Mutual Fund Flows and Capital Supply in Municipal Financing*

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Abstract

We show causal effects of capital supply from mutual funds on municipal financing. We employ a novel identification strategy based on Morningstar star rating introductions to isolate the supply-side effects that are orthogonal to both fund and bond issuer fundamentals. The results using both this instrument and existing approaches in the literature show that higher flows into municipal bond funds lead to more municipal bond issuance and larger issues. Relationships among funds, issuers, and underwriters matter for how capital is allocated, as capital follows previous primary market interactions. Municipal issuers take advantage of favorable shocks to capital supply by opting for issues with less potential for delay and with lower transaction costs, such as non-general-obligation and refinancing issues as well as non-green bonds.

JEL classification: G23, G32, H74

Keywords: Municipal bonds, Capital Supply, Bond Funds, Fund flows

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1. Introduction

Bond mutual funds are an important source of capital in the municipal bond market. Figure 1 shows that mutual funds account for 26.5% of the entire municipal bond holdings in the U.S. as of the third quarter of 2020, making them the largest non-household group of municipal bondholders. Yet, despite the importance of municipal bond markets in infrastructure building and maintenance, financing public services and local government expenditures, the literature has largely ignored the role that bond funds play as a capital supplier in the municipal bond market. In this paper, we provide the first causal evidence that capital flows from bond funds have a significant impact on municipal bond issuance decisions, and that this impact is mediated through existing fund-underwriter-issuer relationships.

FIGURE 1 HERE

It is *a priori* not clear how much and through which mechanisms fund flows should impact municipal financing. On the one hand, municipal financing is largely achieved through bond issuance as opposed to lending from banks.[1] As the second largest holders of municipal bonds after households, more supply of capital to funds should lead to more debt issuance. On the other hand, demand-side frictions (e.g., institutional or local political constraints) could lead to a sluggish response and a small-measured elasticity of issuance to flows.

It is also unclear whether fund-underwriter-issuer relationships should matter in this setting. Despite being a public market, and thus in principle having the properties of arm's length lending, the municipal bond market is also highly fragmented. Small regional borrowers looking for financing rely on their underwriters who also have on-going relationships with mutual funds.[2] On the mutual fund side, funds are likely to value relationships with underwriters that allow them to obtain the desired allocations

[1] Ivanov and Zimmermann (2021) estimate the size of the municipal bank loan market to be around $200 billion as of the third quarter of 2020, which only accounts for just over 5% of the total amount outstanding of the municipal bonds at over $3.9 trillion.

[2] Municipal bonds of relatively small issuers (e.g., local municipalities) are typically sold through negotiated sales, in which issuers sell bonds through their relationship underwriters. Large muni issuers (e.g., states) often issue through competitive sales, in which issuers take bids from multiple underwriters.

in initial offerings of bonds,[3] and also need to trade with these institutions later when they function as dealers in the secondary markets.[4] These factors suggest that capital flows from funds to municipal issuers are likely to operate through fund-underwriter-issuer relationships, a unique economic channel in the municipal bond markets that is distinct from the feedback channel that works through observable market prices.[5]

In this paper, we document a statistically and economically strong association between fund flows and both the likelihood of issuance as well as the size of individual issuances. We use a sample of 20,502 municipal issuers held by one or more of 3,312 share classes of 1,010 U.S. municipal bond funds between 2000 and 2020. A simple regression of fund flows on issuance suggests that a one-standard-deviation increase in fund flows is associated with a 0.55% increase in the likelihood of new issuance by the issuers already in a fund's portfolio, and with a 1.4% increase in the issuance amount. However, a key identification challenge is that this association could be driven by both a supply-side effect, i.e., greater availability of capital leading to issuance, as well as the demand-side effect by which some municipalities may be more attractive (and thus drive fund flows) and more likely to issue new bonds because of local growth opportunities.

We employ a new identification approach to tease out the supply-side effect of bond investor flows using mechanical and predictable changes in Morningstar overall star ratings. Morningstar publishes overall star ratings from 1 to 5 stars, calculated as the weighted averages of 3-, 5-, and 10-year star ratings, which in turn are constructed using the within-category rankings of each share class based on its risk-adjusted return over the said time horizon (Morningstar, 2021). Crucially, the way in which overall star

[3] Prior studies in corporate bonds document favoritism in bond offerings (e.g., Nikolova, Wang, and Wu, 2020), with underwriters offering greater portion to their relationship investors at discount (e.g., Cai, Helwege, and Warga, 2007).
[4] The lack of market liquidity of municipal bonds also adds to the importance of relationships in this market (Harris and Piwowar, 2006; Green, Li, and Schürhoff, 2007; Schwert, 2017). Lenders, or asset managers in the municipal bond market, will need to contact dealers for secondary market transactions, who also tend to be the underwriters in the primary market.
[5] Edmans, Goldstein, and Jiang (2012) and Khan, Kogan, and Serafeim (2012), for example, show that noise in prices induced by fund fire sales and purchases affects corporate financing. In municipal bonds, this feedback effect of market prices is almost non-existent as municipal bonds trade typically only a few times per year (see, e.g., Schwert, 2017).

ratings are calculated changes depending on the age of the fund. When a fund is between 3 and 5 years old, the 5-year star rating is unavailable, and the overall star rating is the same as the 3-year star rating. However, upon a fund reaching the age of 5 years, Morningstar begins to calculate the 5-year risk-adjusted return and the resulting 5-year star rating. The 3- and 5-year star ratings are then averaged with a 40% and 60% weight, respectively, and rounded to the nearest integer to form a new overall star rating. Thus, depending on a fund's performance between 3 and 5 years from the time of calculation, a fund's overall star rating may jump up or down despite very little change in its recent performance (and generally with no change in the 3-year rating). In fact, by the time of the change, virtually all of the data used for the 5-year rating is several months or even years old. If nothing about either the underlying portfolio or the way a fund is managed changes discretely at exactly the 60-month mark, this approach bypasses the identification concerns relating to unobserved portfolio fundamentals simultaneously driving issuer-level outcomes, returns, and fund flows. To the extent that overall star ratings are a salient feature of funds that investors respond to (potentially in addition to star ratings over different time horizons and risk-adjusted returns), these discrete rating changes provide us with a shock to capital flows that is orthogonal to capital demand.

Though the introduction of a new 5-year star rating for 5-year-old funds provides us with the cleanest identification setting, they nevertheless represent a relatively small fraction of our sample. We thus use existing approaches in the literature to verify our main results. Specifically, we use funds rated 4 or 5 stars, with an overall rating score—i.e., the weighted average of 3-, 5-, and 10-year star ratings—greater than or equal to 4.0, similar in spirit to Reuter and Zitzewitz (2021).[6] Morningstar star ratings are calculated on the sole basis of a continuous running variable, Morningstar Risk-Adjusted Return (MRAR). We measure the within-fund flow impact of a fund being rated 5 stars *after* controlling for the same running variable that is used for the construction of star rating, i.e., MRAR. As long as there is no discontinuous jump in managerial ability or the underlying portfolio at the 4/5-star boundary, the

[6] Ben-David, Li, Rossi, and Song (2021) and Evans and Sun (2021) utilize a related set-up for identification purposes.

additional jump in flow response that stems from achieving a 5-star rating may be construed as a flow component that is plausibly unrelated to fund performance.

We first examine whether changes to overall star ratings at the 5-year mark elicit strong investor flow response. We find that funds that experience an upgrade at the 5-year mark receive an additional 3.1% per quarter over the next four quarters (about a half of the quarterly standard deviation of fund flows, or above the 80th percentile of the distribution) relative to those that reach the 5-year mark but remain at their previous ratings. The effect appears right at the time of the introduction of the new rating, with no visible trends in flows prior to the change, which supports a causal interpretation. Our analysis of the 4/5-star share classes reveals a similar picture, with a fund receiving an extra inflow of 1.2% per quarter when it is upgraded to the 5-star status (which is the 70th percentile of the distribution of quarterly flows). Taken together, this evidence points to a significant causal investor response to changes in the overall Morningstar star rating.

We then proceed to examine whether the plausibly exogenous investor inflows into these funds affect the issuance decisions of the issuers they hold. Using the two identification settings, we reveal a strong causal relationship between fund flows and issuance decisions. Following an overall star rating upgrade at the 5-year mark, issuers held by upgraded funds are 1.3% more likely to engage in new issuances, with a 26.6% increase in the issuance amount over the next four quarters compared to issuers whose 5-year-old mutual fund bondholders remain at their previous overall star rating. Our analysis of 4/5-star funds reveal a similar picture; when a fund's overall star rating increases, we observe a subsequent 0.4% increase in the likelihood of new issuance, and 6% larger issues conditional on issuance, among issuers they hold during the next quarter. These results suggest that an exogenously driven investor inflow into mutual funds appears to drive greater issuance in the primary market.

Having established the causal relationship between investor flows and new issuance decisions, we explore the role of relationships in this arms-length but highly segmented market. We employ a strategy similar in spirit to Khwaja and Mian (2008), whereby we exploit within-issuer-quarter variation in fund-

level shocks. Given that multiple funds participate in the bond issuance of a single borrower, this allows us to control for unobservable time-varying factors driving the demand-side effect and gives us the opportunity to cleanly measure how fund-level shocks affect the decision to participate in a new issue.

Depending on the source of variation we use for identification, we find either an economically small positive effect or no average relationship between investor inflows and the participation in new issues. The average effects mask, however, substantial variation depending on previous relationships between the fund, the issuer, and the underwriter. Chen, Cohen, and Liu (2021) note that the relationship between the issuer and the underwriter is sticky, with 87% of an issuer's bonds issued through the same underwriter. Schultz (2012) further finds that the market for municipal bond underwriting is fragmented, with the underwriters highly dependent on their established set of clients for potential issuances.

We focus on three sets of relationships in this market. First, we examine whether the fund has previously participated in the primary bond offering of a given issuer. Second, we examine whether the fund has previously participated in the primary bond offering of the lead underwriter for the new issuance. Third, and finally, we examine the presence of links between all three parties, whereby the fund has participated in previous bond offerings underwritten by the lead underwriter *and* the issuer has a previous relationship with the same lead underwriter.

Using these different definitions of relationship, we re-estimate the within-issuer-quarter specifications described above. For all three types of relationships and for all our empirical approaches (using fund flows directly, and both Morningstar star ratings implementations), we find a strong positive effect of fund flow and the likelihood of participation in new issues when a previous relationship exists somewhere along the intermediation chain. The effect is strongest when there is a link between all parties, i.e., when funds have interacted with the underwriter before, and the underwriter has a previous relationship with the issuer. The effects are about half as large in magnitude (although still highly statistically significant) when the relationship exists only among the fund and the underwriter, or the fund

and the issuer. The evidence suggests that relationships matter for the allocation of capital following supply-side shocks in the municipal bond market.

Having established how fund flows drive municipal bond issuance and how relationships shape this effect, we explore which types of bonds are more likely to be issued in response to favorable capital supply conditions. We first examine whether issuers are more likely to issue general obligation (GO) or non-GO (i.e., revenue bond) issuance. Given that GO bonds require voter approval, which takes more time to organize, and with a greater degree of uncertainty surrounding its passage (Cellini, Ferreira, and Rothstein, 2010), we expect issuers to utilize more non-GO issuances that carry markedly lower transaction costs. Consistent with this hypothesis, we find that the magnitude of the response, as well as the statistical significance of the effects, are markedly stronger among issuances involving non-GO bonds only.

Similarly, we examine whether the issuers are more likely to engage in net new issuance or refinancing of existing issues in response to an inflow of capital into their mutual fund bondholders. Akin to corporate issuers that take advantage of temporarily favorable capital supply conditions to refinance early and better manage their maturity profile (Xu, 2018; Mian and Santos, 2018), we find that investor inflows into mutual funds are primarily associated with issuances involving refinancing. Along with our result on the non-GO issuances, this is consistent with municipal issuers opting for issuances with less administrative burden and faster response time to take advantage of favorable capital supply conditions.

In our final set of analyses, we examine the specific uses of the newly issued bonds. Across our identification settings, we find that new issuances are most common for the financial, housing, and development sectors, with some additional evidence of new issuance in the education sector. Lastly, we find little evidence that the influx of capital is associated with a greater likelihood of green bond issuance, which often require lengthy third-party verifications.

