The Darkside of Dissemination: Evidence from the Provision of Municipal Credit Ratings

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Abstract

We investigate whether increased dissemination of credit ratings affects the investment choices of municipal bond traders. Our analysis exploits a regulatory change that made municipal credit rating information freely and publicly accessible through the Electronic Municipal Market Access (EMMA) database. We provide novel evidence that dissemination influences trading choices by showing that retail investors, the group that was impacted by the dissemination change, differentially increase their reliance on credit ratings following the regulatory event. In supporting analyses, our evidence suggests that this increased reliance appears to produce poor trading choices in two ways. First, retail investors are more likely to acquire bonds that are subsequently downgraded, and those bonds are more likely to be revenue bonds and bonds issued by Chapter 9-eligible states, both of which are indicative of bonds that generate larger losses upon default. We find no evidence that institutional investors, who had access to credit rating information prior to the regulatory change, experienced any change in trading frequency or outcomes. In the setting we study, the adverse effect on retail investor trading is notable given that the specific intent of the regulatory change was to benefit retail investors.

Keywords: Municipal bonds, credit ratings, information intermediaries.

JEL codes: G15, G18, M41.

Data Availability: Data are available from the public sources cited in the text.

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"We believe that there is nothing more relevant than making credit ratings available in one location, where the public can access the information quickly, efficiently, and at no cost to them."

- **Government Finance Officers Association**

1. Introduction

We provide novel evidence that investors adjust their trading choices in the municipal bond market in response to dissemination. Prior studies have examined dissemination in the context of equity markets via multiple outlets, including the business press and newswire services, conference calls, as well as more recently developed outlets such as corporate websites and social media (e.g., Ramesh, Shen, and Xuejun, 2011; Dong, Li, Ramesh, and Shen, 2015; Jung, Naughton, Tahoun, and Wang, 2018; Blankespoor, deHaan, and Zhu, 2018). In the municipal setting, Cuny (2018) examines the effect of increased governmental financial statement availability on spreads, and Zhang (2024) examines the effect of increased credit rating dissemination on yields. Collectively, both the equity market and municipal bond market studies have concluded that dissemination generates capital market benefits, primarily through higher trading volume and reduced spreads.

However, prior research has not generally considered whether trading outcomes are impacted by increased dissemination. In our setting, we document substantial changes in trading outcomes for retail investors, both in the type of bonds they transact in and in the profitability of those trades. Our examination of trading outcomes is a valuable addition to the dissemination literature as it moves beyond the question of whether dissemination facilitates trade, and provides insights into how investors adjust the way they process and assimilate information into their trading decisions based on the extent to which it is disseminated. Our results, which show a differentially negative change in trading choices by retail investors, provide evidence of a previously unexplored drawback of dissemination. These results are notable given that the specific intent of the regulatory change we exploit was to benefit retail investors.

This study exploits the differential provision of credit rating information via the Electronic Municipal Market Access (EMMA) database by the Municipal Securities Rulemaking Board (MSRB), the sole repository for continuing disclosures for municipal bond investors starting July 1, 2009. Although other financial disclosures have been available via EMMA since 2009, rating information was unavailable until November 2011. At that time, MSRB initiated the provision of ratings information for Standard and Poor's (S&P) and Fitch Ratings (Fitch), two of the three major agencies that rate municipal bonds.[1] Prior to this regulatory event, institutional investors had broad access to credit rating information through subscription services. In contrast, retail investors had to manually search for credit rating information (e.g., by obtaining the bond prospectus) on a case-by-case basis. Because of these differences, the overall effect of the regulatory change was to make credit rating information more accessible to retail investors while leaving it effectively unchanged for institutional investors.

Our empirical tests take advantage of the fact that institutional versus retail trades can be reliably identified in the municipal bond market setting using a $100,000 trade cutoff during our sample period (e.g., Cuny et al., 2021; Larcker and Watts, 2020). Using a trade size cutoff is reliable despite advances in algorithmic trading because municipal bond trading takes place in over-the-counter markets where trade splitting is very rare, particularly during our sample period (e.g., O'Hara and Zhou, 2021). Our identification strategy is to compare trading outcomes for retail investors who had increased access to credit rating information with trading outcomes for

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[1] See https://www.wsj.com/articles/BL-TOTALB-123 and https://www.sec.gov/rules/sro/msrb/2010/34-63086.pdf

institutional investors who experienced no change in access to credit rating information. For data availability reasons, these analyses focus on trades of S&P rated bonds.[2]

Broadly, our empirical tests are designed to ascertain whether there is a differential reliance on credit ratings by retail investors following the dissemination event, and if so, what are the consequences of that reliance. We first document that there is a differential increase in retail investors' preference for highly rated bonds and a differential increase in retail investors' preference for higher yielding bonds within rating-maturity groups. These findings are consistent with an increase in ratings fixation because higher yields within a particular rating-maturity group are indicative of credit risks that are reflected in the market yield but not currently reflected in the credit rating (Becker and Ivashina, 2015). More broadly, these results are consistent with retail investors employing a simple heuristic where they group bonds by credit rating and then select from among those bonds based on yield. We find no change in institutional investor demand for highly rated bonds or any change in the average yield of bonds by rating-maturity grouping acquired by institutional investors. These contrasting results indicate that only retail investors increase their reliance on credit ratings in the post-dissemination period.

Next, we examine how the increased reliance on credit ratings by retail investors affects trading outcomes. We begin by showing that retail investors are more likely to acquire bonds that are subsequently downgraded. Bond prices and payoffs drop sharply upon downgrades, so a finding of retail investor purchases in advance of downgrades indicates that these investors experience large negative wealth effects (e.g., deHaan et al., 2023). We also identify two notable aspects of the association between retail investor demand and subsequent bond downgrades—retail

[2] As noted in other studies (e.g., Cornaggia et al., 2018), there is currently no reliable source of Moody's credit ratings history for municipal bonds traded before 2015. Therefore, it is not possible to analyze trading outcomes for Moody's rated bonds.

investor demand for downgraded bonds is concentrated among revenue (as opposed to general obligation) bonds, and among bonds issued by Chapter 9-eligible (as opposed to non-Chapter 9-eligible) states—which strongly undermine the possibility that the retail investor shift towards downgraded bonds is part of an informed risk-return strategy. Covitz and Han (2005) document that general obligation bonds tend to have higher recovery rates than revenue bonds, indicating that the loss given default is greater for revenue bonds. Similarly, Gao, Lee, and Murphy (2020) document that Chapter 9–eligible states face greater uncertainty and potentially larger losses in the event of default because the legal process in those states allows for the judicial modification of debt obligations.

Collectively, our results indicate that increased dissemination is associated with an increased reliance on the disseminated information by retail investors. In our setting, this reliance results in retail investors differentially shifting toward an investment strategy where they select higher yielding bonds from a group of similarly rated bonds. This approach is suboptimal in two ways. First, it results in the acquisition of bonds that are more likely to be subsequently downgraded, in part because there are underlying risks of the bond that are impounded in its yield but not its credit rating. Second, it results in the acquisition of specific bonds—revenue bonds and bonds issued in Chapter 9-eligible states—that generate larger investor losses in the event of default. Importantly, we find no evidence that institutional investors adjusted their trading decisions following the regulatory change. Taken together, the contrasting results for retail and institutional investors suggest that only retail investors are responding to the dissemination change, consistent with the features of our setting. The fact that we document adverse trading outcomes for retail investors is notable given that they were expected by the Government Finance Officers Association to benefit from the increased dissemination of credit ratings.

We supplement these findings with a set of cross-sectional tests that provide additional insights into the role of information acquisition costs in our findings. Intuitively, if there are fewer alternative sources of information or if alternative information is less reliable, retail investors may be differentially more sensitive to the dissemination of credit ratings. These tests are motivated, in part, by the conclusion in Cuny (2018) that investor outcomes in the municipal bond market are positively affected by the content of governmental financial reports. Consistent with this idea, we document that the dissemination effect is stronger in those subsamples where there are fewer alternative sources of information. We use two proxies for issuers' information environment: (1) whether the issuer is subject to a mandatory audit, and (2) whether GAAP reporting is mandated. For each of these proxies, we find consistent evidence that the negative effects on retail investor trading that arise from increased dissemination are greater among issuers with worse information environments.

Lastly, we conduct some supplementary tests to provide a more complete picture of the effect of dissemination in our setting. In particular, we establish that bond market spreads decrease in response to increased dissemination, indicating that while the effect on trading outcomes is negative, the effect on trading costs is not. Whether and how spreads change in our setting is not obvious due to the structure of the municipal bond market and findings from related research. From a structural perspective, the municipal bond market, unlike equity markets, largely functions as an over-the-counter market, where investors place their orders with dealers directly and where most trades are conducted by retail investors. From a related research perspective, while Zhang (2024) documents short-term changes in bond yields in response to increased dissemination of credit ratings, he concludes that there are no corresponding changes in spreads. Our documentation of reduced spreads suggests that our setting may be comparable to equity market settings that have also found that dissemination is associated with reduced spreads.[3]

We believe that our use of the municipal bond market setting provides general insights into our understanding of dissemination in capital markets. Importantly, our setting allows us to document that the integration of newly disseminated information by investors changes trading behavior, an aspect of dissemination that is underexplored in the literature. In our setting, we document a negative effect on trading outcomes, which provides a counterpoint to equity market studies where lower spreads are interpreted as an indication of improved liquidity. It also highlights the importance of understanding how different groups of investors use newly disseminated information in determining whether such dissemination is beneficial or not. In our setting, we show that the dissemination of credit ratings is associated with suboptimal retail investor fixation in the municipal bond market, thus providing novel evidence of the possible negative effects of increased dissemination in capital markets.

