Markup or Markdown: National Underwriters' Exit and the Changing Landscape of Municipal Finance

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Abstract

Both the increased transparency and the institutionalization of the municipal bond market have led to dramatic declines in the profits of underwriters, especially so for those whose underwriting activity is national in scope. Using comprehensive data on all trades, all bonds, and all underwriting spreads available between 2005 and 2023, we show that underwriters facing increasingly informed investors in the primary market are unable to capture high markups from investors but are also unable to raise costs to issuers. Using a structural model to examine trading, we document underwriters are half as likely over the time span of our sample to encounter an uninformed retail investor when selling an issue, and the markups they can charge these dwindling investors have fallen by a third. Increased transparency has not benefited issuers but has led to a decline in profitability for the largest municipal underwriters, several of whom have announced their departure from the market.

Keywords: Public Finance; Municipal Bonds; Underwriters; Markup; Transparency; ESG

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1 Introduction

The $3.8 trillion municipal bond market provides a principal source of capital for funding public infrastructure and services across the United States. Municipal underwriters help local governments access this critical source of financing by organizing bond issuance, buying securities from issuers, and reselling them to investors. In late 2023, several prominent underwriters (including UBS and Citigroup, the largest municipal underwriter) exited the municipal underwriting business, raising concerns about the potential adverse impact on municipalities' access to finance and the associated costs. It has been suggested that these exits are linked to the rising anti-ESG sentiment by some state legislatures and governments, most notably illustrated by bans on various underwriters beginning in 2021 in Texas.[1] However, being banned from accessing one market—albeit a large one (Texas)—hardly seems a reasonable justification for exiting the underwriting business altogether, especially when these underwriters are present in almost all states across the U.S.[2] We propose an alternative explanation for underwriter exit based on changes in market microstructure: profits for dealers have dramatically declined over time, especially for the largest underwriters.

Using comprehensive data spanning 2005 to 2023, we provide an in-depth study of municipal underwriters' profitability over time, thus opening a window into the strategic decisions underwriters make and their implications for municipalities and investors. We document evidence of increased institutionalization and transparency, which we link via the model in

[1] https://www.bloomberg.com/news/articles/2023-10-10/ubs-to-exit-key-muni-investment-banking-business-plans-job-cuts?sref=ftig08a6

[2] Indeed, a recent article by S&P Global notes that "In 2023, a fervent anti-environmental, social and governance campaign swept state legislatures but failed to curtail the movement's main foe: Wall Street and its multitrillion-dollar asset management firms."

Green (2007) to a large decline in primary market markups, especially for the largest underwriters such as Citibank and UBS. Over time, we document that the percentage of profit from these markups for underwriters has fallen by nearly 50% from 2005 to 2023.

The evolution of markups and underwriting spreads over time is critical because the municipal bond market has changed markedly over the past two decades (see Cestau et al., 2019 for a thorough review of key trends in this market). First, with important policy efforts (such as the reporting and public dissemination of offering documents and secondary market trades by the MSRB and the implementation of markup disclosure rules by the SEC and FINRA), market transparency has significantly improved, with more information available to investors.[3] Second, institutional investors, including bond mutual funds, ETFs, and separately managed accounts, have increased their participation in this market.

More specifically, Green (2007)'s model allows us to study how dealer-underwriters, operating as Bertrand competitors for new securities, navigate a secondary market characterized by limited price transparency. The resultant price dispersion, particularly detrimental to retail customers lacking in information gathering capabilities, delineates a market where institutional investors secure more favorable terms due to their repeat interactions and informational advantages. Increased transparency and institutionalization of the investor base reduces the fraction of uninformed (hence profitable) investors and diminishes the secondary market rents that dealer-underwriters can extract from such investors without proportionately benefiting issuers due to the unchanged competitive dynamics in the primary market. Thus, underwriters should find their profits being increasingly compressed. Remarkably, the

[3] These patterns are consistent with what has been observed in the corporate bond market in response to increased transparency (Edwards et al., 2007).

empirical evidence we document in this paper using data up to the end of 2023 fully supports this prediction and confirms Green (2007) insights from nearly twenty years ago.

We build a comprehensive database from multiple sources, on issuance details, trades, and underwriting spreads for all municipal bonds issued since 2005, including the Mergent Municipal Fixed Income Securities database ("Mergent"), the MSRB trade data, the SDC Platinum database, and Bloomberg. From these data, we document several trends in the municipal bond market. First, national underwriters (defined as those doing business in 40 or more states in any given year), although a minority in number, account for the bulk of underwriting activity in both the quantity and value of deals. Second, national underwriters tend to charge lower underwriting spreads to issuers and lower markups to investors in the new issue market. Even after controlling for a wide array of bond characteristics, these markups have been declining over time. Using the May 2018 implementation of SEC and FINRA rules on markup disclosure as a shock to transparency, we find evidence consistent with increased transparency reducing markups, without a significant increase in underwriting spreads to compensate dealer-underwriters for the reduced markups.

