percentage distribution of each feature in the categories of frequently traded bonds and infrequently traded bonds.

Bond Type	All (%)	Frequently Traded Bonds (%)	Infrequently Traded Bonds (%)	Difference (%)
	(1)	(2)	(3)	(3) - (2)
Callable Status:				
Not Callable	30.66	3.24	96.76	93.52***
Is Callable	69.33	6.18	93.82	87.64***
Sinkable Status:				
Not Sinkable	71.77	3.72	96.28	92.56***
Is Sinkable	28.23	12.80	87.20	74.40***
Tax Status:				
AMT	1.29	4.43	95.57	91.14***
Exempt	92.06	4.97	95.03	90.06***
Taxable	6.64	5.94	94.06	88.12***
Bank Qualified Status:				
Not Bank Qualified	94.96	6.10	93.90	87.80***
Bank Qualified	5.04	0.05	99.95	99.90***
Coupon Type (Omit those categories with less than 0.1% in Total):				
FRAJ[8]	0.64	43.16	56.84	13.68***
FRAR	0.17	19.74	80.26	60.52***
FROT	0.11	10.81	89.19	78.38***
FRSU	0.12	41.00	59.00	18.00***
VRGR	2.79	27.53	72.47	44.94***
ZRFX	0.22	14.00	86.00	72.00***
Variable Rate (Total)	4.05			
FXPV	93.52	4.79	95.21	90.42***
FXZC	2.40	4.75	95.25	90.50***
Fixed Rate (Total)	95.92			
Coupon Frequency (Omit those categories with less than 0.1% in Total)				
2	96.18	4.81	95.19	90.38***
4	0.14	12.16	87.84	75.68***
12	3.45	28.32	71.68	43.36***
52	0.17	33.68	66.32	32.64***

[8] All coupon rate definitions sourced from EIKON: FRAJ: Floating with Adjustable Rate; FRAR: Floating with Auction Rate; FROT: Floating; FRSU: Floating with Step Up-Margin over Index; VRGR: Variable with Step Up/Step Down; ZRFX: Variable with Zero Then Fixed; FXPV: Fixed with Plain Vanilla Fixed Coupon; FXZC: Fixed with Zero Coupon.

Table 8

Comparison of Trading Frequency by Issuance State

This table presents a comparison of the trading frequency of bonds across different issuance states. Columns 1 and 5 list the state names. Columns 2 and 6 display the distribution of bonds traded from May 2017 to May 2019 by state. Columns 3 and 4 show the percentage of frequently traded and infrequently traded bonds for each state, respectively. This table also presents the differences between frequently traded bonds and infrequently traded bonds for each state. It emphasizes the proportion of bonds from each state within the two trading frequency groups, offering insights into the geographic distribution of bond activity.