Our study also contributes to our understanding of the role of dissemination in the municipal bond market, an important issue not yet fully explored in the municipal bond literature (e.g., Kim, Plumlee, and Stubben, 2022). Several studies have examined how municipal market investors respond to credit events (e.g., Ivanov et al., 2022; Cornaggia et al., 2018) or to credit-relevant information (e.g., Reck and Wilson, 2006; Beck, 2018; Cuny, Even-Tov, and Watts, 2021; Cheng, Cuny, and Xue, 2022). Two recent studies have examined the municipal bond market effects of changes in the availability of financial information. Cuny (2018) shows that retail investors benefit through reduced spreads (measured using dealer markups) in the municipal bond

[3] In untabulated robustness tests, we also document a differential and significantly positive increase in turnover, count of trades, and log of dollar value of trades for observation with newly provided credit rating information, indicating that the dissemination of credit ratings increased liquidity in the municipal bond market, a finding that is also consistent with equity market-based studies of dissemination.

market when governmental financial statements are more easily accessible. Cuny (2018) suggests that this benefit arises due to reduced information acquisition costs. Zhang (2024) finds that investors benefit through a reduction in bond yields of approximately 6-8 basis points in response to the increased dissemination of credit rating information, and suggests that this benefit arises due to a reduction in dealer search costs. In contrast with these studies, we document an adverse consequence of dissemination by showing that the availability of credit ratings interacts with the availability of fundamental information to negatively impact retail trading outcomes.

Lastly, we add to the emerging literature that examines how credit ratings influence investors' trading decisions (e.g., Benmelech and Dlugosz, 2009; Bongaerts, Cremers, and Goetzmann, 2012; Jiang and Packer 2012; Basu and Naughton, 2020). The closest related paper in this literature, deHaan et al. (2023), finds that retail investors in the corporate bond market exhibit trading preferences that are consistent with credit rating fixation. We build on this insight in the municipal bond market by showing that the consequences of such heuristic trading can be especially severe when credit ratings are disseminated more widely without improvements in investor understanding of bond structure or legal risk. More specifically, we show that increased retail investor reliance on credit ratings following a regulatory change that made ratings more accessible increased retail investors' exposure to bonds with systematically higher expected losses in default, such as revenue bonds and bonds issued by municipalities in Chapter 9–eligible states. Whereas deHaan et al. (2023) focus on investor selection conditional on rating and yield, our analysis highlights the role of bond-specific institutional features that are not captured by the rating itself, and how dissemination may amplify retail investors' misallocation of capital toward higher-risk municipal bonds.

The remainder of this paper is organized as follows. Section 2 describes the institutional setting. Section 3 summarizes the relevant literature and develops our hypothesis. The sample selection process is described in Section 4, followed by our main results in Section 5. Section 6 concludes.

2. Institutional Setting

Municipal bonds are debt securities issued by states, cities, counties, and other governmental entities, such as school systems or water treatment facilities, to fund day-to-day obligations and to finance capital projects. The market is relatively large, with approximately $4.2 trillion in holdings as of September 2020. General obligation (GO) bonds represent roughly 60% of the market. These bonds are backed by the "full faith and credit" of the issuing municipality, meaning that the municipality is obligated to use all available resources, including raising taxes, to repay bondholders. Non-GO bonds are primarily revenue bonds, due to the fact that they are repaid from the revenues generated by specific projects, such as toll roads or utilities. If the project's revenues fall short, there is no obligation for the municipality to cover the deficit using other funds.

The municipal bond market has many retail investors who invest through direct holdings or mutual funds. However, due to the illiquid nature of the market, most trades are decentralized over-the-counter trades with broker-dealers. As a result, retail investors rely on dealer quotes to glean information from the market prior to trading. These quotes provide the expected yield based on the current price of the bond. The historical lack of transparency for retail investors was an important driver of the development of the Electronic Municipal Market Access (EMMA) database by the Municipal Securities Rulemaking Board (MSRB).[4] The database was initially launched as a pilot on March 31, 2008, at which time it served as a free integrated public display of documents and data produced by other pre-existing MSRB systems. These items included official statements and advance refunding documents collected by the MSRB through its former Municipal Securities Information Library (MSIL) system as well as trade data collected by the MSRB's Real-Time Transaction Reporting System (RTRS). Prior to its launch, the information and documents displayed on the EMMA website were not generally freely or publicly available. On June 1, 2009, the documents and data previously handled by the MSIL system were migrated to the new EMMA Primary Market Disclosure Service. Since 2009, the EMMA database has been continuously updated to incorporate changes made to the various MSRB market transparency programs.

On May 20, 2010, the MSRB filed with the U.S. Securities and Exchange Commission (SEC) a proposed rule change to amend the continuing disclosure service to provide for the public posting of credit rating information on EMMA. Under the proposed rule change, MSRB would invite all NRSROs to post their credit ratings "free of charge" on EMMA. The objective was to make credit ratings information easily accessible on an equal basis to all participants, especially retail investors.

The Government Finance Officers Association strongly supported the proposed rule as "something that is a true benefit to investors and the public." In contrast, the credit rating agencies (i.e., S&P, Fitch, and Moody's) expressed the concern that posting free rating data at MSRB would be commercially untenable and would offer only limited incremental value to investors in municipal securities. The proposed rule was approved by the SEC in October 2010[5], and MSRB

[4] See http://emma.msrb.org
[5] See https://www.sec.gov/rules/sro/msrb/2010/34-63086.pdf

started displaying CUSIP[6]-level credit ratings for municipal bonds from Fitch and S&P starting November 2011. Moody's ratings were not displayed until June 2015.[7]

The provision of credit ratings through EMMA meant that all investors could now freely access credit rating information in a timely manner. Prior to the rule change, ratings were typically available through subscription-based services from the rating agencies. In addition, dissemination via EMMA provided investors with an interface that enabled ratings information to be integrated with other details about a security or issue. For example, users could identify all AA-rated bonds and then sort by yield to identify the highest-yielding bonds within that rating category.

This setting has several features that facilitate the identification of increased dissemination. First, it allows us to identify the effect of rating dissemination without any underlying change in the issue's information set. Since the decision to post credit rating information from two of three major agencies via EMMA was undertaken based on a mutual discussion between the MSRB and the rating agencies, it is independent of issuer-level fundamental information. In addition, we select our sample using bonds that were traded *before* the regulatory change, ensuring that the choice to be rated by a particular rating agency is independent of whether the rating information was later provided on EMMA. These two aspects of our setting and research design mitigate concerns about self-selection.

Third, other bond-issue level information was already on EMMA starting in early 2009 (i.e., the start of our sample period). This aspect allows us to employ a research design where the only material change is the provision of ratings information, which allows us to better identify the effect of credit ratings dissemination independent of other financial information. Fourth, since

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[6] A CUSIP number is a unique identifier that stands for the Committee on Uniform Securities Identification Procedures. It is a nine-digit numeric or nine-character alphanumeric code that identifies a North American financial security for the purposes of facilitating clearing and settlement of trades.
[7] https://www.wsj.com/articles/BL-MBB-33860

EMMA is a third-party website, we can rule out the strategic dissemination of financial information independent of the underlying incentives of the issuers and rating agencies. Finally, the rating disclosure, at least in part, is generally accepted to be a material item that should allow market participants to evaluate the relative quality of an issue (e.g., Cornaggia, Cornaggia, and Israelsen, 2018). This aspect of our setting helps to ensure that we have sufficient power to draw meaningful conclusions.

3. Literature Review and Hypothesis development

This study examines the capital market effects of dissemination in the context of credit rating information in the municipal bond market. Dissemination of information is distinct from disclosure, as the latter refers to the provision of information to the public while the former is about the channel entities use to communicate information. Prior studies have found that dissemination via business press (Bushee, Core, Guay, and Hamm, 2010; Rogers, Skinner, and Zechman, 2016), newswire services (Li, Ramesh, and Shen, 2011), conference calls (Frankel, Johnson, and Skinner, 1999; Bushee, Matsumoto, and Miller, 2003), and social media (Blankespoor, Miller, and White, 2014; Jung et al., 2018) has important consequences above and beyond the disclosure decision. Collectively, these studies support the notion that increased dissemination can facilitate trade through a reduction in spreads, with some of these studies interpreting this finding as evidence that dissemination improves market function.

Our setting focuses on the broad dissemination of credit ratings information via EMMA, a third-party website that is the sole repository for continuing disclosures for municipal bond investors. In general, prior research has found that credit ratings incorporate municipal financial information. Ingram and Copeland (1982) find a positive association between credit ratings and subsequent disclosure but only weak evidence that municipal financial statements predict credit ratings, suggesting that credit ratings are a leading indicator of what is disclosed in the financial statements. Consistent with this finding, Ingram, Brooks, and Copeland (1983) find that credit rating changes are more informative in the municipal bond market relative to the corporate market because municipal financial statements are produced with a greater lag, and information processing costs are significantly higher. More recent papers have documented that municipal credit ratings continue to be relevant to investors and issuers (e.g., Cornaggia et al., 2018), and that credit ratings influence issuer decisions, such as those related to the provision of municipal disclosure (Gillette et al., 2020; Basu et al., 2022).