Next, we investigate the channels behind the declining profitability of national underwriters. Green (2007) model suggests that a decreasing mass of uninformed investors and/or their increasing informedness are drivers of shrinking underwriting profits. We formally estimate the fraction of uninformed investors and the markups they pay using a structural model inspired by the work of Green et al. (2007). The model links observed markups in the new issue market to bond and trade characteristics, but such links differ between informed and uninformed investor types. The investor type is latent but, following Green et al. (2007), modeled as a function of bond, issue, and trade characteristics (including underwriting spreads), signifying that investors take into account the nature of information asymmetry around the time of trade and the underwriter's markup-versus-markdown trade-off in choosing whether to become informed. Thus, the empirical model we estimate is a mixture of regression models, consisting of an outcome equation for markups and a latent two-regime classification equation.

Our estimates indicate that over the sample period, the likelihood of encountering an uninformed investor decreases steadily from over 55% in 2006–2007 to 25% in 2022–2023. Moreover, markups charged to such investors have also fallen dramatically, from a high of 152 basis points (bps) in 2008–2009 to about 96 bps by the end of the sample period. Thus, over the last two decades or so, underwriters are half as likely to encounter uninformed investors when selling an issue. The markups they can charge these dwindling uninformed investors have also fallen by a third. To demonstrate the economic significance of our results, we estimate the profit underwriters earn from trading with uninformed investors ("money left on the table", or MLOT) per transaction, per bond, and per issue. All these profit measures have collectively declined by 30–50% over the sample period.

These new empirical regularities are especially informative for interpreting recent concerns about the exit of national underwriters as a result of state policy (Garrett and Ivanov, 2022). While policy choices are important and demand scrutiny, our results suggest that we have largely witnessed underwriter exits in response to a secular decline in profitability for underwriters for reasons unrelated to state policy. Our interpretation of their exits is consistent with their explanations. For instance, a Citigroup memo in December 2023 by Andy Morton, head of markets, and Peter Babej, interim head of banking, commented that "the economics of these activities are no longer viable given our commitment to increase the firm's overall returns."[4] This is not the first time that major underwriters have exited. For instance, UBS exited following the financial crisis, citing similar reasons related to risk and profitability.[5] In this sense, the recent exits from the municipal bond market appear to be driven less by state policies, like SB 13 and 19 in Texas, and more due to declines in the profitability of underwriting municipal debts.

Finally, we examine the implications of underwriter exits on municipal bond issuers and investors, using the Texas laws and its ban on select underwriters as a shock to the competitive landscape. Employing the non-parametric coarsened exact matching (CEM) methodology developed by (Iacus et al., 2012), we match Texas bonds, based on bond characteristics and issuer-underwriter relationships, with bonds issued by other similar low-tax states and compute the treatment effects separately for the before- and after-shock periods. We find that the exit of banned underwriters does not significantly and adversely affect Texas bond yields, indicating an otherwise competitive market for underwriting services. However, there is a 6.7% increase in markups in the cross-section, consistent with what would happen when large underwriters exit the market. We municipal bond market is dynamic, so we anticipate further entry and exit in the years ahead, potentially with re-entry if markups rise again.

Our paper contributes to a large literature on market transparency and transaction costs in the municipal bond market.[6] Ever since Green et al. (2007) and Schultz (2012) (if not earlier), there has been a recognition that the municipal bond market is a decentralized broker-dealer market where pricing information can be costly to obtain and there exists a continuum of small investors. It is widely documented that the costs of trading are high

[4] https://www.reuters.com/business/finance/citigroup-closes-municipal-underwriting-market-making-unit-memo-2023-12-14/

[5] https://www.nytimes.com/2008/06/06/business/worldbusiness/06iht-ubs.1.13516985.html

[6] See Bergstresser (2022) and Cestau et al. (2019) for a detailed review of the recent literature.

and vary across investors, even for trading the same bond on the same day (see e.g., Harris and Piwowar, 2006, Green et al., 2006; Green et al., 2007). Over time, transaction costs have declined, as documented in more recent studies, including Schultz (2012), Chalmers et al. (2021), Wu (2018), and Griffin et al. (2023). However, price dispersion and variation in markups linked to dealer market power still persist, as illustrated in Griffin et al. (2023) and Jotikasthira et al. (2023). Furthermore, both Schultz (2012) and Griffin et al. (2023) find that, despite regulatory efforts to improve market transparency, markups in the new issue market do not decline as much as those on seasoned bonds, even more recently.