We contribute to the literature in several directions. First, we extend the growing literature on the real effects of municipal financing, and how shocks to the informational environment, including changes

in ratings, affect pricing, issuance and local outcomes (e.g., Adelino, Cunha, and Ferreira, 2017; Cornaggia, Cornaggia, and Israelsen, 2018). Gao, Lee, and Murphy (2020) consider the effects on yields of newspaper closures and the consequent reduction in local information production and government oversight. Painter (2020) measures the response of prices to the effects of climate change. Several recent papers have investigated the effects of taxes on the municipal bond market (see, e.g., Garrett, Ordin, Roberts, and Suárez Serrato, 2017, and Babina, Jotikasthira, Lundblad, and Ramadorai, 2021). Whereas most existing studies focus on issuer-specific or overall market conditions and their effects on the likelihood of issuance and/or borrowing cost, we contribute to the literature by highlighting the existence of a strong supply-side effect in this highly fragmented market. This supply-side effect is particularly economically meaningful given the large presence of mutual funds as bondholders in the municipal bond market.

Second, we also contribute to the literature on relationship lending and the role of nonbank financial intermediaries in more general. Whereas the important role of relationship lending has been well documented in the banking literature,[7] the important role of underwriters in bringing together suppliers and demanders of investor capital in an arms-length public market for municipal bonds has yet to be examined. A related study by Zhu (2021) examines the cross-sectional association between investor flows and corporate bond issuances, but we focus on a market where the nature of market segmentation and the issuers' reliance on their existing underwriters is orders of magnitudes more severe. Furthermore, we show the causal relationship between fund flows and municipal bond issuance using a set of identification strategies that are new to the literature. Garrett (2021) focuses on underwriter conflicts of interest and shows that a reduction in potential agency costs leads to lower financing costs for municipalities.

Third, we contribute to the growing body of studies that focus the supply side effect of capital. Lemmon and Roberts (2010) and Erel, Julio, Kim, and Weisbach (2012), for example, examine how firms

[7] Studies on relationship banking include but are not limited to Rajan (1992), Petersen and Rajan (1994), Berger and Udell (1995), Puri, Rocholl, and Steffen (2011), Jiménez, Ongena, Peydró, and Saurina (2012), Iyer, Peydró, da-Rocha-Lopes, and Schoar (2014), Bolton, Freixas, Gambacorta, and Mistrulli (2016), and Beck, Degryse, Haas, and van Horen (2018).

choose debt financing in response to changes in capital supply conditions. Chernenko and Sunderam (2012) show that frictions in capital supply driven by credit ratings affect corporate bond financing. Ma (2019) and Ben-Rephael, Choi, and Goldstein (2021) document market timing in the corporate bond market driven by cross-sectional and aggregate fund flows. While most of these studies examine the supply side effect in corporate bond markets, ours is the first to provide evidence showing the causal effect of capital supply in municipal financing.

Lastly, our empirical strategy also contributes to the large literature examining the effect of mutual fund flows on corporate decisions, beginning with Edmans, Goldstein, and Jiang (2012) and Khan, Kogan, and Serafeim (2012),[8] showing evidence for the feedback channel of market prices. While Wardlaw (2020) calls into question the validity of using flow-driven measure of mispricing, we present two Morningstar-based identification settings that enable us to tease out a plausibly exogenous component of mutual fund flows, particularly the investor response to a change in the overall star rating stemming from a mechanical change in the rating methodology when a fund reaches the age of 5 years. This identification bypasses the concerns raised in the literature and allows us to discern the causal effects of supply-side shocks to capital availability.

2. Data and variable construction

In our empirical analysis, we combine data on municipal issuers and their bond issuance from the Bloomberg and the FTSE Russell Mergent Municipal Bond databases with fund holdings and characteristics from the CRSP Survivor-Bias-Free U.S. Mutual Fund database and the Morningstar databases. In the ensuing subsections, we outline how our main variables of interest are constructed from these datasets.

[8] Other papers using this fund flow price pressure measure include, but are not limited to, Derrien, Kecskes, and Thesmar (2013), Phillips and Zhdanov (2013), Norli, Ostergaard, and Schindele (2015), Lee and So (2017), Bonaime, Gulen, and Ion (2018), Eckbo, Makaew, and Thorburn (2018), Agarwal and Zhao (2019), Dessaint, Foucault, Fresard, and Matray (2019), Choi, Hoseinzade, Shin, and Tehranian (2020), and Dessaint, Olivier, Otto, and Thesmar (2021).

2.1. Issuer characteristics

We begin with the sample of municipal bond issues covered in the Bloomberg and the FTSE Russell Mergent Municipal Bond databases. Bloomberg issuance data contains a swath of information on the issuer, including sector, state, assets and liabilities, and other municipal operating variables. It further contains the Federal Information Processing System (FIPS) code to identify the issuer's county. We use this to match the county-level macroeconomic data of the issuing entity, such as population and personal income per capita, taken from the Bureau of Economic Analysis (BEA), and unemployment rate from the Bureau of Labor Statistics (BLS).

We then supplement this information with the municipal bond issuance information in the FTSE Russell Mergent Municipal Bond data. The dataset contains detailed information on municipal bond issuance dating all the way back to 1970s, including the issuance amount, coupon, maturity, option features, underwriter, and historical and current credit ratings. The dataset further provides information on capital purpose (new money vs. refunding), source of repayment (general obligation, revenue bond, public improvement bonds, etc.), and the use of proceeds (e.g., healthcare, education, and public services) associated with each issuance, as well as the information on the bond's credit enhancements. When the two datasets are combined, we obtain rich information at both the issuer as well as individual issuances.

2.2. Fund characteristics

We begin with all surviving and discontinued fixed income funds in the CRSP Survivor-Bias-Free Mutual Fund database with the first two letters of the CRSP objective code "IU," which denotes municipal bond funds. We use the dataset to collect and construct fund returns, flows, total net assets (TNA), expense ratios, and fund age (described in detail in the Appendix). We separately collect information on all funds that are flagged as municipal bond funds in the Morningstar database. In addition to the Morningstar category of each share class, we further collect its 3-, 5-, and 10-year as well as the overall star ratings at each month-end. We further collect the information on Morningstar risk-

adjusted return (MRAR), the variable used by Morningstar to compute the ranking of each share class within its category (and consequently the star rating for each horizon).

We follow the methodology outlined in Berk and van Binsbergen (2015) and Pástor, Stambaugh, and Taylor (2015) to match each share class in the CRSP database (*crsp_fundno*) with the Morningstar share class identifier (*secid*) using CUSIP identifiers. We then restrict out attention to all funds that are flagged as municipal bond funds by both the CRSP and the Morningstar databases. Wherever necessary, we aggregate the share class-level data at the fund level using the previous month-end TNA of each share class as the weights.[9] Finally, to align the frequency of fund characteristics and holdings information, we convert monthly data into quarterly frequency.

2.3. Fund holdings information

We use both the Morningstar and the CRSP databases to identify a fund's holding information. Both databases contain the holdings information at either monthly or quarterly level for our sample funds. We run our analysis at the quarterly level due to better overall coverage and to avoid interpolation within quarters (we convert the holdings information of any fund reporting at a monthly frequency into quarterly frequency). Our sample of Morningstar holdings end in April 2015, but we supplement the information with the holdings information from CRSP up to September 2020.[10]

Once we augment the holdings dataset with fund characteristics from CRSP and Morningstar, as well as the issuer and issuance characteristics from Bloomberg and FTSE Russell Mergent Municipal, we can identify all issuer-fund holding combinations in a given quarter. This then allows us to form regression samples at different observation levels: First, we construct an issuer-fund-quarter dataset for all issuers held at least once by a municipal bond fund, with each issuer-fund pair as the unit of cross-sectional observation. Second, using this sample, we also construct an analogous sample at the issuer-

[9] For fund-level TNA, we sum the TNAs of all share classes, while we take the maximum age of all share classes to compute the age of a fund.

[10] Whenever we have Morningstar holdings available for a fund at a given quarter, we elect to utilize this information first, and we use the CRSP holdings information whenever Morningstar holdings data is unavailable. The two datasets provide very similar information whenever we observe funds and quarters in the two datasets.

quarter level, with fund-level information of mutual fund bondholders (such as quarterly flows and returns) aggregated at the issuer level using the previous quarter-end holding share of each fund as a fraction of the issuer's total amount outstanding as the weight. Finally, we also construct an issuer-share class-quarter sample in an analogous manner. Even though the portfolio holding is determined at the fund and not at the share class level, our identification strategy utilizes variation in flows emanating from shocks at individual share class level, which necessitates regressions at the issuer-share class-quarter level. All continuous variables are winsorized at the 1% and the 99% levels. Our final sample consists of 20,502 issuers and 3,312 share classes of 1,010 funds between the first quarter of 2000 and the third quarter of 2020, which amounts to 4,552,023 observations at the issuer-fund-quarter level, or 788,477 observations at the issuer-quarter level.

2.4. Summary statistics

Table 1 Panel A presents the summary statistics of issuer characteristics computed at the issuer-quarter level. We find that, on average, issuers issue a new bond on around 14.2% of the quarters during our sample period (or about once every 21 months). The average amount of new issuance is around $58.3 million, with the inter-quartile range of over $54 million, indicating a substantial variation in issuance amounts. New issues on average amount to 20.8% of the issuer's total bonds outstanding. We find that issuers hold substantial leverage, with liabilities amounting to 51.4% of their total assets. There is, however, a large variation in the degree of leverage, with a standard deviation of 65.0%.

TABLE 1 HERE

Panel B summarizes the characteristics of our sample of municipal bond funds at the fund-quarter level, with positive average quarterly fund flows and returns observed during our sample period. On average, our sample funds hold 191 bonds from 95 different issuers in their portfolio. For an average issuer, 48.5% of its outstanding bonds is held by funds (conditional on funds holding any of its bonds). Funds hold, on average, 30.1% of the outstanding bonds of a given issuer. We also note a considerable variation in the total percentage holdings by municipal bond funds, which has a standard deviation of

49.0%; in fact, for a quarter of our issuer-quarter observations, more than two-thirds, or 67.6% to be exact, of the issuer's outstanding bonds are held by our sample funds. This suggests that investors flows into and out of municipal bond funds are, in turn, likely to elicit a nontrivial response on the part of the issuers that they hold.

Finally, in Panel C, we present summary statistics on municipal bond issues by state. In total, we record over 1.92 million bond issuances, with California, Texas, and New York accounting for 12.9%, 9.7%, and 7.2% of total issuances, respectively. California and New York also account for 17.8% and 17.0% of all 7,708 green bond issuances. We observe more new filing issuances (where the proceeds from the issuance is new money, as reported in Mergent Municipal) compared to refunding (where some outstanding bonds are replaced with new bonds) issuances on average, with the former accounting for 55.0% of issuances. However, there is substantial variation at the state level; whereas the share of new filings is close to 70% in New Mexico and Mississippi, they account for only 44.3% of issuances in Pennsylvania. Revenue bond issuances (27.8% of total issuances) are slightly more common compared to general obligation issuances (22.2%), but once again, there is a great deal of heterogeneity between the states. For example, in Texas, the proportions of general obligation and revenue bond issuances are 36.3% and 16.8%, respectively, but at the other end of the spectrum in Florida, we find the corresponding figures to be 2.1% and 43.8%, respectively. We thus find general obligation issuances to be prevalent in some states while revenue bonds to be dominant means of issuances in others.

3. Fund flow and municipal bond issuance

In this section, we first relate investor flows into and out of municipal bond funds and the likelihood of new issuance, as well as the amount of new issuance by issuers that these funds hold, using a simple OLS setup. We then engage in our identification strategy using Morningstar ratings to establish the causal relationship between fund flow and municipal bond issuance. We further examine the role of

the previous relationship between the issuer, the fund, and the underwriter to trace out how capital flows to bond issuers.

3.1. Baseline regressions

Before we engage in identification analyses, we first present two baseline OLS regressions of the following form:

$$New\ issuance\ dummy_{i,t} = \beta_0 + \beta_1 Fund\ flow_{i,t} + \beta \cdot Controls_{i,t} + FEs + \varepsilon_{i,t}. \quad (1)$$

$$Log\ new\ issuance\ amount_{i,t} = \beta_0 + \beta_1 Fund\ flow_{i,t} + \beta \cdot Controls_{i,t} + FEs + \varepsilon_{i,t}. \quad (2)$$

Equation (2) amounts to a linear probability model regression of the new issuance dummy, which takes the value of one whenever an issuer issues a new bond in each quarter, on contemporaneous investor flows of its mutual fund bondholders. We then further examine the average size of new issuance by re-estimating the same set of regressions with the natural logarithm of one plus new issuance amount as the dependent variable instead. Our sample includes all issuer-quarter observations where at least one municipal bond fund in our sample holds nonzero amount of the issuer's outstanding bonds.