The municipal bond market consequences of credit rating dissemination are unclear. Increased dissemination may provide investors with more readily available information on which to base trading decisions, thus reducing information acquisition costs and improving trade outcomes (e.g., Cuny, 2018). In contrast, investors may respond to increased dissemination by placing more weight on the disseminated information, potentially leading to inefficient trades. It is also possible that the third-party dissemination of credit ratings may not have an impact on trading outcomes for at least two reasons. First, investors may be able to gather the same information from other sources, including issuance documents, rating agencies, or issuer websites. Second, it may be the case that credit rating information displayed via EMMA is insufficient for retail investors to integrate credit risk into their trading decisions.[8] In sum, the effect of increased dissemination of credit ratings in the municipal bond market is not obvious.

In the corporate bond market, Badoer and Demiroglu (2019) document that the dissemination of over-the-counter transactions in corporate debt securities increases the

[8] S&P's comment letter on the proposed implementation of the ratings disclosure rule states that "existing disclosure is sufficient to enable investors to access S&P's ratings". S&P further stated that "such information may not be sufficiently tailored to meet the needs of retail investors".

informational efficiency of bond prices and reduces the incremental information content of credit ratings. This finding suggests that the availability of other financial information, such as the trading data on EMMA, could reduce the incremental informativeness of credit ratings. These findings are consistent with the dissemination of credit ratings in the municipal bond market having no effect. In contrast, Zhang (2024) uses a short-window research design to document that effective yields are lower by about 6-8 basis points in the municipal bond market when credit rating information becomes more accessible. While this approach provides insights into short-term investor demand, it does not establish whether there are long-term effects associated with increased credit rating dissemination in the municipal bond market, nor does it provide evidence as to whether there are also changes in spreads through dealer markups.

Similarly, it is not obvious how the increased availability of credit rating information will influence the process by which investors choose municipal bonds. Given the structure of the EMMA interface, we conjecture that investors may use credit ratings to screen investment choices. One possible approach that is easily implementable on EMMA is to select bonds with a specific credit rating, and then pick among those bonds based on a second criterion such as yield (e.g., deHaan et al., 2023). To the extent that investors are using credit ratings as a primary screen, it is possible that they are disregarding other credit-relevant information, such as the underlying financial performance of the municipal entity.

The above discussion suggests that the results of our empirical analyses are challenging to predict. Therefore, we state our hypotheses in null form:

> H1: *The dissemination of credit ratings is not differentially associated with suboptimal trading in the municipal bond market by retail investors.*

Our hypotheses focus on retail investors because they represent the group of investors who are more likely to adjust their behavior in response to increased dissemination in our setting. As outlined in the previous section, it is likely that institutional investors subscribed to the rating agencies and thus did not experience a change in their information environment following the regulatory change. As outlined in more detail in Section 5, we test suboptimal trading outcomes by examining whether there is increased credit rating fixation by retail investors, and then examining the consequences of this fixation for the type of bonds acquired and the likelihood that the acquired bonds are downgraded.

4. Sample Selection

We begin the process of building the sample by identifying the universe of municipal bonds that were issued between July 2009 and October 2011, the period after EMMA began displaying other financial information including continuing disclosures from the issuers, and before it started displaying credit rating information.[9] We restrict our sample to bonds issued before October 2011 to ensure all issues have trading transactions in the pre-period and to mitigate the concern that selection bias may drive our results. In our setting, self-selection would occur if bond issuers chose a particular rating agency because rating information was displayed on EMMA. By restricting our sample to pre-October 2011 issues, all bonds in our sample were assigned ratings before they were aware of the dissemination change, thus mitigating the self-selection issue.

We obtain ratings and other bond-level characteristics from Bloomberg. We also obtain secondary market bond transaction data from the MSRB for July 2009 through June 2015. We start with 13,274,549 total trades over the sample period, representing 298,290 unique bonds and 16,440 unique issuers. We exclude bonds with no investor trades over the sample period. We also eliminate certain types of bonds. We exclude unrated bonds because prior research has found them

[9] SEC Rule 15c2-12.

to have different characteristics than rated bonds (e.g., Peppe and Unal 2021) and bonds not rated by S&P as our empirical tests rely on changes in the S&P credit rating gathered manually from regulatory disclosures on S&P's website. In addition, we exclude bonds rated by Moody's because we do not have Moody's historical rating information for our sample period. The final sample comprises 893,387 transactions across 62,492 bonds issued by 5,534 unique issuers. In robustness tests, we consider further refinements of this sample, such as requiring at least one dealer and one investor trade in both the pre- and post-periods. These tests are discussed in Section 5.

Our identification strategy focuses on differences in trading outcomes for retail versus institutional investors and is conducted at the bond-month level. We follow prior studies and use a transaction cost cutoff of $100,000 to separate trades into retail and institutional. Recent examples of studies that use this cutoff include deHaan et al., 2022, O'Hara and Zhou, 2021, Cuny et al., 2021, Larcker and Watts, 2020, Bessembinder et al., 2018, and Cuny, 2018. Using a trade size cutoff remains appropriate despite advances in algorithmic trading because municipal bond trading takes place in relatively opaque over-the-counter markets where trade splitting is very rare, particularly during our sample period (e.g., O'Hara and Zhou, 2021).[10]

Table 2 provides descriptive statistics. The *Post* variable has a value of 0.726, indicating that about 72.6 percent of the trades in our sample occur after the regulatory change. The mean value of BSI for retail (institutional) trades is 0.008 (-0.001), the median value is 0 (0), and the standard deviation is 0.151 (0.081). These descriptive values indicate that retail investors in the municipal bond market are overall net buyers of bonds, which is expected since most are buy-and-hold investors.

[10] Using an alternative trade size cutoff of $50,000 does not change any of our conclusions.

5. Research Design and Results

5.1 Main Analysis

Our examination of trading outcomes proceed in three steps. First, we show that there is differentially higher retail investor demand for higher rated bonds after the regulatory change. Second, we show that retail investor demand is differentially biased toward the highest-yielding bonds within groups based on the rating and maturity of the bonds. Third, we show that retail investor demand predicts bond downgrades, indicating that retail investors differentially shift their purchases to bonds that are subsequently downgraded. We supplement this last analysis by showing that retail investors are not only more likely to acquire bonds that have a higher likelihood of downgrade, but that their increased demand is concentrated in bonds that generate higher losses given default. Collectively, these tests provide evidence that retail investors differentially increased their fixation on credit ratings, thus providing evidence that dissemination doesn't just facilitate trade, but also impacts the nature of investor trading.

5.1.1 Investor Demand for Highly Rated Bonds

We use the following empirical specification to test whether there is a difference in the association between investor demand and municipal bond ratings following the dissemination change:

$$BSI_{b,t}^{Retail(Instituional)} = \alpha + \beta_1 RATINGS_{b,\,t} + \beta_2 RATINGS_{b,\,t} * Post + \sum \gamma_j\, Controls + Fixed\ Effects + \varepsilon_{i,t} \quad (1)$$

We follow prior studies and calculate buy-sell imbalances at the monthly level (e.g., deHaan et al., 2023; Lee and Zhu, 2020; Ben-David et al., 2013; Kumar and Lee, 2006) using the following formulae:

$$BSI_{b,t}^{Retail} = \frac{\text{Total Retail Buy}_{b,t} - \text{Total Retail Sell}_{b,t}}{\text{Total Retail Buy}_{b,t} + \text{Total Retail Sell}_{b,t}}$$

$$BSI_{b,t}^{Institutional} = \frac{\text{Total Institutional Buy}_{b,t} - \text{Total Institutional Sell}_{b,t}}{\text{Total Institutional Buy}_{b,t} + \text{Total Institutional Sell}_{b,t}}$$

Where Total Retail (Institutional) $\text{Buy}_{b,t}$ and Total Retail (Institutional) $\text{Sell}_{b,t}$ are the total dollar volume of all retail (institutional) investors' buys and sells for bond b in month t, respectively. $BSI_{b,t}^{Retail(Institutional)}$ measures retail (institutional) investors' demand for a given bond b in a given month t, where a positive (negative) value indicates that investors are net buyers (net sellers) of that bond. We calculate BSI separately for retail and institutional investors to identify the differential effect of the dissemination shock across these two groups of investors. The buy-sell imbalance measures the difference between the aggregate value of bonds being bought and the aggregate value of bonds being sold within a particular time frame. When there is a buy-sell imbalance, it means that there is either a greater demand for bonds or a higher supply of bonds in the market compared to the opposite side.

We use two different approaches for RATINGS. In the first approach, we use a numerical credit rating score that ranges from 1 (AAA) to 21 (C) for bond b during month t. In the second approach, we use three separate indicator variables for three groups of credit ratings: AAA and AA ratings in Group 1, A ratings in Group 2, and BBB in Group 3. Under this approach, ratings below investment grades (BBB-) are the baseline group. In each specification, the control variables include the bond issuance amount and remaining time-to-maturity. *Post* is an indicator that takes the value of one for bond-months after November 21st, 2011. We include bond fixed effects to focus our analysis on within bond variation in credit ratings and BSI. Bond fixed effects eliminate time-invariant characteristics that may correlate with credit ratings and determine BSI, including bond characteristics such as maturity, amount, or call features. We also include state and time-fixed effects to control for temporal trends and macroeconomic conditions. Standard errors are clustered by bond and year-month.