Our paper also relates to the literature on underwriters and frictions in the underwriting process. Luby and Moldogaziev (2013) find that underwriting fees are negatively correlated with risk and volatility in the muni market and that using local financial advisors helps reduce such fees, which they link to reduced information asymmetry. Garrett (2023) examines the conflicts of interest associated with dual underwriter-advisor arrangements and shows that such arrangements adversely affect municipal borrowing costs. Our results are also consistent with Garrett et al. (2023), who show how tax policy affects the market microstructure of the municipal bond market. In particular, they show that underwriters are unable to extract as much information rents through markups as the tax advantage increases, suggesting that differences in state-level policy contribute to increased competition. These results are related to our finding that markups have declined, at least in part due to the rise of larger underwriters that operate across states.

Our findings also speak to the literature that documents the strong clientele effects in the municipal bond markets. Babina et al. (2021) and Bergstresser and Cohen (2015) show that the tax advantage of municipal bonds contributes to the segmentation of the market across state lines and the concentration of retail investors. Cornaggia et al. (2022) show evidence of inattentive muni investors, which highlights how the retail-dominated clientele of the muni market contributes to the lower level of market efficiency and helps explain the significant dispersion of markups documented in other studies.

Overall, our paper contributes to a better understanding of how market transparency and the institutionalization of the municipal investor base have driven the evolution of underwriting profits. Our work also contributes additional evidence to the current debate on the potential implications of state laws and policies regarding ESG for municipal issuers, underwriters, and investors.[7] Our results are relevant and timely given the aspirations of the sustainable finance literature pertaining to the municipal bond market (Baker et al., 2022).

The paper proceeds as follows. Section 2 lays out the key features of Green (2007)'s model to form the conceptual framework that guides our empirical analysis. Section 3 describes the data and presents key descriptive patterns. Section 4 analyzes the decline in markups and underwriting spreads in a regression framework and explores the impact of shocks to market transparency on these outcome variables. Section 5 presents the structural model to formally measure investor sophistication and estimate the extent of money left on the table. Section 6 examines the implications of underwriter exits on municipal bond yields and markups. Section 7 concludes.

[7]The ESG debate matters particularly given the precarious state of municipal finance. For example, Chen et al. (2022) observe that U.S. municipals lost over $26 billion from delayed refinancing, whereas the entire U.S. corporate sector lost only $1.4 billion with the same low interest-rate environment. They provide evidence that delays are driven by overwhelmed local departments that are potentially resource-constrained when many calls come in. In addition, Novy-Marx and Rauh (2012) found that municipal bond spreads are highly elastic to default risk, measured through declines in state revenues.

2 A Model of Underwriting Profit

To study the profit function of municipal underwriters, we rely on insights from Green (2007), a theoretical model of strategic interaction among issuers, underwriters, and investors. The model considers two intermediaries, each functioning as both underwriter and dealer ("underwriter–dealer"), who compete to underwrite the bond sale from the issuer and then sell securities to retail and institutional investors.

Underwriters first compete in a Bertrand manner (i.e., price) for the business of an issuer. After acquiring the securities, they can sell their inventory in a secondary market, where they are free to set prices and discriminate between retail and institutional investors. Retail investors are characterized by relatively high valuation and search costs, while institutional investors have infinitely elastic demand at a lower price. Underwriter-dealers will prioritize selling to the most profitable retail trades first, with any remaining inventory sold to institutional investors. Each underwriter-dealer has a limited capacity to reach retail investors, which is determined by their retail distribution network. The capacity constraint means that if the acquired inventory exceeds the underwriter retail capacity, the rest of the inventory must be sold to institutional investors at the lower institutional price. This constraint discourages the underwriters from bidding too aggressively on price for the underwriting business.

Green (2007) analyzes how dealers maximize their profits given the constraints of their retail capacity and the competitive pricing environment and identifies a range of Nash equilibria. They range from the most profitable equilibrium, where both dealers offer the issuer the institutional price and fully utilize their retail capacity, to a unique zero-profit equilibrium, where the dealers bid the same price above the institutional price and each receives exactly half of the issuance. Green (2007) argues that the most profitable equilibrium is particularly natural for the muni market setting and consistent with empirical outcomes documented in Green et al. (2007). In such an equilibrium, dealer i's expected profit is:

$$\pi(b_i, Q_i) = (\bar{p} - v)q\mu + (v - b_i)Q_i, \tag{1}$$

where b_i and Q_i are the bid price the dealer offers to the issuer and the allocated quantity of issuance, respectively, μ is the mass of retail customers, q is the probability that a retail customer chooses not to pay the search costs and remain uninformed, $\bar{p}$ is the reservation price above which no retail investor will buy the security, and v is the institutional price.