We first run regressions at the issuer-quarter level, with the flows of an issuer's fund bondholders aggregated using their respective previous quarter-end holding as a share of the issuer's total debt outstanding as the weight. Along with fund flow, we include the following issuer controls: leverage, the logarithm of total assets of the municipal issuer, the logarithm of total sales revenue, the logarithm of tax revenue, and the logarithm of pension underfunding. In each case, we replace missing values with zero and create a corresponding indicator variable that takes the value of one whenever the information is missing. In addition to the issuer-level controls, we also include additional controls capturing the macroeconomic state of the issuer's county: the logarithm of personal income per capita, the logarithm of population, and unemployment rate.

Along with these issuer-quarter level regressions, we run regressions at the issuer-fund-quarter level, using each issuer-fund pair as the unit of cross-sectional observation instead. With the identical set

of issuer- and county-level controls, we further include the fund's size, namely the log of fund TNA, as well as the latest quarterly return and expense ratio to control for fund characteristics. In all specifications, we include the state-by-quarter fixed effect, which allows us to compare the likelihood of bond issuance among all issuers in the same state in a quarter, as well as issuer fixed effects to absorb time-invariant issuer-level heterogeneity. In all subsequent analyses, we report *t*-statistics that are robust to heteroscedasticity and two-way clustered by issuer and quarter.

TABLE 2 HERE

Columns (1) and (2) of Table 2 Panel A present the results for our baseline new issuance dummy regressions at the issuer-quarter level. We find that a 1% increase in flows into mutual fund bondholders is associated with an increase of 0.04% in the likelihood of new issuance, with the statistical significance at around the 5% level. Both the economic and statistical significance remain virtually identical regardless of whether we include issuer- and county-level controls or not. Columns (3) and (4) confirm that similar patterns hold when we estimate the same relationship at the issuer-fund-quarter level instead, with roughly double the economic magnitude; a 1% increase in fund flow is consistent with around 0.08% increase in the likelihood of new issuance. Once again, we find that both the statistical and economic significance remain largely unchanged regardless of whether issuer-, county-, and fund-level controls are included, further highlighting the existence of a strong statistical relationship between the two.

Panel B reports our regression results for the logarithm of new issuance amount. We find that a 1% increase in mutual fund bondholders' flows is associated with an increase of 0.7% in the issuance amount when estimated at the issuer-quarter level, with the corresponding figure rising to 1.4% when estimated at the issuer-fund-quarter level. In all instances, the coefficients are statistically significant at the 5% or 1% levels. Thus, in addition to increasing the likelihood of new issuance, additional capital supply also serves to increase the average amount of the issuance themselves.[11]

[11] In untabulated analysis, we further examine whether this additional capital supply also influences the issuer's offering yield or choice of bond maturity, but the results are largely insignificant.

3.2. Morningstar star ratings introduction and fund flows

While our results in Table 2 indicate a strong statistical relationship between fund flow and the likelihood of new issuances by issuers they hold, omitted variables remain a concern. Although price pressure resulting from mutual fund outflows has been widely used in the literature as an exogenous shock to stock returns, beginning with Edmans, Goldstein, and Jiang (2012), it well known that flows are related to past returns, and these are plausibly related to unobserved issuer characteristics (Wardlaw, 2020). Related concerns include the possibility that investors commit more capital to managers they perceive to be skilled, who may exhibit preference for issuers with strong fundamentals that enable them to issue new bonds with greater ease. Thus, it is important to identify shocks to mutual fund flows that are likely to be unrelated to the fundamentals.[12]

To this end, we turn to Morningstar overall star ratings for identification purposes. Morningstar publishes discrete overall star ratings from 1 to 5 stars for each fund share class every month. The star ratings are calculated as follows: First, at each month-end, Morningstar calculates 3-, 5-, and 10-year risk-adjusted returns, known as Morningstar Risk-Adjusted Return (MRAR). Using each share class i's total return in excess of the risk-free rate at month t, $ER_{i,t}$, MRAR is defined as:

$$MRAR_{i,t}(T) = \left[\frac{1}{T}\sum_{j=0}^{T-1}\left(1 + ER_{i,t-j}\right)^{-2}\right]^{-\frac{12}{2}} - 1, \tag{3}$$

where T is either 36, 60, or 120 months. Thus, a share class must have at least 36 months of continuous, non-missing return observations before any MRAR may be calculated. Then, using the latest MRAR over each time horizon T as the sorting variable, Morningstar ranks all share classes within a given Morningstar category. The top 10% are assigned 5 stars, the next 22.5% 4 stars, the next 35% 3 stars, the next 22.5% 2 stars, and the bottom 10% 1 star, respectively. This yields the 3-year Morningstar star rating for all share

[12] One exception to the literature is Zhu (2021), who uses Bill Gross' largely unexpected departure from PIMCO in September 2014 as a quasi-exogenous shock to corporate bond fund flows. However, notwithstanding the fact that this represents a single shock in time, this shock is less suitable for our research question because PIMCO's market share in the municipal bond fund market was only 0.4% in June 2014, well below their 16.5% share in the corporate and general bond fund market.

classes aged 3 years or older, 5-year star rating for those aged 5 years or older, and similarly for the 10-year horizon.

Morningstar then produces a (rounded) weighted average of the star ratings over different horizons to arrive at its final overall star rating. Share classes younger than 3 years are not rated. For share classes between 3 years and 4 years and 11 months old, the overall star rating is simply the 3-year star rating. For share classes between 5 years and 9 years and 11 months old, Morningstar assigns a 60% weight to the 5-year rating and a 40% weight to the 3-year rating, then takes the nearest integer. So, if a share class has a 5-year rating or 3 stars and a 3-year rating of 5 stars, the overall star rating is the nearest integer to $0.6 \times 3 + 0.4 \times 5 = 3.8$, i.e., 4 stars. Finally, for share classes older than 10 years, 50% weight is placed on the 10-year rating, with the remaining 30% and 20% weights on the 5- and 3-year ratings, respectively. For the remainder of this paper, we refer to the weighted average value of the 3-, 5-, and 10-year ratings (in decimals) as the "overall rating score" and the rounded integer star rating as "overall star rating."

As our main identification strategy, we exploit the timing of the methodology for the calculation the overall rating. Crucially, when a share class reaches the age of 5 years, 5-year star rating becomes available and both the 3- and 5-year star ratings start to be utilized to construct the overall star rating, as opposed to just the 3-year star rating. It is important to point out that any difference between the 3- and 5-year star ratings stems from the share class's risk-adjusted performance between 3 and 5 years ago and is thus *unrelated* to a fund's recent performance. Yet, despite little change in recent underlying performance, a share class could mechanically be upgraded to a higher rating due to the inclusion of the newly available 5-year rating for a particular fund.

The rationale behind this identification strategy is that investors should not react to an upgrade of the overall rating that is based on stale (more than 3 years old) information. If, however, investors pay particular attention to the overall rating, perhaps because of inattention, or even due to institutional or organizational frictions that make it optimal to follow this particular measure, share classes with no

difference in recent performance would nevertheless receive a disproportionate share of flows depending on which side of the star rating boundary they fall into. The importance of the overall rating is consistent with the findings in Ben-David, Li, Rossi, and Song (2021), Evans and Sun (2021) and Reuter and Zitzewitz (2021).[13]

We identify all share classes reaching their 5-year mark during our sample period, whose new overall star rating either experiences an upgrade or remains the same at the 5-year mark. Our "treated" group consists of share classes that are upgraded at their 5-year mark—whose 3-year ratings generally remain unchanged but are nevertheless upgraded on the basis of the new 5-year star rating—while the "control" group consists of those that remain at their previous rating at the 5-year mark. We then engage in a difference-in-difference analysis of fund flows over the event window of four quarters prior to and after the 5-year mark. We further control for MRAR as a continuous variable, share class and quarter fixed effects.[14] Column (1) of Table 3 presents our results.

TABLE 3 AND FIGURE 2 HERE

We find that share classes that experience an upgrade at the 5-year mark receive, on average, an additional 3.1% per quarter (about one half of the quarterly standard deviation of flows of 7.4%) per one-notch increase in the overall star rating over the next four quarters relative to those that reach the 5-year mark but remain at their previous ratings, with statistical significance at the 1% level.

Panel A of Figure 2 graphically illustrates the dynamics of the difference in investor flows between those that are upgraded at the 5-year mark vs. those that remain at their previous rating. Whereas there is no noticeable pattern in the flow difference between the two groups prior to the 5-year mark, there is an immediate and sizeable increase in investor flows of upgraded classes relative to those that do not

[13] On a related front, Hartzmark and Sussman (2019) find a sizeable difference in investor flows on the basis of Morningstar sustainability star ratings.

[14] When calculating a share class's overall MRAR in a given quarter, 3-, 5-, and 10-year MRARs are converted into overall MRAR in the identical manner as how 3-, 5-, and 10-year star ratings are weighted averaged into overall rating score.

from once they reach 5 years and beyond, which remains strong over the next three quarters before eventually subsiding in the fourth quarter.

3.2.1. Ratings changes and flows

While the introduction of a new star rating at the 5-year mark and the mechanical change in the way Morningstar overall star ratings are calculated yields the cleanest identification setting, these share classes represent a relatively small fraction of our sample. Thus, we use another set of identifications using share classes rated 4 or 5 stars with the overall rating score greater than or equal to 4.0 in a quarter. As discussed earlier, a discrete change in the star rating of a share class is known to garner strong investor flow response (Evans and Sun, 2021; Reuter and Zitzewitz, 2021). If so, funds with similar performance in continuous terms, i.e., those with similar MRARs, may yet experience a large discrepancy in flows when a small difference in MRAR causes their star ratings to diverge. If there is no discrete jump in unobserved managerial attributes around the star rating boundary, the additional flows that accrue from a share class having one additional star may be seen as a culmination of investor heuristics and is thus plausibly exogenous to the underlying fundamentals.

To this end, for these share classes with an overall rating score of 4.0 or above, we control for MRAR, the sole variable used for the construction of Morningstar star ratings and examine the effect of a share class being rated 5 stars in a quarter by creating an indicator variable for the 5-star share classes. We focus on this 4/5-star boundary as this elicits the strongest degree of investor flow response, as found in Reuter and Zitzewitz (2021). Crucially, to account for the possibility that a share class's overall star rating maybe sticky over time, we include share class fixed effect (in addition to quarter fixed effect) to tease out the effect of within-share-class variations in the overall star rating.[15]

[15] To further alleviate the concerns related to stickiness in star ratings, we consider a smaller subsample only consisting of [-1:1], [-2:2], or [-4:4] quarters around a rating change, and we find similar and fully consistent results.

In column (2) of Table 3, it is apparent that, even after controlling for the MRAR, a 5-star-rated share class receives 1.2% extra investor inflows during the quarter, with a *t*-statistic exceeding 3.5. The number of share class-quarters used in the empirical analysis of 4/5-star share classes is three times that our first identification, namely share classes reaching the age of 5 years, alleviating concerns relating to small samples. Our two sets of analyses in Table 3 reveal that, even after controlling for the underlying risk-adjusted performance, there is a strong, disproportionate investor response to a change in the Morningstar overall star rating, even when the rating change is likely to have stemmed from a mechanical change in rating methodology.

3.3. Morningstar ratings and issuance

Table 3 reveals a strong positive relation between Morningstar overall star rating changes and investor flows. Using these two identification set-ups, we now examine whether the investor inflows following changes in Morningstar overall star ratings affects the issuance decisions of them municipal issuers in our sample.

We first turn our attention to share classes reaching the age of 5 years and examine the issuance decisions of municipal issuers held by these share classes. However, because we focus on relatively young share classes to exploit mechanical variations in rating methodology, these share classes tend to be smaller in size; the average TNA of these share classes are around one quarter of the average TNA of the 4/5-star share classes that we utilize in our second set of identifying regressions. Given their relatively small size, it is unlikely that the investor inflows into these share classes would affect all issuers in a meaningful manner, so we focus on share classes that hold a substantial proportion of the outstanding bonds. In Table A.1 in the Appendix we consider various minimum holding weight cut-offs, starting from the absence of a cut-off to a minimum of 5% holding weight of all outstanding bonds during the quarter preceding the share class's 5-year mark. As expected, though the issuance regression results are qualitatively robust regardless of minimum cut-offs, both the statistical as well as economic significance

generally increase as we impose tighter cut-offs. Given the observed patterns, we focus on all issuers that are held with a holding weight of 2.5% or greater during the quarter preceding our sample share class's 5-year mark.