Table 3 Panel A presents the results of estimating equation (1) using the bond month sample for retail investors. In column (1) – (2) the coefficient on the indicator for RATINGS is negative and statistically significant in the post dissemination period (Coefficient on *Rating * Post* = -0.001 and t-statistic = 3.874 in column (1); and coefficient = -0.001 and t-statistic = 3.275 in column (2)) indicating that retail investors have increased their demand for highly rated bonds. A negative coefficient is indicative of increased demand for higher rated bonds because the highest rated bonds have the lowest numerical value assigned to them. In columns (3) and (4) we examine the effect of ratings coefficients for the discrete credit ratings groups. We find that the coefficients corresponding to Groups 1 through 3 are positive and significant, indicating that the BSI for these ratings groups is higher than the baseline group, which consists of below-investment-grade ratings. In addition, these coefficients decline in magnitude when moving from Group 1 to 3, indicating that the change in retail investor demand is highest for the highest rated bonds.

Table 3 Panel B presents the results of estimating equation (1) using the bond month sample for institutional investors. We do find similar evidence of increases in demand on the part of institutional investors. The coefficients in columns (1) and (2) are insignificant, and those in columns (3) and (4) have substantially lower magnitude than those of retail investors. These results are consistent with the fact that institutional investors, who had access to credit rating information before the regulatory change, were unaffected by the increased dissemination of credit ratings. Collectively, Table 3 Panel A and B indicate that there was a differential increase in retail investor demand for bonds with higher credit ratings after the regulatory change.

5.1.2 Investor Selection of Yield Conditional on Rating-Maturity

Next, we examine whether there is a shift by investors toward higher-yielding securities within rating-maturity groups after the regulatory change. As previously noted, this type of shift is consistent with a simple heuristic that relies on credit ratings to group homogeneous bonds from which to select based on price. We sort our sample of bonds into rating-maturity groups in two steps. First, we construct ratings-maturity buckets for each month by sorting bonds in each of the previously defined rating groups according to the decile of its maturity. Next, we sort the maturity buckets into deciles of contemporaneous bond yields. This within rating yield variable is defined as *Rating-Yield Rank*.

Table 4 Panel A presents the results for retail investors and Table 4 Panel B presents the results for institutional investors. The sample in Table 4 is smaller than the sample in Table 3 because the determination of yield dictates that only bond months with a buy or sell transaction be included. In Panel A, the coefficient on *Rating-Yield Rank* * *Post* is positive and significant (Coefficient on *Rating-Yield Rank* * *Post* = 0.017 and t-statistic = 3.501). This coefficient indicates that retail investors purchase higher yield bonds within a given ratings category after the dissemination change. Column (2) provides the results with Bond fixed effects. For Table 4 Panel B the *Rating-Yield Rank* * *Post* interaction term is negative in column (1) and insignificant in column (2). This indicates that institutional investors don't purchase higher yield bonds within a given ratings category after the regulatory change. Rather, it appears that institutional investors appear to shift toward lower yielding bonds, the opposite behavior of retail investors. Collectively, these results indicate that retail investors differentially changed their trading decisions to acquire higher yielding bonds within a particular rating category after the regulatory change.

5.1.3 Rating Fixation and Trading Outcomes

Next, we show that the increased focus by retail investors on selecting bonds based on yield within credit rating categories is suboptimal because it leads to increased trading of bonds in advance of downgrades. Empirically, we show that bond downgrades are predicted to a greater extent after the dissemination change by retail investor demand, which implies that retail investors are differentially purchasing bonds that are more likely to be subsequently downgraded. Bond prices and payoffs drop sharply upon downgrades, defaults, and bankruptcies, so this result indicates that retail investors differentially experience large negative wealth effects following the regulatory change (deHaan et al., 2023).

We focus specifically on trading around downgrades because ratings are not continuous and therefore there are periods in advance of downgrades where reliance on ratings can result in suboptimal purchases. We use the following empirical specification to test whether there is a change in the association between investor demand and subsequent bond downgrades following the dissemination change:

$$Downgrade_{b,\,(t,t+h)} = \alpha + \beta_1 BSI_{b,t}^{Retail(Instituional)} + \beta_{2t} BSI_{b,t}^{Retail(Instituional)} * Post + \sum \gamma_j \, Controls + Fixed\ Effects + \varepsilon_{i,t} \quad (2)$$

$Downgrade_{b,\,(t,t+h)}$ is an indicator that takes the value of one if bond b is downgraded h months in the future, where h takes values of six and twelve months. We include controls for the ratings level, and remaining time-to-maturity. We include bond fixed effects as before to eliminate time-invariant characteristics that may correlate with future downgrades. We also include state and time fixed effects to control temporal trends and macroeconomic conditions. All specifications cluster standard errors by bond and year-month.

Table 5 Panel A presents the results of estimating equation (2) using our bond month sample for retail investors. In all columns, the coefficients on the *BSI * Post* interaction term are significantly positive (coefficient = 0.007 and t-statistic = 2.120 in column (1)). These results indicate that retail investors are differentially more likely to trade in S&P rated bonds that are subsequently downgraded. For Table 5 Panel B the *BSI* * *Post* interaction term is insignificant. This implies institutional investors don't significantly increase their purchases around downgrades after the regulatory change.

5.1.4 Rating Fixation and Bond Type Selection

We supplement the yield and downgrade analysis by examining whether the type of bond that retail investors purchase is different in the post-dissemination period. The intuition for this analysis is driven by the fact that S&P credit ratings during our sample period were primarily derived from the issuer's likelihood of default (i.e., the issuer's capacity and willingness to meet its financial obligations in full and on time) rather than the expected loss given default.[11] We consider two bond attributes that have significant implications for the expected loss given default—whether the bond is a general obligation bond or revenue bond, and whether the bond is issued by a Chapter 9-eligible municipality. In our setting, a shift towards bonds that have higher expected losses given default provides further evidence of credit rating fixation and suboptimal trading.

Covitz and Han (2005) document that general obligation (GO) bonds, which are backed by the full faith and credit of the issuing municipality, tend to have significantly higher recovery rates in default scenarios relative to revenue bonds, which are secured solely by the income generated from a specific project or enterprise (e.g., toll roads, utilities). This structural difference in collateral and legal recourse implies that loss given default (LGD) is systematically higher for revenue bonds, which lack broad government backing. Gao et al. (2019) show that municipalities

[11] https://www.spglobal.com/ratings/_division-assets/pdfs/guide_to_credit_rating_essentials_digital.pdf

in states that authorize access to Chapter 9 bankruptcy face greater uncertainty and potentially larger creditor losses upon default. This is because Chapter 9 permits the judicial restructuring of debt without requiring the liquidation of assets or the consent of all creditors. The ability to impair contractual obligations through a court-approved plan introduces material legal risk for creditors, particularly in contrast to states that impose fiscal oversight or disallow bankruptcy filings altogether.

The separation of our main analysis across these two dimensions are provided in Table 6 (General Obligation versus Revenue) and Table 7 (Chapter 9 Municipal Bankruptcy Laws). The results in Table 6 Panel A show a strong shift on the part of retail investors away from general obligation bonds and toward revenue bonds. The main coefficient in column (1) indicates a slight shift toward lower rated general obligation bonds (Coefficient on *Rating* * *Post* = 0.000 and t-statistic = 1.917 in column (1)), whereas the coefficients in column (3) are not significant, indicating no detectable shift toward higher rated general obligation bonds. In contrast, the results in both columns (2) and (4) show a strong shift on the part of retail investors towards higher rated revenue bonds (Coefficient on *Rating* * *Post* = -0.002 and t-statistic = 3.4 in column (2)). The results in Panel B show that increased retail investor demand for revenue bonds results in the acquisition of bonds that are subsequently downgraded. At the 12-month interval, there is no association between retail investor BSI and future downgrades for general obligation bonds (coefficient on BSI^{Retail} * *Post* is -0.001 with t-statistic of 0.145 in column (1)), but a positive statistically significant association for revenue bonds (coefficient on BSI^{Retail} * *Post* is 0.007 with t-statistic of 2.137 in column (2)).

The results in Table 7 provide the same conclusions. In Table 7 Panel A, column (1) shows that there is only a negative statistically significant coefficient on the *Rating**Post* interaction term for Chapter 9-eligble issuers (Coefficient on *Rating* * *Post* = -0.002 and t-statistic = 4.368 in column (1)), and column (3) shows that this increased demand is increasing in the credit rating. Similarly, Table 7 Panel B shows that the increased retail investor BSI is correlated with future bond downgrades. In each of columns (1), (3), and (5), the coefficient is positive and significant (Coefficient on BSI^{Retail} * *Post* is 0.013, 0.009, and 0.012 with t-statistics of 2.4, 1.74 and 3.11in column (1), (3) and (5) respectively). In contrast, the change in retail investor demand for non-Chapter 9-eligible bonds does not appear to predict future downgrades.

Collectively, the results in Table 6 and 7 indicate that increased dissemination had a material impact on the types of bonds purchased by retail investors. Both sets of analyses indicate a shift towards bonds where the risks are not reflected in the credit rating, consistent with credit rating fixation. In addition, both tests provide insights into how retail investors selected higher yielding bonds within rating categories—by purchasing bonds where the expected loss given default is greater.