Empirically, Green et al. (2007) document that the price offered by underwriters to issuers, plus the negotiated underwriting spread, is highly correlated with the institutional price. This implies that the empirical equivalence of $(v - b_i)$ is the underwriting spread, and that $(\bar{p} - v)$ represents the markup per bond in the new issue market. Thus, the dealer's expected profit expressed in Equation (1) has a natural interpretation: it is the combined markups charged to uninformed customers plus the spread earned on the amount underwritten. This equilibrium profit function allows us to make predictions with respect to underwriting profitability amid key changes in the municipal bond market.

The first change is a marked increase in market transparency over time. The SEC and MSRB have introduced various rules designed to improve market transparency, including mandates for post-trade price dissemination and markup disclosures (see Wu, 2018 for a history of MSRB market transparency enhancement activities since 2005 and Cestau et al., 2019 for a review of key trends in the muni market). A large literature, including Harris and Piwowar (2006) and Chalmers et al. (2021), among others, provides supportive evidence that increased market transparency results in lower transaction costs for investors. Thus, the probability that a retail investor remains uninformed (q) should decrease, thereby reducing underwriters' profits. Moreover, with greater availability of pricing information, the markup that dealers can charge uninformed retail customers ($\bar{p} - v$) should shrink as well.

Second, there has been a clear increase in the participation of institutional investors in the muni market. For example, Cumberland Advisors document a steady rise of separately-managed accounts (SMAs) alongside the growth of muni mutual funds, concurrent with the decline in direct muni retail assets.[8] It appears that many retail investors have switched to using SMAs to manage their muni investments and enjoy lower costs associated with institutional trading done by the SMAs. If retail participation decreases, a lower μ immediately implies decreased profits for muni underwriters.

The above insights from the Green et al. (2007) model provide conceptual guidance for our empirical work. Specifically, we examine how both the probability of uninformed trading and the markups on these uninformed trades decline over time with the rise of market transparency and participation of institutional investors. The resultant decrease in profitability, in turn, pushes some underwriters to exit the market. This empirical outcome, if supported using more comprehensive data and in more general settings, would corroborate Green (2007)'s prediction that issuers have no incentive to improve market transparency.

[8] Healy, Patricia, "The Rise of Separately Managed Accounts – 2021 Update," November 2, 2021, available at https://www.cumber.com/market-commentary/rise-separately-managed-accounts-2021-update

3 Data and Descriptive Statistics

3.1 Data

The data used in this analysis come from several sources. First, municipal bond issuance information is from the Mergent Municipal Fixed Income Securities database ("Mergent"). The data provide information on the total issue size, the offering date, the name of the issuer, the type of the offering (competitive versus negotiated), and the agents involved in the sale of the issue. Each bond issuance typically comprises multiple CUSIPs ("bonds") at various maturities. For each bond, the data include bond characteristics such as the issuance amount, coupon rate, maturity, bond type (GO versus revenue), use of funds, tax status, callability, credit rating, and whether it is insured.

Among the agents facilitating an issue sale, we focus on underwriters. We manually clean the names to ensure that multiple variations of an underwriter's name are attributed to the same underwriter. We then classify underwriters based on the geographic reach of their underwriting business, proxied by the number of states in which each given underwriter does business in a given year. "Single-state" underwriters are those that underwrite bonds in only one state in a given year. "Small regional" are those doing business in two to 19 states, "Large regional" if between 20 and 39 states, and "National" if 40 states and above.

The second data source is the trade data from the Municipal Securities Rule Making Board ("MSRB"). For each trade in a given bond, the MSRB data contain the timestamp, trade size, the trade type (for customer buy, customer sell, or interdealer trade), and the trade price, among others. Because we are interested in the markups that underwriters and their dealers charge customers when they distribute the bonds, we examine customer buy trades within 14 days of the offering date—similar to Schultz (2012) and Griffin et al. (2023), or until they fully absorb a bond size, whichever is earlier. This ensures that we examine trades in the new issue market and that the markup measure is not contaminated by secondary market activity. Following the literature, we compute the new issue markup as the difference between the customer purchase price and the offering price of the bond, expressed as a percentage of the offering price. For example, a markup of 0.2 indicates a 20 basis point (bp) markup over the offering price. For analysis at the bond level, we use the trade-size-weighted average markup across all new issue trades in each given bond.

Third, in addition to new issue markups, we collect underwriting spreads from the SDC Platinum database ("SDC"), combined with data from Bloomberg for those issuers without SDC spread data. The SDC data contain the reported gross spreads per $1000, which we convert to percent of the issue size to be consistent with the Bloomberg spreads data. Underwriting spreads are at the issue level. To our knowledge, this is the most comprehensive underwriting spreads data used in a study of municipal underwriters' profits.