For this subsample of issuer-share class-quarters, we first graphically plot the difference in the likelihood of new issuance between share classes that are upgraded at the 5-year mark and those that remain at their previous rating at the 5-year mark and present the results in Figure 2 Panel B. We find the patterns to be remarkably similar to investor flows plotted in Panel A with a one-quarter lag; issuers held by funds moving to the higher rating category are indeed more likely to issue during the first two quarters following the share class's 5-year mark. This one-quarter delay likely reflects the time and effort required to issue a new municipal bond.

We test this in a regression setting in Table 4 Panel A, where we examine the next-quarter new issuance dummy or log new issuance amount on the interaction of rating change at the 5-year mark and the post 5-year dummy. In addition to controlling for MRAR, we include share class, issuer, and state-by-quarter fixed effect. We find that an overall star rating upgrade at a share class's 5-year mark leads to a 1.3% increase in the likelihood of new issuance during the subsequent four quarters when they hold 2.5% or more of an issuer's outstanding bonds, compared to share classes that remain at their previous overall star rating. As for the issuance amount, we document a 26.6% increase in the issuance amount; given that our sample issuers, on average, issue $92.90 million in new issuance per quarter, this amounts to an extra issuance of $24.71 million. In both regressions, we obtain statistical significance at the 1% level.

TABLE 4 HERE

In addition to these share classes reaching the 5-year mark, we consider our larger sample of 4/5-star share classes in Table 4 Panel B. Specifically, we run the identical set of regressions as in column (2) of Table 3, i.e., with the 5-star class dummy and MRAR, albeit with the next-quarter new issuance dummy or log new issuance amount as the dependent variable instead of contemporaneous fund flow. Given

that these share classes are much larger in size, we do not impose a minimum holding weight cut-off, although untabulated analysis confirms that results are qualitatively similar with their inclusion. The coefficients in Table 4 Panel B imply that, when a share class moves up from 4 to 5 stars, this increases the likelihood of new issuance among issuers they hold by 0.4% during the subsequent quarter, with a 6.3% increase in the issuance amount, with *t*-statistics exceeding 3.5 in both instances.

Our two sets of identifying regressions in Table 4 strongly indicate that the observed flow-issuance relationship in our baseline regressions in Table 2 is unlikely to be driven solely by omitted variables. Instead, our results point to a strong causal relationship, whereby an exogenously driven investor inflow into mutual fund bondholders is consistent with an ensuing increased willingness on the part of issuers to issue more new bonds. Put differently, an excess supply of capital into mutual funds in turn appears to be absorbed through greater issuance in the primary market, consistent with significant illiquidity, infrequent trading, and transaction cost in the *secondary* market for municipal bonds (e.g., Harris and Piwowar, 2006; Green, Li, and Schürhoff, 2007; Schwert, 2017), with the average holding-level zero-trading-day ratio of municipal bond funds standing at a staggering 85% (Choi, Kronlund, and Oh, 2021). In a market where secondary market purchases are particularly difficult and costly, as is the case of municipal bonds, we observe a strong relation between capital supply and the likelihood of new bond issuance.

3.4. Fund, issuer, and underwriter relationship

A defining characteristic of the municipal bond market is its fragmented structure. For example, 333,905 municipal bond issuances since 2000 with lead underwriter details available in the FTSE Russell Mergent Municipal database were underwritten by 2,023 lead underwriters. This is more than double the number of lead underwriters for corporate bonds, which stands at around 1,000 over the same time period. Many municipal underwriters are local banks, with the market characterized by a much lower combined market share of the top 10 investment banks than the market for IPOs or convertible bond

issuances (Butler, 2008). As for the secondary market, Li and Schürhoff (2019) note a clear core-periphery structure in the municipal bond market, with 10 to 30 highly interconnected dealers at the center but the other 2,000 at the periphery with very little connection. Further contributing to this market segmentation is the fact that in-state and out-of-state residents are often treated differently in terms of state tax privileges, making risk sharing across different states difficult (Babina, Jotikasthira, Lundblad, and Ramadorai, 2021). Due to this market fragmentation, underwriters are known to rely heavily on their established customers; as Schultz (2012) notes, it is usually the underwriters, not the investors, that makes the first contact, approaching likely investors for new issues. Moreover, as Chen, Cohen, and Liu (2021) note, municipal issuers are slow to change their underwriters, with a municipal issuer issuing, on average, 87% of its bonds with the same underwriter.

In this instance, it would be natural to surmise that the observed patterns in fund flow and the likelihood of new issuances by issuers they hold would be stronger when the fund has prior relationship with the issuer or the underwriter. Put differently, when there are reasons to believe that the mutual fund would be a "natural client" of the issuer's bonds, we would expect fund flows and new issuances to bear a stronger association. To answer this question, we first ask whether funds experiencing favorable inflows are more likely to participate in the issuer's new issuance.

$$New\ issuance\ participation\ dummy_{i,t} = \beta_0 + \beta_1 Fund\ flow_{i,t} + Fixed\ effects + \varepsilon_{i,t}. \quad (4)$$

Here, the new issuance participation dummy takes the value of one if a fund holds nonzero amount of the issuer's newly issued bond at the end of the quarter. Unlike the new issuance dummy, this new issuance participation dummy varies within issuer and quarter, so we can include issuer-by-quarter fixed effects and examine the likelihood of participation among funds with different flows for a given issuer and quarter, akin to Khwaja and Mian (2005; 2008). This removes time-varying unobserved

demand-side heterogeneity, which strengthens our identification. Like in the bank setting, this limits the analysis to borrowers with multiple relationships.[16]

In addition to using fund flows at the issuer-fund-quarter level, we also utilize the two Morningstar rating identification strategies shown in Table 4 (both at the issuer-share class-quarter level) to further alleviate any remaining concerns about endogeneity. Table 5 presents our results.

TABLE 5 HERE

Column (1) presents the OLS regression results with issuer-by-quarter fixed effect. We find that a 1% increase in fund flow increases the likelihood of the fund's participation in the issuer's new issuance by 0.02%, even when we engage in within-issuer-quarter comparison by controlling for issuer-by-quarter fixed effect. The results are weaker when we consider the Morningstar rating introduction at the 5-year mark in column (2), with little statistical or economic significance. The 4/5-star share class analysis in column (3) once again reaffirms the OLS regression results in column (1), with a 5-star share class more likely to participate in new issuances even after controlling for MRAR, with a *t*-statistic exceeding 4.

The analysis in Table 5 fails to distinguish whether a fund previously participated in the issuance by the same issuer or in issuances organized by the same underwriter. In fact, this relationship would be at its strongest if the issuer has an established relationship with the underwriter, whom, in turn, shares a strong previous relationship with the fund in question.

To this end, we examine three different definitions of "relationship." First, we consider the relationship between the fund and the issuer. Specifically, a fund and an issuer are said to have a relationship if the fund holds a nonzero amount of the issuer's new issuances within the previous four quarters. Second, we consider the relationship between the fund and the underwriter. We define the relationship in an analogous manner, i.e., if the fund holds a nonzero amount of the new issuances underwritten by the lead underwriter of the new issuances within the previous four quarters. Finally, we

[16] For a discussion of the issue of single-relationship firms see, among many others, Paravisini, Rappoport, and Schnabl (2015), Cahn, Duquerroy, and Mullins (2017), or Degryse, De Jonghe, Jakovljević, Mulier, and Schepens (2018).

consider a two-way relationship between issuer-underwriter and underwriter-fund. Here, we require that the issuer has issued a bond with the lead underwriter of the bond as the underwriter over the past four quarters *and* the fund holds a nonzero amount of the new issuances underwritten by this lead underwriter over the same time horizon. Using these three definitions of the relationship, we interact the key variables in Table 5 with mutually exclusive variables indicating previous relationship history or lack thereof. Table 6 presents our results.

TABLE 6 HERE

In Panel A, we first consider the relationship between the fund and the issuer. The OLS estimates in column (1) imply that funds holding the issuer's bonds in the previous four quarters are almost four times more likely to participate in the said issuer's new issuance after receiving investor flows of the same magnitude. Our two Morningstar identification regressions in (2) and (3) reveal a similar pattern, with an upgraded significantly more likely to engage in new issuances of issuers that they have already interacted in the primary market. In all three instances, we find the interaction term on the previous relationship to be statistically significant at the 1% level.

In addition to the fund-issuer relationship, we document a similarly strong relationship between the fund and the lead underwriter in Panel B. In column (1), the OLS estimates imply that fund flow has insignificant impact on the likelihood of a fund's participation in new issuance if the fund has not bought the underwriter's bonds in the primary market in the previous four quarters. In contrast, we find statistically significant association between fund flow and the likelihood of its participation in new issuance when the fund has previous ties with the lead underwriter of the new issuance, with columns (2) and (3) reaffirming this using the two Morningstar identification settings. As Schultz (2012) notes, our results are consistent with underwriters approaching their established potential clients, informing them of potential new issuances in a highly fragmented market.

Finally, we consider the dual relationship between the fund-issuer and issuer-underwriter in Panel C and obtain the strongest economic and statistical significance. For example, the rating introduction at

the 5-year mark setting in column (2) of Panel C implies that, when the fund has participated in the lead underwriter's issuance within the past four quarters *and* when the issuer has previously issued a bond with the same underwriter, we find the coefficient on the interaction term to almost double compared to when we consider the one-dimensional relationship between the fund and the issuer only. Indeed, regardless of the identification setting, we always find the strongest economic and statistical significance when we consider this dual relationship. Our results in Table 6, particularly the fact that the likelihood of a fund's participation in new issuance grows as the strength of the relationship between the fund, the issuer, and the underwriter is intensified, further signals the importance of the role of previous interactions between the suppliers and the demanders of capital in this supposedly arms-length but highly fragmented market.

4. Additional Evidence on Flow and Issuance

The previous section establishes that investor flows into municipal bond funds are associated with a greater likelihood of issuance by issuers that these funds hold, and that funds are more likely to participate in these issuers' new issuances, particularly when they have an established relationship with the issuer and/or the lead underwriter. In this section, we explore whether the issuers are more likely to issue certain types of bonds over others in response to favorable capital supply conditions.

4.1. Source of repayment

Municipal bonds broadly fall into two categories, namely general obligation (GO) and revenue bonds. GO bonds are issued with a pledge by the municipality to use its taxing powers, if necessary, to meet its obligation, and therefore the issuance of these bonds often requires voter approval at the ballot. Voter approval is not a bygone conclusion by any means, and many of these ballots are fiercely contested, with Cellini, Ferreira, and Rothstein (2010) reporting that the election outcomes of 35% of their sample of school GO bonds are decided by a margin of 5% or less. In contrast, revenue bonds are repaid with cash flows from a revenue-generating entity without an explicit legal pledge from the municipality itself.

Most revenue bonds consequently do not require voter approval as they do not carry a taxing pledge. The additional steps required to undertake the issuance of GO bonds imply that issuers may prefer to issue non-GO bonds, with a markedly lower transactional cost, to take a brisk advantage of favorable supply conditions. We examine whether this is the case in Table 7 by separately considering new issuances with vs. without a GO bond issuance. To this end, we use the two identification strategies outlined in Table 4, but with two separate dependent variables that take the value of one if and only if the issuer issues at least one GO bond during the quarter vs. all new issuances during the quarter are non-GO bonds. Table 7 presents the results.

TABLE 7 HERE

Column (1) presents the results using the rating introduction at the 5-year mark as identification. We find the interaction term to be statistically significant at the 5% level when the issuer engages in issuances involving non-GO bonds only, with the point estimate more than three times larger. Column (2) reveals a similar picture when we consider the 4/5-star share classes, with the coefficient on the 5-star share class indicator three times larger when the issuances do not involve a GO issuance. Our results are thus consistent with issuers taking advantage of temporarily favorable capital supply with issuances that involve lower transactional cost and uncertainties surrounding its passage.