5.1.5 Summary

Collectively, the results in Tables 3 through 7 indicate that the increased dissemination of credit ratings generated suboptimal retail investor trading. More specifically, the data shows that retail investors increased their demand for highly rated bonds and that they were more likely to acquire higher yielding bonds within a credit rating category, thus acquiring bonds that were more likely to be subsequently downgraded. In addition, they appear to be unaware of the increased likelihood of downgrades, as they focus their trades on revenue bonds and on bonds issued in Chapter 9-eligible states. This type of trading is indicative of suboptimal investor fixation. Notably, institutional investors were not similarly affected.

We do not tabulate tests examining whether retail investors exhibit the opposite behavior with respect to credit rating upgrades for two reasons. First and most importantly, the intuition that supports our downgrade analyses does not extend to upgrades. While it is suboptimal to acquire bonds before they are downgraded, it is not necessarily preferable to acquire bonds in advance of upgrades. For example, in the corporate bond setting, Even-Tov and Ozel (2021) find that institutional investors are net sellers ahead of downgrade announcements and that their trade volume, relative to that of retail investors, increases ahead of downgrades but not upgrades. This difference makes it very challenging to interpret coefficients in a regression that examines upgrades. Second, several studies have documented that the capital market response to downgrades is much greater than the response to upgrades (e.g., Holthausen and Leftwich, 1986; Hand, Holthausen, and Leftwich, 1992; Dichev and Piotroski, 2001). In untabulated tests, we find weak evidence that retail investors are less likely to acquire bonds that are subsequently upgraded. While consistent with the conclusion that retail investors are fixated on credit ratings, we caution that there are other reasonable interpretations of these findings given the distinct economic incentives that drive the acquisition of bonds that are subsequently downgraded.

5.2 Cross-sectional effect based on the information environment

We add context to our findings by investigating whether the suboptimal fixation on credit ratings by retail investors we document is exacerbated when there are fewer alternative sources of information about the issuer's credit quality. We conduct these analyses using two proxies for issuers' information environment: state laws that require external audits and state laws mandating GAAP accounting. We expect that issuers in states that do not require external audits or do not mandate GAAP accounting will have lower quality financial disclosures and hence a worse information environment (Baber and Gore, 2008).

Table 8 Panel A presents the mandatory audit results. In columns (1) and (2) we measure the probability of downgrades over 12 months. The coefficient on BSI^{Retail} * *Post* is significant only for issuers in states that do not mandate audits (Coefficient on BSI^{Retail} * *Post* = 0.010 and t-statistic = 2.572 for non-mandatory audit sample; and coefficient = -0.006 and t-statistic = 1.29 for mandatory audit sample). An F-test shows the difference in the coefficients on BSI^{Retail} * *Post* is significant at the 1% level. These results indicate that the suboptimal investor fixation effect we document is concentrated in issuers that do not have mandatory audits.

Table 8 Panel B presents the results when we partition the sample based on the mandatory GAAP accounting results. Columns (1) and (2) show that the suboptimal investor fixation effect is much stronger for issuers that in states do not mandate GAAP accounting (Coefficient on BSI^{Retail} * *Post* =0.009 and t-statistics=2.223 for no GAAP mandatory sample; and coefficient=-0.001 and t-statisitc=0.231 for GAAP mandatory sample). An F-test shows the difference in the coefficients on BSI^{Retail} * *Post* is significant at 5% level. Overall, each of the two cross-sectional tests indicates that the suboptimal retail investor fixation is accentuated among those issues where there is a worse information environment.

5.3 The Effect of Dissemination on Spreads

Our final analysis examines whether dissemination leads to a change in spreads. For the purposes of this analysis, we employ a slightly different identification strategy that compares pre-dissemination period bonds that were rated by either S&P or Fitch but not Moody's (treated observations) with bonds that were rated only by Moody's (control observations). We then show that the effects are concentrated among retail investors, consistent with the assumption underlying our main analyses, and that the effects are concentrated among bond purchases, consistent with the implications of our cross-sectional tests. The goal of this analysis is to identify whether spreads adjust in response to increased dissemination, as such a reduction is predicted by much of the equity market literature, but explicitly not identified by Zhang (2024).

For each test, we employ the following specification:

$$TransactionCost_{b,t} = \alpha + \beta_1 Treated_{b,t} + \beta_2 Treated_{b,t} * Post + \sum \gamma_j \, Controls + Fixed\ Effects + \varepsilon_{i,t} \quad (3)$$

We follow the methodology in Schultz (2012) and Cuny (2018) and proxy for spreads using *Markup*, the difference between a bond's inter-dealer price and the price paid by an investor. More specifically, the markup on any trade in bond *b* on date *t* using the formula below:

$$\text{Markup}_{b,t} = TradeSign_{b,t} * 10{,}000 * \text{Log}\left[\frac{\text{InvestorPrice}_{b,t}}{\text{AvgInterdealerPrice}_{b,t}}\right]$$

TradeSign is a buy/sell indicator equal to "1" if the trade is a customer purchase, "-1" if the trade is a customer sale, and "0" if the trade is inter-dealer. Markup can only be determined if there is both a transaction between an investor and dealer as well as at least one inter-dealer trade on the same day. The *InvestorPrice* is the purchase (sale) price paid (received) by an investor in bond *b* on date *t*. The *AvgInterdealerPrice* is the average price of all inter-dealer transactions in bond *b* on date *t*. The Markup captures the basis point difference between the inter-dealer price and the price at which investors purchase (sale) the same security on the same day. Following prior literature, negative values of *Markup* are dropped as those are uncommon and akin to a negative bid-ask spread (e.g., Chordia et al., 2001).[12] We define *Treated* as an indicator that equals 1 for bonds rated by S&P or Fitch but not by Moody's and 0 for bonds that are rated by Moody's but neither S&P nor Fitch. *Post* is an indicator that equals 1 for transactions that take place after MSRB started posting S&P and Fitch credit ratings on November 21st, 2011.

[12] We drop 4.6% of trades (i.e., 20,918 out of 475,844 trades) due to a negative value for *Markup*.

The regression results are presented in Table 9 Panel A. The dependent variable is *Markup* in columns (1), (2), and (3). All columns include trade date fixed effects, trade type (indicating whether the transaction is a purchase or sale) fixed effects, and state-year fixed effects. Columns (1) and (2) include bond fixed effects, and Column (3) instead include issuer fixed effects and control variables at the bond level. Across all columns, the coefficient on the *Treated * Post* interaction term is significantly negative. This coefficient value indicates that investors trading bonds rated by S&P or Fitch had differentially lower *Markup* in the post-dissemination period compared to those trading in bonds rated by Moody's. The effects we document are also economically meaningful. The coefficients on *Treated * Post* are negative and significant at the 5% level (coefficient =-4.533 and t-statistic = 2.153 in column (1); coefficient =-4.193 and t-statistic = 2.088 in column (2); coefficient =-4.404 and t-statistic = 2.179 in column (3)), indicating that treated bonds have an approximately 4.5% relative decline in *Markup*.

Table 9 Panel B separates the sample into retail versus institutional trades using a $100,000 trade size cutoff. The regression results show that there is a significantly negative effect on *Markup* for retail investors but not for institutional investors (Coefficient on *Treated * Post* = -4.632 and t-statistic = 2.010 for retail trading sample; and coefficient = -1.329 and t-statistic = 0.625 for institutional trading sample). An F-test shows the difference in the coefficients on *Treated * Post* is significant at the 1% level. In terms of economic significance, retail investors exhibit a decline in *Markup* of about 4.6 basis points compared with virtually no change for institutional investors. Collectively, these results provide evidence that the dissemination effects are concentrated among retail investors, the group most likely to experience a decline in information acquisition costs as a result of the regulatory change.

Table 9 Panel C disaggregates the overall aggregate effect of bond purchases and sales documented in Panel A into the component that arises from purchases and the component that arises from sales. Prior studies have documented that information acquisition costs are a more important determinant of bargaining power in bond purchases than in bond sales (e.g., Cuny, 2018). We find that the coefficient on the interaction term *Treated* * *Post* is negative and significant for bond purchases but insignificant for bond sales (Coefficient on *Treated* * *Post* = -5.028 and t-statistic = 2.313 for purchase sample; and coefficient = -1.718 and t-statistic = 0.797 for sale sample).

6. Conclusion

We examine how the dissemination of credit ratings affects trading outcomes in the municipal bond market. We find that retail investors respond to improved access by placing greater reliance on credit ratings at the cost of fully incorporating other dimensions of credit risk. This behavior leads to suboptimal trading decisions, including the purchase of bonds that are more likely to be downgraded and that carry higher losses in the event of default, such as revenue bonds and bonds issued in Chapter 9–eligible states. Importantly, we find no evidence of similar trading changes among institutional investors, who already had access to this information prior to the regulatory change. These findings suggest that greater access to information alone does not ensure better outcomes, particularly when the information is complex and prone to misinterpretation by less sophisticated investors.

Our results have clear and timely policy implications for market transparency initiatives. The MSRB's intent in expanding access to credit ratings via EMMA was to democratize information and improve retail investor outcomes. However, our evidence suggests that without accompanying interpretive support, such dissemination may lead retail investors to incorrectly process the disseminated information, thereby amplifying rather than reducing misallocation. These findings suggest a need for regulatory bodies to rethink the implementation of disclosure mandates to consider whether improving access should go hand-in-hand with tools that aid in comprehension. For example, EMMA could offer investor education modules, standardized warnings about bond structure risk, or interactive visualizations that highlight differences in default risk and recovery. In the absence of such guidance, well-intentioned transparency efforts may inadvertently deepen the informational disadvantage of retail investors.