We provide details on our data cleaning procedures and filters in Table 1. Our sample period is from 2005 to 2023, dictated by the availability of the MSRB trade data. Our final sample consists of 183,502 issues and 2,076,767 bonds. Markup analyses are based on 12,389,917 new issue trades in these bonds. Analyses of underwriting spreads are based on 132,588 issues with available spreads data.

3.2 Descriptive Statistics

Table 2 provides summary statistics of municipal underwriting activity, markups, and spreads, categorized by underwriter type, over the sample period from 2005 to 2023. Panel A of Table 2 presents the average annual underwriting activity statistics, highlighting the vastly different scale of operation across underwriter types. The average single-state underwriter participates in approximately seven deals worth $66 million per year. Small regional underwriters—covering roughly seven states on average—are more active, with the average underwriter doing about 53 deals with a total volume of $615 million per year. Large regional underwriters typically cover about 28 states and are disproportionately more active than small regional ones, each taking part in about 255 deals totaling $5.5 billion in volume. Nevertheless, this activity level is about a third of that of an average national underwriter, which typically underwrites 655 bond sales worth $18.5 billion in about 44 states in a given year.

Collectively, national underwriters (about eight of them) account for nearly 50% of total volume in a given year, followed by a 30% market share of about 18 large regional underwriters. These volume shares are higher than the corresponding deal count shares, suggesting that national and large regional underwriters tend to underwrite very large bond sales. On the other hand, small regional underwriters and single-state underwriters are numerous (97 and 111 underwriters, respectively) but tend to underwrite much smaller bond issues, collectively accounting for only 20% of the total market volume. To supplement these full sample statistics, Figure 1 plots the time series trends in underwriting activity and market share. Amid the generally increasing trend in bond issuance over time, the market share of national underwriters—already prominent—also increases, from below 40% in 2005 to about 60% in

2020 before dropping to slightly less than 50% in 2023. The loss of market share of national underwriters in 2018 and 2022–2023 tends to be offset by a corresponding increase in the market share of large regional underwriters, whereas that of small players (small regional and single state) has remained steady at a relatively low level.

Panel B of Table 2 provides some descriptive statistics of markups in the new issue market. Most bonds are distributed to investors at the offering price, as indicated by the zero median markup across all underwriter types. However, investors still buy many bonds in the new issue market at a markup from the offering price, with the average markup varying across underwriters. Compared to other underwriter types (especially single-state ones), markups are the lowest and least variable among bonds underwritten by national underwriters. More importantly, Panel A of Figure 2 shows that except for bonds underwritten by single-state underwriters, the average markup has steadily decreased over time, from the high teens in 2005 to about five bps in 2023 for all national and regional underwriters. This decline could be due to an increased fraction of bonds distributed with zero markups and/or lower markups on bonds with non-zero markups, which we will explore in greater detail.

National underwriters also seem to charge the lowest underwriting spreads (in basis points of the issue size) as reported in Panel C of Table 2, averaging approximately 75bps compared to 90bps, 112bps, and 161bps charged by large regional, small regional, and single-state underwriters, respectively. Given that national underwriters tend to underwrite larger deals than those by other underwriters, the underwriting fees in dollars they collect on an average bond sale are still the highest, but the fixed costs in underwriting are spread over a much larger volume, resulting in lower underwriting spreads per issue. Panel B of Figure 2 shows that the average underwriting spreads charged by national and large regional underwriters always stay in the 50-100bps range and appear to increase only slightly in recent years, whereas those charged by small regional and single-state underwriters are consistently higher and increased at a much faster rate.

4 The Decline in Underwriting Profits

The preceding section highlights several key trends in municipal bond underwriting, including the dominant presence of national underwriters and the declining markups in the new issue market for municipal bonds. In this section, we investigate in greater detail whether underwriters' profitability has declined over time, carefully controlling for changes in bond characteristics and the macro environment potentially underlying the descriptive patterns discussed earlier. Specifically, we estimate a series of regressions for two outcome variables: markups in the new issue market (at the bond level) and underwriting spreads (at the issue level). Markups reflect the profit made from distributing the bonds to investors, whereas underwriting spreads (or "markdowns") represent the profit collected from the issuers.