4.2. Capital purpose

We now ask whether the municipalities, in response to favorable capital supply conditions, prefer to engage in new issuances or refund their existing issuances at or nearing the maturity. After all, it is well known that firms actively engage in debt maturity management (e.g., Choi, Hackbarth, and Zechner, 2018; 2021), with firms often taking advantage of favorable credit supply conditions to refinance early and "kick maturity down the road" (e.g., Xu, 2018; Mian and Santos, 2018). Given that municipal bonds carry substantially higher yields compared to the Treasuries even after adjusting for taxes due to a high price of default risk (e.g., Schwert, 2017), an inflow of capital may encourage the issuers to roll over their

existing debt and lengthen the maturity. We examine this issue in Table 8 in a manner similar to Table 7, by separately considering issuer-quarters with issuances involving only new filings vs. those that involve only refundings, using the information on the capital purpose in Mergent Municipal. Table 8 presents the results.

TABLE 8 HERE

Columns (1) and (2) present the results for the rating introduction at the 5-year mark and the 4/5-star share class analysis, respectively. In each instance, we find that the coefficient on the interaction term (for the case of 5-year rating introduction) or the 5-star share class indicator only retains statistical significance when issuances involve only refinancing, with more than twice the economic magnitude of issuances involving only new filings. As in the case of GO vs. non-GO issuances earlier, refinancing issuances are associated with lower administrative burden and other transaction costs, making it easier for the issuers to take advantage of capital supply inflows in a short span of time. It thus appears that issuers are more likely to use a temporary, exogenous inflow of capital for refinancing purposes.

4.3. Use of proceeds

Issuers use their debt financing for a variety of uses, ranging from public services, transport, education, and healthcare. In addition to these specific uses, they may also use it as a form of "working capital" for general and other miscellaneous uses. Adelino, Cunha, and Ferreira (2017) find that additional bond financing that resulted from rating upgrades following Moody's recalibration of municipal bond rating scale is known to have a heterogeneous impact on private employment, with some sectors responding noticeably stronger than the others. Moreover, whereas the effect of policies that are designed to affect certain municipal sectors more than others have been well examined (e.g., Gao, Lee, and Murphy, 2021), it remains to be examined whether an exogenous supply of capital would affect certain sectors more so than others.

We collect the use of proceeds information associated with each bond issuance in Mergent Municipal and group them into seven specific uses and a general use category: (1) public service, environment, and recreation, (2) financial, housing, and development, (3) transport, (4) utilities, (5) higher education, (6) other (primary and secondary) education, (7) healthcare, and (8) general purpose and others. We then re-estimate our two Morningstar identification settings, albeit separately for each dependent variable that takes the value of one when the issuer issues at least one bond satisfying each of the criteria above during the quarter, respectively. Table 9 presents our results.

TABLE 9 HERE

Panel A of Table 9 reports the results for the rating introduction at the 5-year mark akin to column (1) of Tables 7 and 8. We obtain statistical significance at the 5% level when we consider issuances involving financial, housing, and development, with further marginal significance for transport and higher education sectors. In contrast, all other uses of proceeds lack statistical significance, with the point estimates close to zero in many instances. Panel B then reports the results of 4/5-star share class analysis. Once again, we find strong statistical significance when considering new issuances involving financial, housing, and development, with significance at the 1% level. In addition, other education (which involves primary and secondary education) also turns out to be significant at the 5% level. Thus, across two different sets of analyses, we obtain a consistently strong association between fund flow and issuances involving financial, housing, and development, with some additional evidence of increased likelihood of issuance in the education sector. Overall, our evidence in Table 9 suggests that additional supply of capital appears to be primarily driven toward financial, housing and development endeavors.

4.4. Green bond issuance

Lastly, we ask whether investor flows into municipal bond funds has a differential impact on the likelihood of green vs. non-green bond issuance. As Larcker and Watts (2020) note, the market for municipal bonds has grown at a fast pace, and the number of municipal green bond issuances is far larger

than that of corporate bonds (Baker, Bergstresser, Serafeim, and Wurgler, 2018).[17] Though there are a number of papers that examine the characteristics of municipal green bond issuances as well as that of corporate green bonds,[18] it remains to be examined whether an exogenous inflow of capital affects the likelihood of green and non-green issuances in a different manner. We examine this in Table 10 by separately considering issuer-quarters with new issuances that involve at least one green bond issuance vs. those that involve only non-green issuances. We then proceed in the identical manner as in Tables 7 and 8, utilizing our two Morningstar identification settings.

TABLE 10 HERE

Regardless of the identification methodology involved, we find that most of the effect of additional inflow of investor capital into mutual fund bondholders is concentrated among non-green issuances; in both columns (1) and (3), we find that the coefficient on the interaction term or 5-star share class indicator is not only statistically insignificant but also very close to zero in point estimate when we focus on issuer-quarters with at least one new green bond issuance. In contrast, columns (2) and (4) reveal that the coefficients are virtually identical to our headline results when we focus on non-green issuances only, suggesting that fund flow has an insignificant impact on the likelihood of green bond issuance. Given that green bond issuance often involves third party verifications (e.g., Flammer, 2021) and thus takes more administrative steps to be completed, it may explain the issuers' reluctance to issue green bonds in response to a temporary inflow of investor capital.

5. Conclusion

This paper uses a novel identification strategy to identify the effect of mutual fund flows on bond issuance. In order to generate variation in flows that is orthogonal to fund fundamentals we use the

[17] For example, in their sample ending in 2016, Baker, Bergstresser, Serafeim, and Wurgler (2018) report 2,083 municipal green bond issuances compared to 19 for corporate green bonds.
[18] For municipal green bonds, see, e.g., Baker, Bergstresser, Serafeim, and Wurgler (2018) and Larcker and Watts (2020). For corporate green bonds, see, e.g., Zerbib (2019), Tang and Zhang (2020), and Flammer (2021).

introduction of Morningstar ratings at the five-year mark. When funds obtain a 5-star overall rating due to the addition of a new 5-year rating we observe significant inflows despite the absence of new information that this new rating provides. These inflows, in turn, lead to more bond issuance and larger issues on the part of issuers already held by these funds.

Capital flows to issuers according to existing relationships at the underwriter-fund-issuer level, suggesting an important role for relationships in what looks at first sight as an arms-length market. Issuers are more likely to use supply-driven funds to refinance existing issues and to issue bonds with lower costs of issuance such as non-general-obligation and non-green bonds. Overall, we find strong evidence of a supply-side effect in municipal financing that operates through lender-borrower relationship, with issuers taking advantage of favorable capital supply conditions emanating from fund investor inflows.

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Appendix. Variable descriptions

In this table, we provide detailed definition of the variables in our empirical analysis, with the data source in parentheses.

A.1. Issuer characteristics

New issuance dummy (Mergent Municipal): An indicator variable that takes the value of one when a municipal issuer issues a bond in a given quarter.

Log new issuance amount (Mergent Municipal): Log of the total amount of bond issuance by a municipal issuer in a given quarter. For all issuer-quarters without issuance, this value is set to zero.

Total assets (Bloomberg): The sum of short- and long-term assets on the issuer's balance sheet.

Total liabilities (Bloomberg): The sum of short- and long-term liabilities on the issuer's balance sheet.

Sales revenue (Bloomberg): The revenue generated after the deduction of sales returns, allowances, discounts, and sales-based taxes, including the subsidies from federal or local government.

Tax revenue (Bloomberg): The sum of income tax revenues, property tax revenues, sales and use tax revenues, tourist taxes, franchise taxes, and other tax revenues.

Pension underfunding (Bloomberg): The difference between the fair value of the plan assets less the projected benefit obligation. The pension plan is over(under)funded if the plan assets exceed (do not exceed) the projected benefit obligation.

Personal income (Bureau of Economic Analysis): Personal income from wages and salaries, social security and other government benefits, dividends and interest, business ownership, and other sources per capita in the issuer's county, in thousands of dollars, as provided by the Bureau of Economic Analysis.

Unemployment rate (Bureau of Labor Statistics): Number of unemployed persons divided by the labor force in the issuer's county, as reported in the Bureau of Labor Statistics.

A.2. Fund characteristics

Morningstar Risk-Adjusted Return (MRAR, Morningstar): Morningstar provides information on each share class's MRAR over 3- , 5- , and 10-year horizons. Overall MRAR is calculated in the following manner. For funds between the age of 36 and 59 months, we use the 3-year MRAR to calculate the overall MRAR. For funds between the age of 60 and 119 months, we average the 3- and 5-year MRAR with 40% and 60% weights, respectively. For funds older than 10 years, we average the 3-, 5-, and 10-year MRAR with 20%, 30%, and 50% weights, respectively.

Morningstar overall star rating (Morningstar): Morningstar uses 3-, 5-, and 10-year MRAR to calculate the star rating over specific time horizons. At the end of each month, all share classes belonging to the same Morningstar categories are ranked on the basis of MRAR over the horizon of interest, and the top 10% receive 5 stars, the next 22.5% 4 stars, the next 35% 3 stars, the next 22.5% 2 stars, and the bottom 10% 1 star. Then, the overall rating score is calculated as follows.

1. Share classes below the age of three years are not rated.
2. The overall rating score of share classes between the age of 36 and 59 months is the 3-year star rating.
3. The overall rating score of share classes between the age of 60 and 119 months places 40% weight on the 3-year star rating and 60% weight on the 5-year star rating, respectively.
4. The overall rating score of share classes older than or equal to 10 years places 20% weight on the 3-year star rating, 30% weight on the 5-year star rating, and 50% weight on the 10-year star rating, respectively.

The overall star rating is the rounded integer value of the overall rating score.

Fund return (CRSP MF): Time-weighted total return of a fund during a quarter, compounded using monthly returns.

Fund flow (CRSP MF): We estimate monthly flows using monthly returns as follows:

$$Flow_{j,t} = \frac{TNA_{j,t} - TNA_{j,t-1}(1 + r_{j,t})}{TNA_{j,t-1}}$$

where $TNA_{j,t}$ is fund *j*'s total net assets and $r_{j,t}$is the monthly return of fund *j* at month *t*. We compound monthly fund flows during a quarter to arrive at quarterly fund flow.

Fund size (CRSP MF): Natural log of the fund's previous quarter-end total net assets.

Fund age (CRSP MF): Years since the first appearance of the oldest share class on the CRSP Mutual Fund file.

Expense ratio (CRSP MF): Expense ratio as reported in the CRSP Mutual Funds database.

A.3. Issue characteristics

General obligation (GO) issue (Mergent Municipal): An issue whose source of repayment is not from a specific project but backed by the credit and taxing power of the issuer, as reported in Mergent Municipal.

Revenue bond issue (Mergent Municipal): An issue whose source of repayment is backed by the revenues from a specific project and does not have general recourse, as reported in Mergent Municipal.

New filing issue (Mergent Municipal): An issue where the proceeds from the issuance is new money to the issuer, as reported in Mergent Municipal.

Refunding issue (Mergent Municipal): An issue whose issuance replaces an outstanding bond, as reported in Mergent Municipal.

Green bond (Bloomberg/Mergent Municipal): A bond that is flagged to be green bonds by both Bloomberg and Mergent Municipal.

Table 1. Summary statistics

This table reports summary statistics on the sample of issuance and fund-level data. The sample period runs from 2000Q1 through 2020Q3. We report issuer characteristics in Panel A, while fund characteristics are presented in Panel B. For a detailed description of the definition of each variable, see the appendix. Continuous variables are winsorized at the 1% and 99% levels; these summary statistics are computed using these winsorized values.