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Appendix A: Variable Definitions

Variable	Description	Data Source
Main Analysis		
BSI	$BSI_{b,t}^{Retail/Insitution} = \frac{\text{Total Buy}_{b,t} - \text{Total Sell}_{b,t}}{\text{Total Buy}_{b,t} + \text{Total Sell}_{b,t}}$ BSI measures retail (institutional) investors' demand for a given bond b in a given month t, where a positive (negative) value indicates that investors are net buyers (net sellers) of that bond.	Constructed, MSRB
Chap9	Indicator variable set to one for issuers in Chapter 9 states, 0 otherwise. The Chapter 9 states are Alabama, Arkansas, Arizona, California, Idaho, Minnesota, Missouri, Montana, Nebraska, Oklahoma, South Carolina, and Washington.	Constructed
Downgrade – *N mon*	An indicator for that takes the value of one if bond b is downgraded in N months in the future, where N takes values of six and twelve months.	Constructed
Maturity (yrs.)	Years to Maturity	Bloomberg
GAAP State	Indicator variable set to one for issuers in states that the state law mandate GAAP accounting, and 0 otherwise.	Constructed
GO Bonds	Indicator variable set to one for general obligation bonds, 0 otherwise.	Constructed
Log (Amount)	Natural logarithm of issue amount	Bloomberg
Mandatory Audit	Indicator variable set to one for issuers in states that the state law requires mandate audits, 0 for issuers in states that do not mandate audits	Constructed
Post	Indicator that takes the value of one for bond-months after November 21st, 2011.	Constructed
Rating	S&P ratings category at the time of the trade	Constructed
Rating-Yield Rank	The decile rank of yield of the within rating and maturity deciles in a month	MSRB
Raw Yield Rank	The decile rank of yield in a month	MSRB
Retail	Indicator variable set to one for trades with par values under $100,000	Constructed
Rev Bonds	Indicator variable set to one if the bonds are not general obligation bonds, 0 otherwise.	Constructed
Spreads Analysis		
Callable	Indicator variables set to one for callable bonds	Bloomberg
Bond Purchase	Indicator variable set to one if the transaction is a bond purchase	MSRB
Bond Sale	Indicator variable set to one if the transaction is a bond sale	MSRB
Duration	Time remaining to maturity	MSRB
Inventory		Constructed

Variable	Description	Data Source
	An indicator equals one if a purchase (sale) does not follow (precede) a sale (purchase) within one day of the trade date	
Insured	Indicator variables set to one for insured bonds, 0 otherwise	Bloomberg
Log (TradeSize)	The natural log of the trade value of the transaction.	Constructed
Log (AggTrades)	The natural log of the trade value of all transactions in a bond during a given month	Constructed
Markup	$TradeSign_{b,t} * 10{,}000 * \text{Log}\ [\frac{\text{InvestorPrice}_{b,t}}{\text{AvgInterdealerPrice}_{b,t}}]$ Trade Sign is a buy/sell indicator equal to "1" if the trade is a customer purchase, "-1" if the trade is a customer sale, and "0" if the trade is inter-dealer. The InvestorPrice is the purchase (sale) price of bond b on date t if at least one inter-dealer trade occurs on the same day. The *AvgInterdealerPrice* is the average price of all inter-dealer transactions in bond b on date t.	Constructed, MSRB
Treated	Indicator set to one for bonds that are rated by S&P and Fitch but not by Moody's, and to zero for bonds that are rated by Moody's but neither S&P nor Fitch	Constructed

Appendix B: Ratings Scale

The table describes categories for credit ratings, as well as the numerical scale used in the paper. Multiple numerical values for a single rating level represent the number assigned to ratings with a + qualifier, no qualifier, and a − qualifier, respectively for S&P and Fitch, and with a 1, 2 or 3 qualifier for Moody's. The source for ratings definitions is S&P Ratings Definitions from November 20, 2014 (http://www.standardandpoors.com/).

S&P Rating	**Moody's Rating**	**Fitch Rating**	**Assigned Value**	**Group Description**	**S&P Ratings Definition**
AAA	Aaa	AAA	1	Prime	An obligation rated 'AAA' has the highest rating assigned by S&P. The obligor's capacity to meet its financial commitment on the obligation is extremely strong.
AA	Aa	AA	2, 3, 4	High grade	An obligation rated 'AA' differs from the highest-rated obligations only to a small degree. The obligor's capacity to meet its financial commitment on the obligation is very strong.
A	A	A	5, 6, 7	Upper medium grade	An obligation rated 'A' is somewhat more susceptible to the adverse effects of changes in circumstances and economic conditions than obligations in higher-rated categories. However, the obligor's capacity to meet its financial commitment on the obligation is still strong.
BBB	Baa	BBB	8, 9, 10	Lower medium grade	An obligation rated 'BBB' exhibits adequate protection parameters. However, adverse economic conditions or changing circumstances are more likely to lead to a weakened capacity of the obligor to meet its financial commitment on the obligation.
BB	Ba	BB	11, 12, 13	Non-investment grade speculative	An obligation rated 'BB' is less Vulnerable to nonpayment than other speculative issues. However, it faces major ongoing uncertainties or exposure to adverse business, financial, or economic conditions which could lead to the obligor's inadequate capacity to meet its financial commitment on the obligation.
B	B	B	14, 15, 16	Highly speculative	An obligation rated 'B' is more Vulnerable to nonpayment than obligations rated 'BB', but the obligor currently has the capacity to meet its financial commitment on the obligation. Adverse business, financial, or economic conditions will likely impair the obligor's capacity or willingness to meet its financial commitment on the obligation.
CCC	Caa	CCC	17, 18, 19	Substantial risks	An obligation rated 'CCC' is currently Vulnerable to nonpayment, and is dependent upon favorable business, financial, and economic conditions for the obligor to meet its financial commitment on the obligation. In the event of adverse business, financial, or economic conditions, the obligor is not likely to have the capacity to meet its financial commitment on the obligation.
CC	Ca	CC	20	Extremely speculative	An obligation rated 'CC' is currently highly vulnerable to nonpayment. The 'CC' rating is used when a default has not yet occurred, but S&P expects default to be a virtual certainty, regardless of the anticipated time to default.
C	C	C	21	Default imminent	An obligation rated 'C' is currently highly vulnerable to nonpayment, and the obligation is expected to have lower relative seniority or lower ultimate recovery compared to obligations that are rated higher.

Table 1: Sample Selection

Sample Selection Criteria	Number of Trades	Number of Unique Bonds	Number of Unique Issuers	Bond -Year-Month Obs
Bonds issued between July 2009 and Oct 2011, and traded during 2009-2015	13,274,549	298,290	16,440	14,678,653
No Investor Trading	4,347,698	546	6	33,009
Bond Type Restrictions:				
Unrated Bonds	1,429,692	92,269	4,634	4,275,319
Bonds not rated by S&P	4,561,636	110,325	5,118	5,661,882
Bonds rated by Moodys	1,845,524	32,605	1,145	1,610,872
Bonds missing information	196,612	53	3	269,703
Full Sample	893,387	62,492	5,534	2,827,868

This table summarizes the sample selection process.

Table 2: Summary Statistics

Variable (2,827,868 Bonds-Months)	*Mean*	*Std. Dev.*	*P25*	*Median*	*P75*
Main Variables:					
Post	0.726	0.446	0	1	1
BSI_R	0.008	0.151	0	0	0
BSI_I	-0.001	0.081	0	0	0
Dependent Variable					
Downgrade-12 Mo	0.073	0.260	0	0	0
Downgrade – 6 Mo	0.039	0.194	0	0	0
Control Variables:					
Ratings	3.95	1.855	2.75	4	5
Maturity (yrs.)	6.357	5.449	2.29	4.756	9.005
Log(Amount)	15.800	1.20	14.956	15.729	16.519
Cross-sectional Variables:					
GO Bonds	0.625	0.484	0	1	1
Mandatory Audit	0.216	0.411	0	0	0
GAAP State	0.145	0.352	0	0	0

Table 2 presents descriptive statistics for our sample, which consists of 893,387 daily trades representing 62,492 unique bond issuances from 5,534 issuers.