4.1 Markups in the new issue market

The regression model for the markup on bond i issued at time t is:

$$\begin{aligned}\text{Markup}_{i,t} \quad = \quad & \delta'\text{Year}_t + \beta_1\text{National}_i + \beta_2'\text{National}_i \times \text{Year}_t + \beta_3\text{LnIssueSize}_i \\ & +\beta_4\text{LnBondSize}_i + \beta_5\text{Maturity}_i + \beta_6\text{Maturity}_i^2 + \beta_7\text{Coupon}_i \\ & +\beta_8\text{Premium}_i + \beta_9\text{Callable}_i + \beta_{10}\text{Insurance}_i + \beta_{11}\text{AddCredit}_i \\ & +\beta_{12}\text{BankQlf}_i + \beta_{13}\text{OfferType}_i + \gamma_1'\text{BondType}_i + \gamma_2'\text{Rating}_i \\ & +\gamma_3'\text{Proceeds}_i + \eta'\text{State}_i + \epsilon_{i,t}, \qquad (2)\end{aligned}$$

where $Markup_{i,t}$ is the trade-size-weighted average markup on customer buy trades within

14 days of the offering date or until the total bond amount is fully sold, whichever is earlier. δ is a vector of year fixed effects, which capture the average markups over the years in the sample after controlling for various determinants of markups. $National$ is a dummy variable for whether a national underwriter underwrote the bond sale. We include $National$ to assess whether markups charged by national underwriters still differ from those by other underwriters after controlling for different characteristics of the bonds they underwrite.

We control for the following bond characteristics. $LnIssueSize$ and $LnBondSize$ indicate the logged issue amount and logged bond amount, respectively. $Maturity$ is the bond's maturity, and $Maturity^2$ is the squared maturity to capture any potential non-linearity. $Coupon$ is the coupon rate of the bond. Dummy variables for bonds that are issued at a premium ($Premium$), callable ($Callable$), insured ($Insured$), with additional credit enhancement ($AddCredit$), bank-qualified ($BankQlf$), and whether the offering type is negotiated ($OfferType$) are also included. Vectors of coefficients are denoted by γ on types of bonds (GO, Revenue, or Other), rating dummies, and broad use of proceeds categories (General, Higher Education, Primary Education, Water, and Other uses). The regression model also includes state and fixed effects.

We plot the year fixed effects (δ_t) in Panel A of Figure 3. Each coefficient represents the average new issue markup in the corresponding year relative to the base year of 2005. Markups significantly increase after the 2008 financial crisis until 2015 before steadily decreasing to almost the 2005 level toward the end of the sample period. This plot indicates that, after accounting for differences in bonds issued over time, markups do not decline as early as indicated by the descriptive patterns shown in Figure 2, nor soon after the public dissemination of municipal trade data in 2005, the first among several important initiatives to improve muni market transparency.

Panel B of Figure 3 shows the differential markups on bonds underwritten by national underwriters over time. These are the estimates for β_2 from Equation (2) above. For most of the years, markups by national underwriters are significantly lower than those by other underwriter types, consistent with unconditional summary statistics even after controlling for a comprehensive list of bond controls and fixed effects. It is possible that national underwriters have better access to institutional investors who tend to get better terms of trade. Indeed, our analysis provided in Figure 4 shows that the share of institutional sized trades in the new issue market is highest among bonds underwritten by national underwriters. Moreover, this share has risen over time, from around 70% in 2005 to nearly 90% in 2023, which could contribute to the lower and declining markups of national underwriters.

4.2 Underwriting Spreads

The regression model for underwriting spreads on bond issue j issued at time t is:

$$\begin{aligned} \text{UndSpread}_{j,t} \;=\; & \delta'\text{Year}_t + \beta_1\text{National}_j + \beta_2'\text{National}_j \times \text{Year}_t + \beta_3\text{LnIssueSize}_j \\ & + \beta_4\text{Callable}_j + \beta_5\text{Insurance}_j + \beta_6\text{AddCredit}_j \\ & + \beta_7\text{BankQlf}_j + \beta_8\text{OfferType}_j + \gamma_1'\text{BondType}_j + \gamma_2'\text{Rating}_j \\ & + \gamma_3'\text{Proceeds}_j + \eta'\text{State}_j + u_{j,t}, \end{aligned} \tag{3}$$

where the control variables are as explained for Equation (2). Because the underwriting spread is an issue-level outcome variable, this regression model does not contain bond-level variables. Similar to our regression analysis of markups, we plot in Figure 5 the estimated year fixed effects and their interactions with the National underwriter dummy to expose the average underwriting spreads over time after accounting for possible variation in issuance characteristics and cross-sectional variation across states.

Panel A of Figure 5 reveals a trend in underwriting spreads somewhat opposite that of markups, with spreads declining in the post-2008 crisis period (when markups were rising) but starting to increase from 2016 until the present (when markups were declining). The evidence seems to suggest a preference for stable underwriting profitability and that shortfalls on one side appear to be made up for with some increased profits on the other side. However, as shown in Panel B of Figure 5, underwriting spreads are significantly lower for national underwriters than for other underwriters and trend down over time, along the similar trend in markups shown in Panel B of Figure 3. Collectively, these plots paint a consistent picture of declining profits for national underwriters, with the decline starting long before the emergence of ESG-related sentiment in recent years.