Panel A. Issuer characteristics

	Obs.	Mean	St. Dev.	P1	P25	P50	P75	P99
New issuance dummy	831,257	0.142	0.349	0.000	0.000	0.000	0.000	1.000
New issuance amount ($ millions)	116,805	58.37	85.28	0.710	8.570	21.75	62.85	325.1
New issuance / Total outstanding	116,773	0.208	0.181	0.002	0.054	0.143	0.344	0.527
Total asset ($ billions)	336,480	0.319	1.073	0.000	0.008	0.027	0.105	7.771
Total liabilities ($ billions)	305,236	0.218	0.741	0.000	0.003	0.011	0.058	5.266
Leverage	305,215	0.514	0.650	0.004	0.174	0.378	0.652	5.010
Population (millions)	781,663	0.952	1.730	0.009	0.125	0.373	0.933	9.876
Personal income per capita ($ thousands)	781,663	39.92	13.77	18.24	30.21	37.70	46.53	92.25
Unemployment rate (%)	779,128	5.901	2.484	2.300	4.100	5.300	7.100	14.40
Average percentage held per fund (%)	798,758	30.07	39.30	0.105	3.660	13.33	42.19	100.0
Total percentage held by funds (%)	798,758	48.45	49.01	0.633	16.67	34.49	67.62	100.0

Panel B. Fund characteristics

	Obs.	Mean	St. Dev.	P1	P25	P50	P75	P99
Morningstar overall rating	45,353	3.471	0.982	1.000	3.000	3.000	4.000	5.000
Fund flow (%, per quarter)	51,041	0.132	7.229	-16.39	-2.958	-0.844	1.779	33.85
Fund size ($ millions)	51,041	657.2	1,291.4	5.800	75.50	192.6	578.3	7,852.3
Fund return (%, per quarter)	51,041	1.055	1.954	-5.121	0.065	1.014	2.166	6.441
Fund age	51,041	17.98	8.689	1.166	11.49	17.60	24.24	38.75
Expense ratio (%)	50,941	0.782	0.246	0.120	0.630	0.778	0.936	1.503
Number of bonds held	59,628	190.9	244.8	9.000	60.00	106.0	208.0	1,460.0
Number of issuers held	59,628	95.08	102.6	7.000	35.00	57.00	109.0	560.0

Panel C. Issuance characteristics by state

State	No. of new issuances	No. of new filings	No. of refundings	No. of GO issuances	No. of revenue bond issuances	No. of green bond issuances	Total new issuance amount ($ millions)	New issuance / Total outstanding (%)
AK	4,703	2,654	2,018	699	1,318	0	23.12	3.45
AL	25,592	11,732	13,741	4,742	8,088	35	86.03	3.50
AR	17,688	9,027	8,589	3,158	5,767	127	30.69	4.14
AZ	33,531	20,883	12,433	6,644	9,989	162	155.8	3.88
CA	248,005	139,252	106,861	56,268	81,225	1,372	1,490.7	3.55
CO	38,064	19,565	17,860	5,456	13,283	106	179.2	3.72
CT	35,011	21,238	13,397	11,284	5,916	140	158.7	4.68
DE	3,983	2,170	1,789	849	1,023	1	21.45	2.84
FL	65,786	32,822	32,209	1,384	28,846	113	383.7	3.30
GA	28,799	16,328	12,036	2,456	11,781	3	189.7	3.44
HI	7,479	4,385	3,025	2,495	1,664	80	56.88	3.25
IA	17,742	11,411	6,270	4,674	4,945	122	44.87	4.55
ID	7,858	4,836	2,984	1,341	2,403	0	24.95	3.97
IL	60,518	31,919	27,706	17,870	11,436	153	380.0	3.55
IN	35,400	18,348	16,606	956	16,797	331	139.1	3.87
KS	37,033	19,375	17,544	9,094	8,786	38	66.37	3.85
KY	33,002	18,468	13,884	2,337	14,449	85	91.48	3.47
LA	19,411	11,026	8,046	3,018	7,200	28	93.94	3.38
MA	49,818	25,332	24,083	15,032	11,671	508	316.0	5.29
MD	32,510	19,130	13,180	7,709	8,754	134	170.3	3.42
ME	12,185	7,717	4,422	2,286	4,029	88	29.19	3.76
MI	56,912	29,539	26,748	15,219	10,242	76	240.5	3.22
MN	72,139	47,483	24,316	17,411	12,296	167	143.7	3.80
MO	37,803	21,619	15,923	5,340	13,322	44	120.7	3.92
MS	15,600	10,833	4,710	1,820	5,154	11	44.28	3.26
MT	7,140	4,643	2,470	1,775	1,894	0	13.50	5.04
NC	34,857	20,621	14,054	5,328	11,986	30	151.3	3.68
ND	9,834	4,646	5,011	741	4,128	21	14.19	4.39
NE	23,037	12,195	10,794	4,021	5,623	11	62.91	4.47
NH	7,968	4,961	2,733	1,707	2,278	1	26.82	4.19
NJ	62,723	32,973	29,394	14,704	16,044	495	352.3	5.10
NM	13,355	9,307	3,911	1,908	4,804	46	50.85	4.11
NV	15,033	8,805	5,924	1,824	3,075	7	80.76	3.66
NY	137,646	82,325	53,197	27,391	36,867	1,310	1,219.1	5.85
OH	79,928	39,618	39,672	23,021	16,197	317	281.2	3.83
OK	16,397	10,896	5,131	1,706	7,642	0	56.53	4.64
OR	28,865	17,801	11,002	8,213	6,133	97	101.6	3.63
PA	88,296	39,131	48,370	23,521	18,612	252	375.7	3.52
RI	12,500	8,102	4,332	1,871	4,394	219	33.38	3.86
SC	23,528	12,781	10,581	4,725	6,778	26	105.6	3.73
SD	5,124	2,661	2,389	548	2,278	0	15.32	3.23
TN	27,858	13,322	14,130	6,614	7,466	91	118.1	3.38
TX	185,846	96,058	88,487	67,421	31,291	270	896.5	3.97
UT	15,548	8,976	6,417	2,366	5,906	64	64.17	3.66
VA	39,440	21,615	16,691	6,131	14,082	47	172.7	3.51
VT	5,432	3,333	2,038	890	2,165	96	15.12	3.20
WA	40,567	21,628	18,653	8,517	11,425	276	221.3	3.58
WI	31,658	17,001	14,398	10,129	7,020	108	130.7	5.09
WV	6,315	3,033	3,233	432	2,817	0	23.82	3.20
WY	2,211	1,228	935	14	939	0	8.81	2.92
Total	1,917,678	1,054,752	844,327	425,060	532,228	7,708	9,273.6	3.97

Table 2. Fund flow and municipal bond issuance

In this table, we examine the relationship between fund flow and the issuance decision of the municipal issuers held by the fund. In Panel A, we report the OLS regression results of the new issuance dummy on contemporaneous fund flow. New issuance dummy takes the value of one if whenever a municipal issuer issues a bond during the quarter. In columns (1) and (2), we run regressions at the issuer-quarter level, with the flows of all mutual fund bondholders weighted by their holding share as a percentage of the issuer's total amount of bonds outstanding. In columns (3) and (4), we run regressions at the issuer-fund-quarter level. In columns (2) and (4), we include the following issuer controls: (county-level) log personal income per capita, log population, and unemployment rate, and (issuer-level) leverage, log total assets, log sales revenue, log tax revenue, and log pension underfunding. For each control, we replace missing values with zero and further include an indicator variable for missing information. In column (4), we further control for the fund's return, size, and expense ratio. In all instances, we control for issuer and state-by-quarter fixed effects. Then, in Panel B, we repeat the same analysis with the log new issuance amount as the dependent variable instead. The sample period is from 2000Q1 to 2020Q3. *t*-statistics based on standard errors robust to heteroskedasticity and two-way clustered by issuer and quarter are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. New issuance dummy

	Dependent variable: New issuance dummy			
	(1)	(2)	(3)	(4)
Fund flow	0.039**	0.038*	0.077***	0.076***
	(2.001)	(1.962)	(15.462)	(15.570)
Issuer controls	NO	YES	NO	YES
Fund controls	NO	NO	NO	YES
No. of observations	787,851	787,851	4,551,560	4,500,024
Adjusted R-squared	0.181	0.182	0.377	0.377
Issuer FE	YES	YES	YES	YES
State-by-quarter FE	YES	YES	YES	YES

Panel B. Log new issuance amount

	Dependent variable: Log new issuance amount			
	(1)	(2)	(3)	(4)
Fund flow	0.738**	0.712**	1.389***	1.383***
	(2.146)	(2.083)	(15.144)	(15.353)
Issuer controls	NO	YES	NO	YES
Fund controls	NO	NO	NO	YES
No. of observations	787,851	787,851	4,551,560	4,500,024
Adjusted R-squared	0.195	0.196	0.405	0.405
Issuer FE	YES	YES	YES	YES
State-by-quarter FE	YES	YES	YES	YES

Table 3. Morningstar rating changes and fund flow

In this table, we present the result of two separate analyses examining the effect of Morningstar rating changes on contemporaneous fund flow. First, in column (1), we engage in a difference-in-difference analysis of share classes when they reach the age of 5 years, at which point a new Morningstar 5-year rating becomes available, with a consequent change in the rating methodology for the overall star rating. We define the awarding of the 5-year rating as the "event quarter." Then, we focus on all classes whose overall star rating either goes up or remains the same during the event quarter and compute the rating change at the 5-year event quarter. We then focus on four quarters prior to and after the awarding of the 5-year rating as our event window. We interact the rating change at 5-year, which takes the value of the change in the star rating throughout the event window, with the post 5-year dummy (the standalone rating change at 5-year term is subsumed by the inclusion of share class fixed effect). We then use fund flow as the dependent variable for the difference-in-difference analysis. Second, in column (2), we run OLS regressions of fund flow on 5-star indicator, which takes the value of one for 5-star classes, for share classes rated either 4 or 5 stars with an overall rating score of above or equal to 4.0. We focus on within-share-class variation in Morningstar star rating through the inclusion of share class fixed effect. In both instances, we further include Morningstar risk-adjusted return (MRAR), the continuous running variable used for the construction of Morningstar star rating, as a control. Regressions are conducted at the share class-quarter level. We control for share class and quarter fixed effects. *t*-statistics based on standard errors robust to heteroskedasticity and two-way clustered by issuer and quarter are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: Fund flow	
	(1)	(2)
Post 5-year dummy	-0.002	
	(-0.242)	
Rating change at 5-year × Post 5-year dummy	0.031**	
	(2.374)	
5-star class indicator		0.012***
		(3.519)
MRAR	0.016***	0.017***
	(3.489)	(5.242)
No. of observations	6,740	19,956
Adjusted R-squared	0.232	0.224
Share class FE	YES	YES
Quarter FE	YES	YES

Table 4. Morningstar rating changes and issuance decisions

In this table, we repeat the analysis in Table 3, albeit using the next-quarter new issuance dummy or log new issuance amount as the dependent variable instead. Panel A corresponds to column (1) of Table 3, and Panel B corresponds to column (2). When considering the 5-year rating introduction in Panel A, we focus on all issuers whose outstanding bonds are held by the share classes reaching the 5-year mark with a holding weight equal to or greater than 2.5% during the quarter preceding the 5-year mark. All regressions are conducted at the issuer-share class-quarter level. We further control for MRAR as well as issuer, share class, and state-by-quarter FE in all instances. *t*-statistics based on standard errors robust to heteroskedasticity and two-way clustered by issuer and quarter are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Rating introduction at the 5-year mark

	Dependent variable	
	(1)	(2)
	New issuance dummy	Log new issuance amount
Post 5-year dummy	0.002	-0.002
	(0.335)	(-0.021)
Rating change at 5-year × Post 5-year dummy	0.013***	0.266***
	(2.834)	(3.241)
MRAR	0.000	0.013
	(0.292)	(0.497)
No. of observations	250,148	250,148
Adjusted R-squared	0.435	0.463
Share class FE	YES	YES
Issuer FE	YES	YES
State-by-quarter FE	YES	YES

Panel B. 4/5-star share classes

	Dependent variable	
	(1)	(2)
	New issuance dummy	Log new issuance amount
5-star class indicator	0.004***	0.063***
	(3.629)	(3.589)
MRAR	0.001	0.016
	(0.777)	(0.870)
No. of observations	2,386,429	2,386,429
Adjusted R-squared	0.378	0.403
Share class FE	YES	YES
Issuer FE	YES	YES
State-by-quarter FE	YES	YES

Table 5. Fund flow and muni bond issuance: Within-issuer-quarter effects

In this table, we examine whether funds experiencing inflows are more likely to participate in the new issuances of the issuers they hold. In column (1), we report the OLS regression results of the new issuance participation dummy on contemporaneous fund flow. New issuance participation dummy takes the value of one if a fund purchases non-zero amount of an issuer's new issuance. We then run regressions at the issuer-share class-quarter level. For further identification purposes, in column (2), we utilize our 5-year rating introduction analysis in Table 3, and in column (3), we use the 4/5-star share class analysis in Table 4 to examine the likelihood of a fund's participation in new issuance. In column (1), we include issuer-by-quarter fixed effect, while we control for MRAR as well as issuer-by-quarter and share class FE in columns (2) and (3). *t*-statistics based on standard errors robust to heteroskedasticity and two-way clustered by issuer and quarter are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: New issuance participation dummy		
	(1)	(2)	(3)
Fund flow	0.015***		
	(11.777)		
Rating change at 5-year ×		-0.001	
Post 5-year dummy		(-0.412)	
5-star class indicator			0.003***
			(4.029)
No. of observations	15,856,904	219,737	2,428,757
Adjusted R-squared	0.402	0.604	0.478
Issuer-by-quarter FE	YES	YES	YES
Share class FE	NO	YES	YES