Table 3: Investor Demand for Highly Rated Bonds

Panel A: Retail Investor

	(1)	(2)	(3)	(4)
Dependent variable	*BSI*	*BSI*	*BSI*	*BSI*
Rating * Post	-0.001***	-0.001***		
	(3.874)	(3.275)		
AAA/AA Rating * Post			0.039***	0.036***
			(3.646)	(3.237)
A Rating * Post			0.036***	0.034***
			(3.473)	(3.076)
B Rating * Post			0.032***	0.030***
			(2.998)	(2.667)
Control Variables:				
Maturity (yrs.)	0.001***	-0.009***	0.001***	-0.010***
	(11.167)	(4.081)	(11.135)	(4.340)
Log(Amount)	0.003***		0.003***	
	(12.549)		(12.641)	
Observations	2,827,868	2,827,868	2,827,868	2,827,868
Adjusted R-squared	0.008	0.003	0.008	0.003
Bond Fixed Effects	No	Yes	No	Yes
Issuer Fixed Effects	Yes	No	Yes	No
Year-Month Fixed Effects	Yes	Yes	Yes	Yes
Rating Fixed Effects	Yes	Yes	Yes	Yes
State X Year Fixed Effects	Yes	Yes	Yes	Yes

Panel B: Institutional Investor

	(1)	(2)	(3)	(4)
Dependent variable	*BSI*	*BSI*	*BSI*	*BSI*
Rating * Post	-0.000	-0.000		
	(0.553)	(0.534)		
AAA/AA Rating * Post			0.008*	0.008*
			(1.738)	(1.761)
A Rating * Post			0.007*	0.008*
			(1.712)	(1.732)
B Rating * Post			0.008*	0.009*
			(1.946)	(1.933)
Control Variables:				
Maturity (yrs.)	-0.000***	0.002*	-0.000***	0.002*
	(6.977)	(1.736)	(6.997)	(1.735)
Log(Amount)	-0.001***		-0.001***	
	(4.147)		(4.090)	
Observations	2,827,868	2,827,868	2,827,868	2,827,868
Adjusted R-squared	0.002	-0.004	0.002	-0.004
Bond Fixed Effects	No	Yes	No	Yes
Issuer Fixed Effects	Yes	No	Yes	No

Year-Month Fixed Effects	Yes	Yes	Yes	Yes
Rating Fixed Effects	Yes	Yes	Yes	Yes
State X Year Fixed Effects	Yes	Yes	Yes	Yes

This table reports analyses of the effect of ratings dissemination on investors' BSI defined as a bond's buy-sell imbalances in a given month. Rating is defined as the S&P ratings category at the time of the trade converted to a 1 through 21 numerical scale (see appendix). Because lower numbers represent higher credit ratings, a negative coefficient indicates that there is greater demand (higher BSI) for highly rated bonds (lower numerical rating). *Post* is an indicator that takes the value of one for bond months after November 21^{st,} 2011. All columns present OLS coefficient estimates and t-statistics based on robust standard errors clustered by bond and year-month. Variables are defined in Appendix A. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% p-levels (two-tailed), respectively.

Table 4: Yield Selection within Rating

Panel A: Retail Investor

Dependent variable	(1) *BSI*	(2) *BSI*
Rating-Yield Rank * Post	0.017***	0.033***
	(3.501)	(5.528)
Control Variables:		
Rating-Yield Rank	-0.086***	-0.109***
	(15.433)	(16.888)
Raw Yield Rank	-0.012***	-0.063***
	(3.116)	(13.815)
Maturity (yrs.)	0.002***	0.016
	(3.457)	(1.634)
Log(Amount)	-0.009***	
	(2.708)	
Observations	162,640	162,640
Adjusted R-squared	0.076	0.041
Bond Fixed Effects	No	Yes
Issuer Fixed Effects	Yes	No
Year-Month Fixed Effects	Yes	Yes
Rating Fixed Effects	Yes	Yes
State X Year Fixed Effects	Yes	Yes

Panel B: Institutional Investor

Dependent variable	(1) *BSI*	(2) *BSI*
Rating-Yield Rank * Post	-0.011*	-0.004
	(1.884)	(0.584)
Control Variables:		
Rating-Yield Rank	-0.054***	-0.104***
	(8.100)	(13.447)
Raw Yield Rank	0.018***	0.026***
	(5.137)	(3.546)
Maturity (yrs.)	-0.010***	0.053***
	(8.071)	(3.338)
Log(Amount)	-0.011	
	(1.596)	
Observations	42,626	42,626
Adjusted R-squared	0.057	-0.058
Bond Fixed Effects	No	Yes
Issuer Fixed Effects	Yes	No
Year-Month Fixed Effects	Yes	Yes
Rating Fixed Effects	Yes	Yes
State X Year Fixed Effects	Yes	Yes

This table reports analyses of the effect of ratings dissemination on investors' BSI defined as a bond's monthly buy-sell imbalances in a given month. Rating-Yield Rank is defined as the decile rank of yield of the within rating and maturity decile in a specific month. *Post* is an indicator that takes the value of one for bond-months after November 21st, 2011. All columns present OLS coefficient estimates and t-statistics based on robust standard errors clustered by bond and year-month. Variables are defined in Appendix A. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% p-levels (two-tailed), respectively.

Table 5: Investor Demand and Subsequent Bond Downgrades

Panel A: Retail Investor

	(1)	(2)
Dependent variable	*Downgrade - 12 mon*	*Downgrade - 6 mon*
BSI^{Retail} * Post	0.007**	0.009***
	(2.120)	(2.983)
Control Variables:		
BSI^{Retail}	-0.009***	-0.009***
	(2.801)	(3.386)
Rating	-0.334***	-0.179***
	(9.622)	(3.469)
Maturity (yrs.)	0.003	0.001
	(0.506)	(0.217)
Observations	2,827,868	2,827,868
Adjusted R-squared	0.377	0.251
Bond Fixed Effects	Yes	Yes
Year-Month Fixed Effects	Yes	Yes
State X Year Fixed Effects	Yes	Yes

Panel B: Institutional Investor

	(1)	(2)
Dependent variable	*Downgrade - 12 mon*	*Downgrade - 6 mon*
$BSI^{Institutional}$ * Post	0.006	0.000
	(1.656)	(0.100)
Control Variables:		
$BSI^{Institutional}$	-0.007**	-0.004
	(2.143)	(1.661)
Rating	-0.334***	-0.179***
	(9.622)	(3.470)
Maturity (yrs.)	0.003	0.001
	(0.534)	(0.259)
Observations	2,827,868	2,827,868
Adjusted R-squared	0.377	0.251
Bond Fixed Effects	Yes	Yes
Year-Month Fixed Effects	Yes	Yes
State X Year Fixed Effects	Yes	Yes

This table reports analyses of the effect of ratings dissemination on the relation between BSI (a bond's buy-sell imbalances in a given month) and future downgrades. $Downgrade_{b,\,(t,t+h)}$ is an indicator for downgrade of bond b in the future h months, where h = six or twelve months. Rating is defined as the S&P ratings category at the time of the trade. *Post* is an indicator that takes the value of one for bond-months after November 21st, 2011. All columns present OLS coefficient estimates and t-statistics based on robust standard errors clustered by bond and year-month. Variables are defined in Appendix A. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% p-levels (two-tailed), respectively.

Table 6: Revenue versus General Obligation Bonds

Panel A - Investor Demand for Highly Rated Bonds

	(1)	(2)	(3)	(4)
Dependent variable	*BSI GO Bonds*	*BSI Rev Bonds*	*BSI GO Bonds*	*BSI Rev Bonds*
Rating * Post	0.000*	-0.002***		
	(1.917)	(3.400)		
F-Stat	*P=0.000*			
AAA/AA Rating * Post			0.058	0.031**
			(1.514)	(2.555)
F-Stat			*P= 0.045*	
A Rating * Post			0.059	0.028**
			(1.540)	(2.281)
F-Stat			*P = 0.020*	
B Rating * Post			0.062	0.021*
			(1.584)	(1.705)
F-Stat			*P = 0.005*	
Control Variables:				
Maturity (yrs.)	-0.005	-0.009***	-0.009**	-0.009***
	(1.516)	(3.495)	(2.376)	(3.480)
Observations	1,767,848	1,060,020	1,767,848	1,060,020
Adjusted R-squared	-0.002	0.008	-0.002	0.008
Bond Fixed Effects	Yes	Yes	Yes	Yes
Year-Month Fixed Effects	Yes	Yes	Yes	Yes
Rating Fixed Effects	Yes	Yes	Yes	Yes
State X Year Fixed Effects	Yes	Yes	Yes	Yes

Panel B - Investor Demand and Subsequent Bond Downgrades

	(1)	(2)	(3)	(4)
Dependent variable	*Downgrade - 12 mon*	*Downgrade - 12 mon*	*Downgrade - 6 mon*	*Downgrade - 6 mon*
	GO Bonds	*Rev Bonds*	*GO Bonds*	*Rev Bonds*
BSI^{Retail} * Post	0.002	0.008**	0.007**	0.007**
	(0.338)	(2.068)	(2.079)	(2.328)
F-stat	*P=0.085*		*P=0.445*	
Control Variables:				
BSI^{Retail}	-0.004	-0.010***	-0.009***	-0.009***
	(0.827)	(2.690)	(2.722)	(2.957)
Rating	-0.441***	-0.246***	-0.182***	-0.126***
	(10.289)	(8.840)	(5.490)	(3.696)
Maturity (yrs.)	-0.015	0.004	0.003	0.001
	(1.305)	(0.718)	(0.577)	(0.388)
Observations	1,767,848	1,060,020	1,767,848	1,060,020
Adjusted R-squared	0.408	0.365	0.285	0.223

Bond Fixed Effects	Yes	Yes	Yes	Yes
Year-Month Fixed Effects	Yes	Yes	Yes	Yes
State X Year Fixed Effects	Yes	Yes	Yes	Yes

This table reports the effect of ratings dissemination on *retail* investors' BSI (panel A) and the relation between BSI and future downgrades (panel B) across two separate groups based on whether Bonds are General Obligation bonds or Revenue bonds. All columns present OLS coefficient estimates and t-statistics based on robust standard errors clustered by bond and trade date. Variables are defined in Appendix A. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% p-levels (two-tailed), respectively.