4.3 Shocks to Transparency for Spreads and Markups

Lastly, we exploit a national shock to transparency, the implementation of amended SEC Rules G-15, G-30, and FINRA Rule 2232 in May 2018 that required dealers to disclose the compensation that they receive in certain primary market transactions with investors. We add a dummy variable reflecting the post-policy change as well as its interaction with the National dummy to the regression model in both Equations 2 and 3 while removing the Year x National effects. Table 3 presents the results. Panel A shows that a positive shock to transparency dramatically reduced the markups charged in the primary market by national underwriters. Consistent with the figures above, while national underwriters have pricing power and potentially a larger unsophisticated retail network in the earlier years of the sample, this declines substantially after the implementation of markup disclosures in May of 2018. Panel B shows again that national underwriters are unable to compensate for this decline in markup profits by raising spreads to issuers, especially so after the increase in primary market transparency.

While we cannot rule out the possibility that this national policy change is correlated with other unobserved shocks, our results suggest rapidly declining profits from investors (markups) which are unable to be compensated by rising profits from issuers. These results accelerate as transparency increases (consistent with Green, 2007) and are magnified for national underwriters. This is also consistent with Allahrahka et al. (2019) who find, in the corporate bond trading market, that the Volcker Rule had no statistically significant impact on firm riskiness but an unintended negative effect on liquidity for covered firms. Nonetheless, we formally investigate the mechanisms with a structural model in Section 5.

5 Why Do Underwriting Profits Decline?

In this section, we investigate the channels behind the declining profitability of national underwriters documented in the previous sections. Green (2007)'s model points to increased investor sophistication, either through a decrease in the mass of retail investors (μ) or an increase in their informedness (q), as a direct driver of decreased underwriter profitability. There are reasons to believe that both of these trends are at work. First, as previously discussed, institutional investors (investment funds and SMAs that manage muni assets on behalf of retail investors) increasingly participate in the muni market in recent years. Second, with greater market transparency and greater public availability of municipal securities primary offering documents and secondary market trading information, the cost of becoming informed for retail investors has fallen significantly (see e.g., Wu, 2018 for evidence).

While anecdotal and descriptive evidence abounds, it is challenging to measure the mass of retail investors and how informed they are—the two key constructs in Green (2007)'s model—to assess if they indeed have changed and accordingly driven underwriting profitability lower over time. To this end, to infer the degree of investor sophistication, we adapt the structural model developed in Green et al. (2007). With a long sample period until the end of 2023, we offer an updated and time series perspective on muni investor sophistication; this long period complements the initial results in Green et al. (2007), which were based on a small sample of bonds issued back in 2000–2003. Our analysis thus adds new insights into the implications of important changes in the market on investor sophistication, which in turn affects underwriters' profitability and the competitive landscape of the muni market.

5.1 Structural Estimation of Markups

We start by briefly describing the structure and notations of Green et al. (2007)'s model before presenting our estimation results. There are two classes of investors in the primary market: informed and uninformed. An investor decides to become informed if the benefit of being informed, e.g., better terms of trade, exceeds the cost of information acquisition. Denote by z_i^* the net benefit of being informed, which is latent but modeled as a function of observable bond and trade characteristics ω_i, i.e., $z_i^* = \omega_i \delta + u_i$. The markup each type ($U$ for uninformed and I for informed) pays on trade i is also a linear function of observable characteristics x_i:

$$y_i^U = x_i\beta^U + \epsilon_i^U, \tag{4}$$

$$y_i^I = x_i\beta^I + \epsilon_i^I. \tag{5}$$

The observed markup y_i for trade i is thus:

$$y_i = \begin{cases} y_i^U & \text{if } z_i^* < 0 \\ y_i^I & \text{if } z_i^* \geq 0 \end{cases} \tag{6}$$

This model lends itself to a structural version of a finite mixture of regression models with latent categorical classification. The first equation corresponds to z_i^* (the classification regression), which classifies trade i as either informed or uninformed based on the conditioning variables ω_i prevailing at the time of the trade.

The outcome regression corresponds to observed markup, y_i, which is drawn from one of the two regimes specified in Equations (4) and (5) and is determined endogenously by the classification regression. The conditioning variables x_i include all bond characteristics as used in Equation (2), in addition to the following trade variables: the days since the offering and percentage of issue sold prior to the trade.

Following Green et al. (2007), the set of conditioning variables ω_i used in the classification regression includes all conditioning variables in the outcome regressions listed above, as well as the following: a dummy for whether the issuer is a first-time issuer, the number of issues sold prior to this bond sale by the issuer, and the underwriting spread. The first two added variables capture the information asymmetry of the issue, which are arguably important considerations when an investor decides whether to become informed or not. The inclusion of the underwriting spread reflects the trade-off between markups and markdowns as underwriters optimize their markup strategy, which likely affects the investor's net benefit of becoming informed.