Table 6. Fund flow and muni bond issuance: The role of fund-issuer-underwriter relationship

In this table, we examine the likelihood of a mutual fund bondholder's likelihood of participation in the issuer's new issuance, albeit separately for those with vs. without a previous relationship. Relationship is defined at: (i) fund-issuer level, i.e., when the fund has participated in the issuer's primary market issuance within the past four quarters, (ii) fund-underwriter level, i.e., when the fund has participated in an issuance underwritten by the lead underwriter of the issuer's new issuance within the past four quarters, and (iii) issuer-fund-underwriter level, i.e., when the fund has participated in the lead underwriter's new issuance within the past four quarters *and* the issuer has issued a new issuance underwritten by the said underwriter within the past four quarters. All other specifications are identical to Table 5. *t*-statistics based on standard errors robust to heteroskedasticity and two-way clustered by issuer and quarter are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Fund-issuer relationship

	Dependent variable: New issuance participation dummy		
	(1)	(2)	(3)
Variable of interest:	Fund flow	Rating change at 5-year × Post 5-year	5-star class indicator
Variable of interest: × Prev. relationship dummy	0.036*** (9.335)	0.024*** (4.540)	0.045*** (16.527)
Variable of interest: × No prev. relationship dummy	0.010*** (7.292)	-0.013*** (-4.029)	-0.010*** (-9.791)
No. of observations	15,856,904	219,740	2,428,757
Adjusted R-squared	0.398	0.593	0.400
Issuer-by-quarter FE	YES	YES	YES
Share class FE	NO	YES	YES

Panel B. Fund-underwriter relationship

	Dependent variable: New issuance participation dummy		
	(1)	(2)	(3)
Variable of interest:	Fund flow	Rating change at 5-year × Post 5-year	5-star class indicator
Variable of interest: × Prev. relationship dummy	0.030*** (9.334)	0.010** (2.365)	0.020*** (15.683)
Variable of interest: × No prev. relationship dummy	-0.001 (-0.944)	-0.017*** (-4.981)	-0.022*** (-18.467)
No. of observations	15,856,904	219,740	2,428,757
Adjusted R-squared	0.398	0.593	0.399
Issuer-by-quarter FE	YES	YES	YES
Share class FE	NO	YES	YES

Panel C. Fund-issuer-underwriter relationship

	Dependent variable: New issuance participation dummy		
	(1)	(2)	(3)
Variable of interest:	Fund flow	Rating change at 5-year × Post 5-year	5-star class indicator
Variable of interest: × Prev. relationship dummy	0.058*** (9.704)	0.048*** (6.525)	0.064*** (18.198)
Variable of interest: × No prev. relationship dummy	0.008*** (6.354)	-0.013*** (-4.368)	-0.009*** (-9.974)
No. of observations	15,856,904	219,740	2,428,757
Adjusted R-squared	0.398	0.594	0.401
Issuer-by-quarter FE	YES	YES	YES
Share class FE	NO	YES	YES

Table 7. Fund flow and muni bond issuance: Source of repayment

In this table, we present the extensive and intensive margin issuance regressions in columns (2) and (3) of Table 3 using the two Morningstar identifications in Tables 3 and 4, albeit separately for issuances involving at least one general obligation (GO) bonds vs. those that do not involve GO bonds. All specifications include MRAR as control as well as issuer, share class, and state-by-quarter fixed effects. *t*-statistics based on standard errors robust to heteroskedasticity and two-way clustered by issuer and quarter are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. New issuance dummy

	Dependent variable: New issuance dummy			
	(1)	(2)	(3)	(4)
	At least one GO issuance	No GO issuance	At least one GO issuance	No GO issuance
Rating change at 5-year × Post 5-year dummy	0.003	0.010**		
	(1.607)	(2.513)		
5-star class indicator			0.001**	0.003***
			(2.056)	(3.354)
No. of observations	250,148	250,148	2,386,429	2,386,429
Adjusted R-squared	0.358	0.419	0.326	0.368
Issuer FE	YES	YES	YES	YES
Share class FE	YES	YES	YES	YES
State-by-quarter FE	YES	YES	YES	YES

Panel B. Log new issuance amount

	Dependent variable: Log new issuance amount			
	(1)	(2)	(3)	(4)
	At least one GO issuance	No GO issuance	At least one GO issuance	No GO issuance
Rating change at 5-year × Post 5-year dummy	0.059*	0.207***		
	(1.710)	(2.996)		
5-star class indicator			0.014*	0.048***
			(1.966)	(3.311)
No. of observations	250,148	250,148	2,386,429	2,386,429
Adjusted R-squared	0.386	0.441	0.357	0.388
Issuer FE	YES	YES	YES	YES
Share class FE	YES	YES	YES	YES
State-by-quarter FE	YES	YES	YES	YES

Table 8. Fund flow and muni bond issuance: Capital purpose

In this table, we present the extensive and intensive margin issuance regressions in columns (2) and (3) of Table 3 using the two Morningstar identifications in Tables 3 and 4, albeit separately for issuances involving new filings only vs. those that only consist of refundings. All specifications include MRAR as control as well as issuer, share class, and state-by-quarter fixed effects. *t*-statistics based on standard errors robust to heteroskedasticity and two-way clustered by issuer and quarter are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. New issuance dummy

	Dependent variable: New issuance dummy			
	(1)	(2)	(3)	(4)
	New filing issuance only	Refunding issuance only	New filing issuance only	Refunding issuance only
Rating change at 5-year × Post 5-year dummy	0.004	0.009**		
	(1.036)	(2.225)		
5-star class indicator			0.001	0.003***
			(1.167)	(3.268)
No. of observations	250,148	250,148	2,386,429	2,386,429
Adjusted R-squared	0.261	0.316	0.216	0.275
Issuer FE	YES	YES	YES	YES
Share class FE	YES	YES	YES	YES
State-by-quarter FE	YES	YES	YES	YES

Panel B. Log new issuance amount

	Dependent variable: Log new issuance amount			
	(1)	(2)	(3)	(4)
	New filing issuance only	Refunding issuance only	New filing issuance only	Refunding issuance only
Rating change at 5-year × Post 5-year dummy	0.097	0.170**		
	(1.417)	(2.379)		
5-star class indicator			0.016	0.047***
			(1.045)	(3.178)
No. of observations	250,148	250,148	2,386,429	2,386,429
Adjusted R-squared	0.265	0.333	0.221	0.293
Issuer FE	YES	YES	YES	YES
Share class FE	YES	YES	YES	YES
State-by-quarter FE	YES	YES	YES	YES

Table 9. Fund flow and muni bond issuance: Use of proceeds

In this table, we re-run the new issuance dummy regression in column (2) of Tables 3 and 4, albeit separately for issuances with the following use of proceeds as reported in Mergent Municipal: public service, environment, and recreation; financial, housing, and development; transport; utilities; higher education; education; healthcare. In addition to these seven specific categories, we also include general purpose and other uses. In Panel A, we consider the 5-year rating introduction subsample in Table 3, while we consider the 4/5-star funds as in Table 4 in Panel B. All specifications include MRAR as control as well as issuer, share class, and state-by-quarter fixed effects. *t*-statistics based on standard errors robust to heteroskedasticity and two-way clustered by issuer and quarter are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Rating introduction at the 5-year mark

	Dependent variable: New issuance dummy							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Use of proceeds	Public service, environment, and recreation	Financial, housing, and development	Transport	Utilities	Higher education	Other education	Healthcare	General purpose and others
5-star class indicator	-0.002	0.003**	0.003*	0.003	0.002*	0.000	0.002	0.002
	(-1.370)	(2.158)	(1.880)	(1.351)	(1.735)	(0.301)	(1.184)	(0.569)
No. of observations	250,148	250,148	250,148	250,148	250,148	250,148	250,148	250,148
Adjusted R-squared	0.199	0.363	0.322	0.282	0.469	0.279	0.443	0.259
Issuer FE	YES	YES	YES	YES	YES	YES	YES	YES
Share class FE	YES	YES	YES	YES	YES	YES	YES	YES
State-by-quarter FE	YES	YES	YES	YES	YES	YES	YES	YES

Panel B. 4/5-star share classes

	Dependent variable: New issuance dummy							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Use of proceeds	Public service, environment, and recreation	Financial, housing, and development	Transport	Utilities	Higher education	Other education	Healthcare	General purpose and others
Rating change at 5-year ×	0.000*	0.001***	-0.000	0.000	0.000	0.001**	0.000	0.000
Post 5-year dummy	(1.697)	(2.751)	(-0.247)	(1.386)	(1.465)	(2.242)	(1.287)	(0.615)
No. of observations	2,386,429	2,386,429	2,386,429	2,386,429	2,386,429	2,386,429	2,386,429	2,386,429
Adjusted R-squared	0.208	0.359	0.318	0.272	0.426	0.260	0.416	0.232
Issuer FE	YES	YES	YES	YES	YES	YES	YES	YES
Share class FE	YES	YES	YES	YES	YES	YES	YES	YES
State-by-quarter FE	YES	YES	YES	YES	YES	YES	YES	YES

Table 10. Fund flow and muni bond issuance: Green vs. non-green bonds

In this table, we re-run the new issuance dummy regression in column (2) of Tables 3 and 4, albeit separately for issuances involving at least one green bond issuance vs. those that only involve non-green issuances. We consider the 5-year rating introduction specification in Table 3 column (2) in columns (1) and (2), while we focus on the 4/5-star share classes in columns (3) and (4). All specifications include MRAR as control as well as issuer, share class, and state-by-quarter fixed effects. *t*-statistics based on standard errors robust to heteroskedasticity and two-way clustered by issuer and quarter are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: New issuance dummy			
	(1)	(2)	(3)	(4)
	At least one green issuance	No green issuance	At least one green issuance	No green issuance
Rating change at 5-year × Post 5-year dummy	-0.000	0.013***		
	(-0.021)	(2.874)		
5-star class indicator			0.000	0.003***
			(1.092)	(3.442)
No. of observations	250,148	250,148	2,386,429	2,386,429
Adjusted R-squared	0.267	0.457	0.197	0.366
Issuer FE	YES	YES	YES	YES
Share class FE	YES	YES	YES	YES
State-by-quarter FE	YES	YES	YES	YES

Figure 1. Holders of municipal bonds

In this figure, we use the December 2020 release of the Federal Reserve's Financial Accounts of the United States (Z.1) item L.212 to graphically illustrate the percentage holding of municipal bonds by various financial institutions.