Table 7: State Chapter 9 municipal bankruptcy laws

Panel A - Investor Demand for Highly Rated Bonds

Dependent variable	(1) *BSI* *Chap9=1*	(2) *BSI* *Chap9=0*	(3) *BSI* *Chap9=1*	(4) *BSI* *Chap9=0*
Rating * Post	-0.002***	0.000		
	(4.368)	(1.092)		
F-Stat	*P=0.000*			
AAA/AA Rating * Post			0.045***	0.019
			(3.213)	(0.895)
F-Stat			*P= 0.000*	
A Rating * Post			0.042***	0.020
			(2.955)	(0.949)
F-Stat			*P = 0.000*	
B Rating * Post			0.037**	0.010
			(2.596)	(0.466)
F-Stat			*P = 0.000*	
Control Variables:				
Maturity (yrs.)	-0.012***	-0.013***	-0.014***	-0.014***
	(3.082)	(3.712)	(3.495)	(3.736)
Observations	1,184,237	1,643,632	1,184,237	1,643,632
Adjusted R-squared	0.003	0.003	0.002	0.003
Bond Fixed Effects	Yes	Yes	Yes	Yes
Year-Month Fixed Effects	Yes	Yes	Yes	Yes
Rating Fixed Effects	Yes	Yes	Yes	Yes

Panel B - Investor Demand and Subsequent Bond Downgrades

Dependent variable	(1) *Downgrade - 12 mon* *Chap9=1*	(2) *Downgrade - 12 mon* *Chap9=0*	(3) *Downgrade - 6 mon* *Chap9=1*	(4) *Downgrade - 6 mon* *Chap9=0*
BSI^{Retail} * Post	0.013**	0.001	0.012***	0.006*
	(2.400)	(0.242)	(3.111)	(1.942)
F-stat	*P=0.000*		*P=0.000*	
Control Variables:				
BSI^{Retail}	-0.011**	-0.006	-0.011***	-0.008***
	(2.206)	(1.510)	(3.137)	(2.687)
Rating	-0.280***	-0.360***	-0.142***	-0.207***
	(7.088)	(9.879)	(2.893)	(3.611)
Maturity (yrs.)	0.008	-0.003	0.002	-0.002
	(0.875)	(0.330)	(0.471)	(0.359)
Observations	1,184,237	1,643,632	1,184,237	1,643,632

Adjusted R-squared	0.350	0.338	0.248	0.217
Bond Fixed Effects	Yes	Yes	Yes	Yes
Year-Month Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes

This table reports the effect of ratings dissemination on retail investors' BSI (Panel A) and the relation between BSI and future downgrades (panel B) across two separate groups based on whether bonds are issued by Chapter-9 States or not. The Chapter 9 states are Alabama, Arkansas, Arizona, California, Idaho, Minnesota, Missouri, Montana, Nebraska, Oklahoma, South Carolina, and Washington. All columns present OLS coefficient estimates and t-statistics based on robust standard errors clustered by bond and trade date. Variables are defined in Appendix A. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% p-levels (two-tailed), respectively.

Table 8: Cross-sectional Tests for Retail Investors based on Issuer Information Environment

Panel A - Conditional on Mandatory External Audit Law

	(1)	(2)	(3)	(4)
Dependent variable	*Downgrade - 12 mon*	*Downgrade - 12 mon*	*Downgrade - 6 mon*	*Downgrade - 6 mon*
	No Mandatory Audit	*Mandatory Audit*	*No Mandatory Audit*	*Mandatory Audit*
BSI^{Retail} * Post	0.010**	-0.006	0.012***	-0.003
	(2.572)	(1.290)	(3.496)	(0.906)
F-stat	*P=0. 000*		*P=0.000*	
Control Variables:				
BSI^{Retail}	-0.012***	0.004	-0.012***	0.002
	(3.195)	(0.928)	(3.901)	(0.539)
Rating	-0.321***	-0.384***	-0.170***	-0.215***
	(9.585)	(9.211)	(3.481)	(3.408)
Maturity (yrs.)	-0.002	0.013	-0.002	0.007
	(0.280)	(1.567)	(0.529)	(1.662)
Observations	2,217,842	610,026	2,217,842	610,026
Adjusted R-squared	0.374	0.392	0.246	0.277
Bond Fixed Effects	Yes	Yes	Yes	Yes
Year-Month Fixed Effects	Yes	Yes	Yes	Yes
State X Year Fixed Effects	Yes	Yes	Yes	Yes

Panel B – Conditional on Mandatory GAAP Accounting Law

	(1)	(2)	(3)	(4)
Dependent variable	*Downgrade - 12 mon*	*Downgrade - 12 mon*	*Downgrade - 6 mon*	*Downgrade - 6 mon*
	GAAP State = 0	*GAAP State = 1*	*GAAP State = 0*	*GAAP State = 1*
BSI^{Retail} * Post	0.009**	-0.001	0.010***	0.002
	(2.223)	(0.231)	(2.995)	(0.474)
F-stat	*P=0.018*		*P=0.065*	
Control Variables:				
BSI^{Retail}	-0.010***	-0.004	-0.010***	-0.003
	(2.649)	(0.638)	(3.403)	(0.750)
Rating	-0.325***	-0.401***	-0.174***	-0.216***
	(9.450)	(8.647)	(3.454)	(3.419)
Maturity (yrs.)	0.002	0.005	-0.000	0.004
	(0.331)	(0.499)	(0.009)	(0.597)
Observations	2,417,524	410,344	2,417,524	410,344

Adjusted R-squared	0.373	0.395	0.250	0.261
Bond Fixed Effects	Yes	Yes	Yes	Yes
Year-Month Fixed Effects	Yes	Yes	Yes	Yes
State X Year Fixed Effects	Yes	Yes	Yes	Yes

This table reports the effect of dissemination on the relationship between BSI for Retail Investors and future downgrades across two separate groups based on proxies for the issuer's information environment: for Mandatory external audit states vs Non-mandatory external audit states (Panel A), and Mandatory GAAP accounting state vs Non-mandatory GAAP accounting states (Panel B). All columns present OLS coefficient estimates and t-statistics based on robust standard errors clustered by bond and trade date. Variables are defined in Appendix A. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% p-levels (two-tailed), respectively.

Table 9: The Effect of Dissemination on Spreads

Panel A: The Overall Effect of Dissemination

	(1)	(2)	(3)
Dependent variable	*Markup*	*Markup*	*Markup*
Treated * Post	-4.533**	-4.193**	-4.404**
	(2.153)	(2.088)	(2.179)
Treated			3.782
			(0.693)
Control Variables:			
Log(AggTrades)		4.667***	4.791***
		(15.536)	(16.356)
Duration		5.477**	3.174***
		(2.033)	(26.648)
Log(TradeSize)		-10.287***	-10.947***
		(29.813)	(30.307)
Inventory		-12.879***	-11.707***
		(15.043)	(13.129)
Retail		15.182***	15.216***
		(18.143)	(17.296)
Insured			6.532
			(1.206)
Log (Amount)			-0.120***
			(3.788)
Callable			15.102***
			(9.056)
Rating			2.042***
			(2.592)
Adj R-squared	0.401	0.425	0.401
Number of Trades	475,844	475,844	475,844
Bond Fixed Effects	Yes	Yes	No
Issuer Fixed Effects	No	No	Yes
Trade Date Fixed Effects	Yes	Yes	Yes
Trade Type Fixed Effects	Yes	Yes	Yes
State X Year Fixed Effects	Yes	Yes	Yes

Panel B: Retail versus Institutional Investors

	(1)	(2)
Dependent variable	*Markup-Retail*	*Markup-Institutional*
Treated * Post	-4.632**	-1.329
	(2.010)	(0.625)
F-stat	P = 0.000	
Control Variables:		
Log(AggTrades)	4.056***	-0.212
	(12.988)	(0.416)
Duration	7.588***	-2.728
	(2.637)	(0.892)
Log(TradeSize)	-6.916***	-13.619***
	(19.248)	(22.193)
Inventory	-13.059***	-10.369***

	(14.048)	(10.660)
Adj R-squared	0.417	0.324
Number of Trades	414,239	61,560
Bond Fixed Effects	Yes	Yes
Trade Date Fixed Effects	Yes	Yes
Trade Type Fixed Effects	Yes	Yes
State X Year Fixed Effects	Yes	Yes

Panel C: Bond Sales versus Bond Purchases

Dependent variable	(1) *Markup -Purchase*	(2) *Markup -Sale*
Treated * Post	-5.028**	-1.718
	(2.313)	(0.797)
F-stat	P = 0.000	
Control Variables:		
Log(AggTrades)	3.620***	0.958***
	(10.815)	(2.587)
Duration	3.780	1.656
	(1.539)	(0.399)
Log(TradeSize)	-8.100***	-9.569***
	(21.348)	(19.022)
Inventory	-14.758***	-11.469***
	(14.170)	(14.398)
Retail	20.780***	-3.431***
	(21.858)	(3.312)
Adj R-squared	0.414	0.191
Number of Trades	379,411	95,939
Bond Fixed Effects	Yes	Yes
Trade Date Fixed Effects	Yes	Yes
Trade Type Fixed Effects	Yes	Yes
State X Year Fixed Effects	Yes	Yes

This table reports analyses of the effect of dissemination on spreads using *Markup*. Panel A Columns (1) – (3) report multivariate results for the differential effect of S&P and Fitch rated firms (Treatment group) over Moody's rated issuers (Control group) on *Markup*. Panel B reports analyses of the effect of dissemination on *Markup* separately for retail versus institutional investors. Column (1) restricts to retail trades and Column (2) restricts to institutional trades. Panel C reports analyses of the effect of dissemination on Markup separately for bond purchases versus bond sales. Column (1) restricts to bond purchases and Column (2) restricts to bond sales. All columns present OLS coefficient estimates, and t-statistics based on robust standard errors clustered by bond and trade date. Variables are defined in Appendix A. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% p-levels (two-tailed), respectively.