State	All (%)	Frequently Traded Bonds (%)	Infrequently Traded Bonds (%)	Difference (%)	State	All (%)	Frequently Traded Bonds (%)	Infrequently Traded Bonds (%)	Difference (%)
(1)	(2)	(3)	(4)	(4)-(3)	(5)	(6)	(7)	(8)	(8)-(7)
AK	0.33	3.16	96.84	93.68***	**MT**	0.27	0.76	99.24	98.48***
AL	1.52	3.12	96.88	93.76***	**NC**	1.67	5.34	94.66	89.32***
AR	0.99	0.83	99.17	98.34***	**ND**	0.42	0.59	99.41	98.82***
AZ	1.59	5.64	94.36	88.72***	**NE**	0.79	3.17	96.83	93.66***
CA	13.2	5.69	94.31	88.62***	**NH**	0.37	2.70	97.30	94.60***
CO	1.76	4.45	95.55	91.10***	**NJ**	3.77	5.35	94.65	89.30***
CT	1.82	6.98	93.02	86.04***	**NM**	0.55	2.81	97.19	94.38***
DC	0.28	18.3	81.7	63.40***	**NV**	0.61	6.59	93.41	86.82***
DE	0.17	7.95	92.05	84.10***	**NY**	7.05	11.26	88.74	77.48***
FL	3.16	7.88	92.12	84.24***	**OH**	3.36	4.36	95.64	91.28***
GA	1.52	7.23	92.77	85.54***	**OK**	0.85	3.50	96.50	93.00***
GU	0.04	14.05	85.95	71.90***	**OR**	1.37	4.18	95.82	91.64***
HI	0.4	9.49	90.51	81.02***	**PA**	4.55	4.70	95.30	90.60***
IA	1.09	1.43	98.57	97.14***	**PR**	0.23	44.37	55.63	11.26***
ID	0.28	3.20	96.80	93.60***	**RI**	0.43	2.84	97.16	94.32***
IL	3.42	6.05	93.95	87.90***	**SC**	1.17	5.62	94.38	88.76***
IN	2.22	2.09	97.91	95.82***	**SD**	0.30	1.17	98.83	97.66***
KS	1.38	1.64	98.36	96.72***	**TN**	1.43	2.63	97.37	94.74***
KY	1.62	2.66	97.34	94.68***	**TX**	12.75	2.97	97.03	94.06***
LA	1.02	4.87	95.13	90.26***	**UT**	0.76	2.75	97.25	94.50***
MA	2.92	6.09	93.91	87.82***	**VA**	2.04	4.41	95.59	91.18***
MD	1.35	7.08	92.92	85.84***	**VI**	0.03	27.42	72.58	45.16***
ME	0.51	1.69	98.31	96.62***	**VT**	0.24	2.56	97.44	94.88***
MI	2.77	2.47	97.53	95.06***	**WA**	2.28	6.17	93.83	87.66***
MN	2.63	1.84	98.16	96.32***	**WI**	2.1	3.16	96.84	93.68***
MO	1.71	3.28	96.72	93.44***	**WV**	0.28	4.13	95.87	91.74***
MS	0.56	3.24	96.72	93.52***	**WY**	0.08	2.99	97.01	94.02***

Table 9

Trading Costs Changes 1 Year Around Mark-up Disclosure Rule Effective Date, by Trading Frequency

The table below investigates mark-up changes surrounding the effective date of the mark-up disclosure rule. Columns 1 and 3 analyze the dependent variable of effective spreads, while Columns 2 and 4 focus on mark-ups. The examination is conducted on two subsamples: frequently traded bonds in Columns 1 and 2 and infrequently traded bonds in Columns 3 and 4. The variable of interest is denoted as Post * Retail. The 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 10

Cross-sectional Variation in Trading Costs Changes 1 Year Around Mark-up Disclosure Rule Effective Date, 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. 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. The dependent variable is mark-up. The variable of interest is Post × Retail. All columns control for date and bond fixed effects. The 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

Table 11

Trading Cost Changes 1 Year Around Mark-up Disclosure Rule Announcement Date, by Trading Frequency

This table assesses trading cost variations around the announcement of the mark-up disclosure rule, categorized by trading frequency. Columns 1 and 3 analyze effective spreads, while Columns 2 and 4 focus on mark-ups. The analysis distinguishes between frequently and infrequently traded bonds. The variable of interest is Post * Retail. The appendix provides variable definitions. T-values are in parentheses, with ***, **, and * indicating 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	46.94***	30.38***	6.23***	11.73***
	(56.18)	(98.29)	(7.50)	(46.64)
Post × Retail	-10.98***	-4.21***	-0.53	0.68**
	(-11.54)	(-11.39)	(-0.57)	(2.32)
Maturity	-48.02***	-29.05***	-20.07***	-15.45***
	(-15.14)	(-22.99)	(-9.01)	(-23.48)
Age	32.66***	13.44***	20.93***	8.69***
	(30.18)	(35.07)	(22.12)	(31.98)
Trade Volume	-8.42***	-3.19***	-8.90***	-2.74***
	(-43.11)	(-44.26)	(-43.96)	(-47.32)
No. of Interdealer Trades	34.83***	9.200***	34.23***	10.59***
	(69.06)	(45.74)	(54.33)	(62.32)
No. of Trades	1.25	23.45***	11.03***	20.70***
	(1.64)	(94.21)	(10.14)	(93.50)
Constant	240.74***	106.62***	166.00***	65.45***
	(28.49)	(32.21)	(30.93)	(43.20)
Date FEs	YES	YES	YES	YES
Bond FEs	YES	YES	YES	YES
No. of Observations	319,036	1,440,362	322,367	2,198,422
Adjusted R^2	0.43	0.25	0.39	0.25