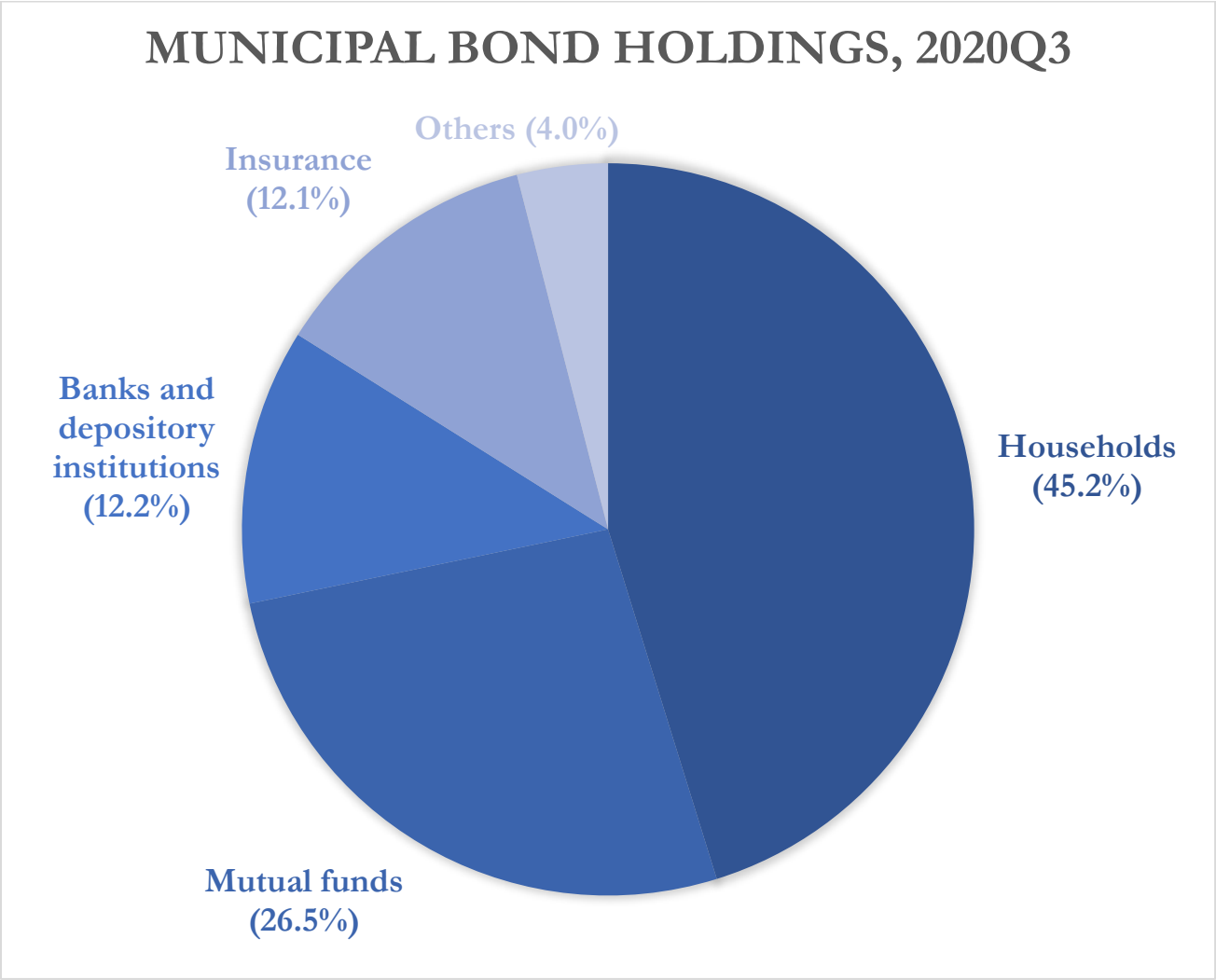
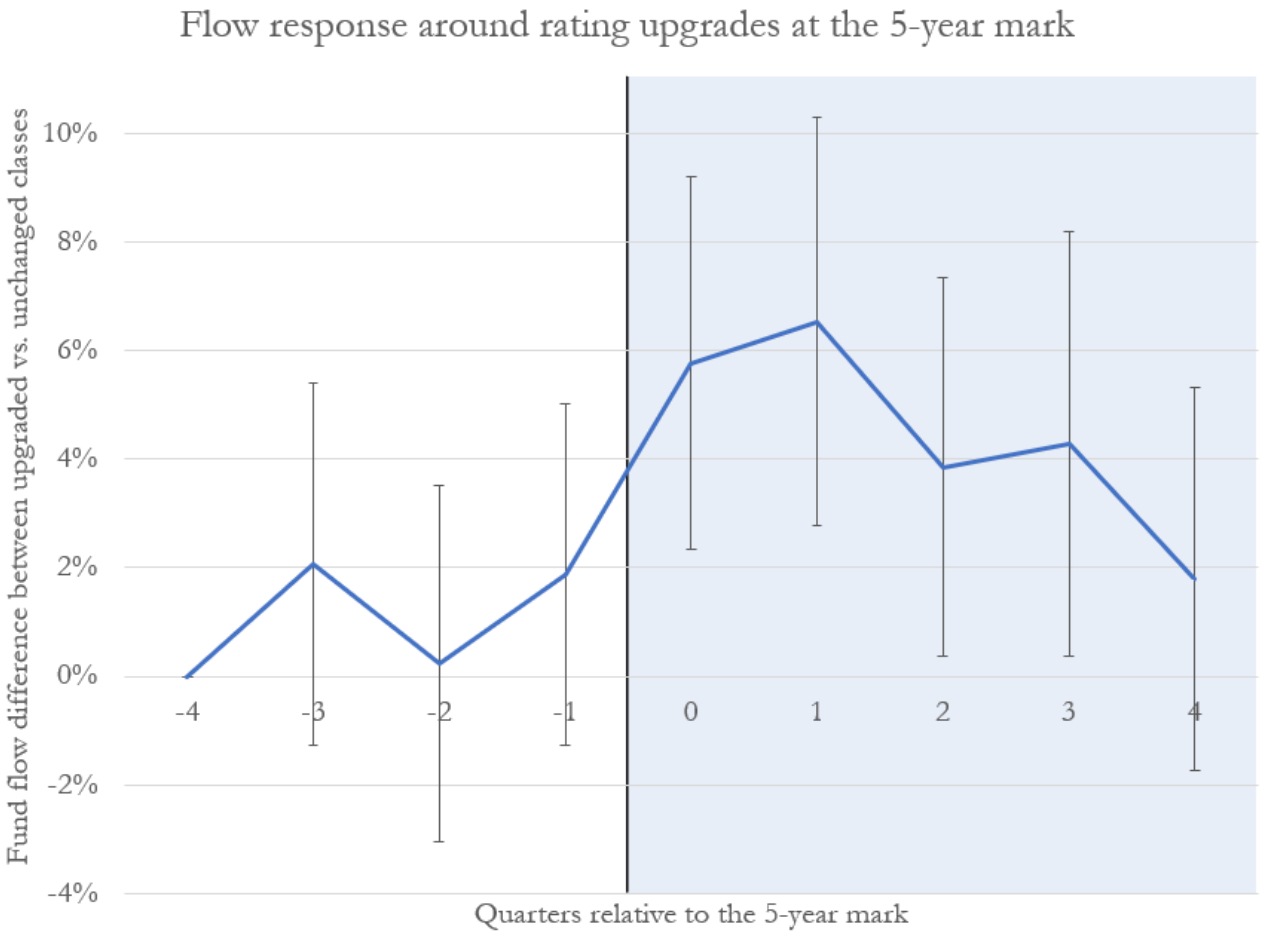


Figure 2. Morningstar star rating change at 5-year rating introduction

In this table, we compute the difference in quarterly flows or the likelihood of new issuance between share classes that experience an upward changing at their 5-year, when the Morningstar's star rating calculation method changes, and those that remain at their previous star rating. The quarter at which a share class reaches the age of 5 years is defined as quarter 0. Error bars denote the 90% confidence interval.

Panel A. Fund Flow



Panel B. New issuance

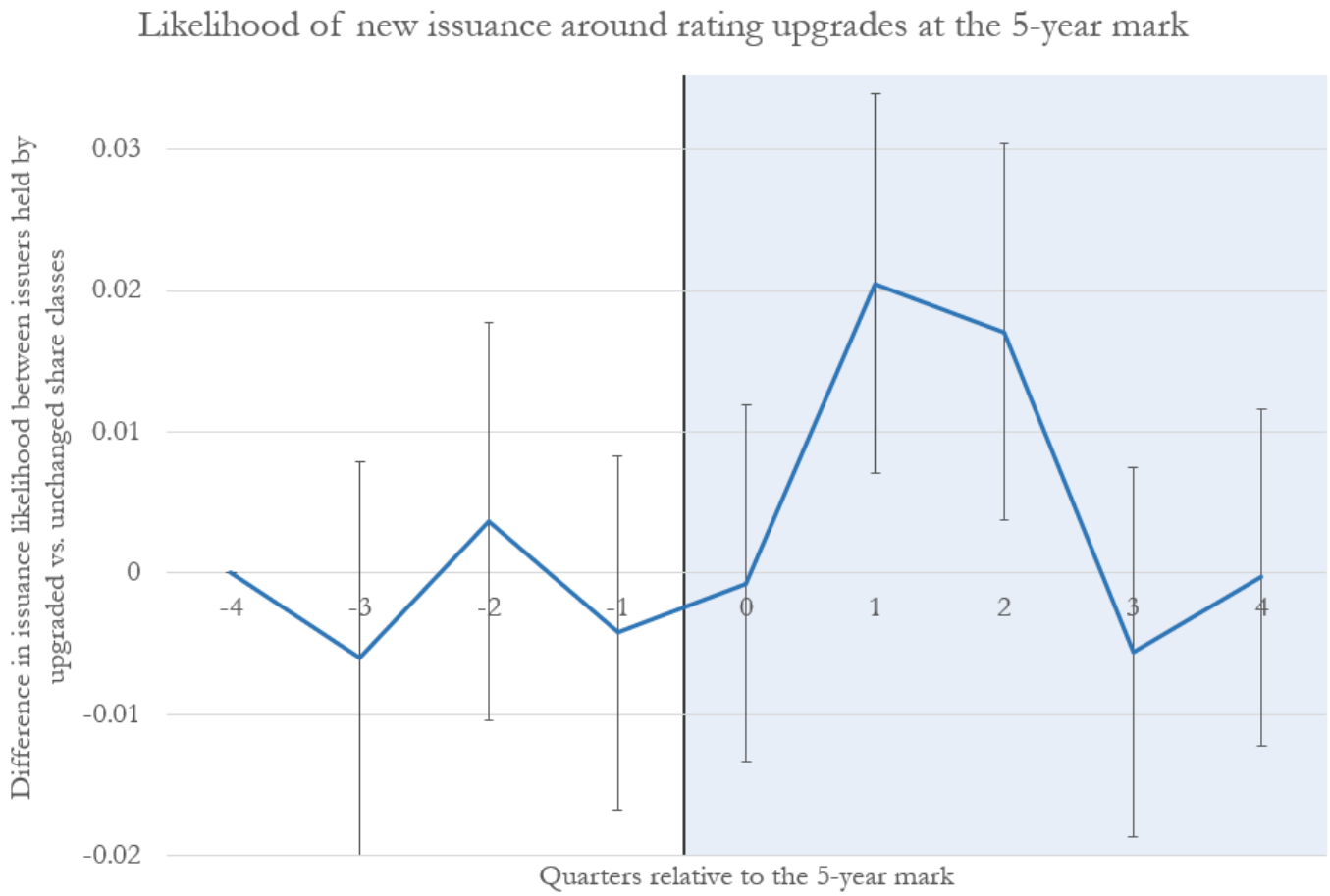


Table A.1. Morningstar rating changes and issuance decisions

In this table, we repeat the analysis in Table 4 Panel A, albeit for alternative minimum cut-offs for the holding weight. Panel A presents the results for the new issuance dummy regressions, while log new issuance amount regression results are presented in Panel B. All other specifications are identical to Table 4 Panel A. *t*-statistics based on standard errors robust to heteroskedasticity and two-way clustered by issuer and quarter are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. New issuance dummy

	Dependent variable: New issuance dummy					
	(1)	(2)	(3)	(4)	(5)	(6)
Minimum holding weight	All issuers	1%	2%	2.5%	3%	5%
Post 5-year dummy	-0.004	0.001	0.002	0.002	0.001	0.000
	(-1.118)	(0.255)	(0.377)	(0.335)	(0.163)	(0.049)
Rating change at 5-year ×	0.006**	0.007*	0.010**	0.013***	0.013***	0.015***
Post 5-year dummy	(2.214)	(1.976)	(2.360)	(2.834)	(2.860)	(2.977)
MRAR	-0.001	-0.000	0.001	0.000	0.000	0.001
	(-1.245)	(-0.149)	(0.518)	(0.292)	(0.169)	(0.736)
No. of observations	627,703	294,822	260,047	250,148	242,535	224,782
Adjusted R-squared	0.408	0.417	0.431	0.435	0.438	0.445
Share class FE	YES	YES	YES	YES	YES	YES
Issuer FE	YES	YES	YES	YES	YES	YES
State-by-quarter FE	YES	YES	YES	YES	YES	YES

Panel B. Log new issuance amount

	Dependent variable: Log new issuance amount					
	(1)	(2)	(3)	(4)	(5)	(6)
Minimum holding weight	All issuers	1%	2%	2.5%	3%	5%
Post 5-year dummy	-0.073	-0.010	0.003	-0.002	-0.021	-0.034
	(-1.240)	(-0.114)	(0.029)	(-0.021)	(-0.192)	(-0.283)
Rating change at 5-year ×	0.126**	0.164**	0.227***	0.266***	0.275***	0.310***
Post 5-year dummy	(2.324)	(2.371)	(2.784)	(3.241)	(3.215)	(3.262)
MRAR	-0.020	0.004	0.017	0.013	0.010	0.026
	(-1.057)	(0.222)	(0.757)	(0.497)	(0.350)	(0.859)
No. of observations	627,703	294,822	260,047	250,148	242,535	224,782
Adjusted R-squared	0.434	0.445	0.459	0.463	0.466	0.471
Share class FE	YES	YES	YES	YES	YES	YES
Issuer FE	YES	YES	YES	YES	YES	YES
State-by-quarter FE	YES	YES	YES	YES	YES	YES