We use the expectation-maximization (EM) algorithm to obtain reasonable starting values and then estimate the entire system via maximum likelihood. We estimate the model separately for each consecutive non-overlapping two-year period beginning in 2006–2007 and ending in 2022–2023. Consistent with the regressions in Section 4, the estimation is based on all trades for rated bonds of all types within 14 days of the offering date, or until the total bond amount is fully absorbed by customer buys, whichever is earlier.[9] From the estimated model, we obtain the time series of two important measures: the probability of uninformed trades (which maps to the mass of retail investors in Green, 2007) and the average markup conditional on uninformed trades (with a lower markup mapping to greater informedness of retail investors in Green, 2007), along with the corresponding standard errors.

5.2 Time Series Results

We plot the proportion of uninformed trades and their standard errors in Figure 6. The likelihood of facing an uninformed trader decreases steadily over the entire sample period, from 55.5% in 2006–2007 to 25.2% in 2022–2023. At the same time, markups charged to uninformed investors have fallen dramatically, as shown in Figure 7. From a high of 152 bps in 2008–2009, average markups for uninformed investors have fallen to about 96 bps by the end of the sample period, a decline of over 36%. In other words, over the last two decades or

[9] We also perform the estimations separately for GO and revenue bonds and over a fixed window, with virtually identical results.

so, underwriters have faced an ever-increasing proportion of informed traders (who pay zero markups), while the much smaller proportion of uninformed traders they face are paying average markups that are over a third lower.

Figure 8 builds on these results by presenting the coefficients on the National Underwriter dummy in the classification regression. Controlling for trade and other bond characteristics, these coefficients capture the effects of national underwriters on the probability of encountering uninformed investors in selling the bonds they underwrite in the new issue market. While we cannot reject the null that national underwriters are no less likely than their counterparts to face uninformed investors at the beginning of our sample, we find they are between 0.10 to 0.40 percentage points less likely to trade with uninformed investors in the latter part of the sample. Furthermore, Figure 9 shows that national underwriters also have significantly lower markups on uninformed trades than regional underwriters for most of the sample period.

We also plot the coefficient of underwriting spreads in the classification equation over time in Figure 10. The significantly negative coefficient reflects the tradeoff underwriters face between their two sources of profit: markups to uninformed investors and spreads charged to issuers. The more likely an underwriter is to encounter retail investors (based on its retail distribution network, or μ in Green, 2007), the lower its underwriting spread. Over time, the effects of this tradeoff squeeze underwriters and the increase in coefficients (although still significantly negative) suggests underwriter attempts to mitigate the problems caused by declining retail participation by muting this tradeoff.

5.3 Money Left on the Table

To quantify the economic effects of the changing investor sophistication on underwriting profitability, we estimate the "money left on the table" (MLOT), which reflects the profit underwriters earn from trading with uninformed investors. While underwriting spreads are immediately observable, markups collected from distributing bonds to investors constitute the much less transparent component of underwriters' profit. MLOT provides additional insight into the components of underwriting profit and how they have evolved over time.

Following Green et al. (2007), we compute MLOT as follows. First, using the estimated classification equation, we classify each trade as informed or uninformed, based on whether the conditional net benefit $E(z_i^*|\omega_i)$ is greater than 0 or not. For each trade classified as uninformed, we compute the difference in the conditional expected markup between an uninformed and an informed investor, i.e., $MLOT_i = E(y_i^U - y_i^I|\omega_i, x_i, z_i^* < 0)$. We then aggregate the dollar amount of trade-level MLOTs (i.e., $MLOT_i \times TradeSize_i$) across all trades in a given bond to obtain the bond-level MLOTs, and then further aggregate them to the issue level to obtain the issue-level MLOTs.

Table 4 reports MLOTs estimates by year. The first column, which presents the average MLOT per transaction in basis points, shows an increase from roughly 130 bps in 2006 to 178 bps in 2011, later reversing to reach about 113 bps in 2023. The second and third columns report the bond- and issue-level MLOTs expressed in basis points of the bond and issue par amount, respectively. On average, uninformed traders leave \$0.5913 per \$100 of par value per bond, and \$0.1495 per \$100 par value per issue on the table. These averages mask the fact that MLOTs have fallen significantly over time, collectively exhibiting a 30-50% decline.

If the issue-level MLOTs reported in the third column reflect the profit obtained from distributing bonds to uninformed investors, the underwriting spreads reflect the profit collected directly from the issuer. Unlike MLOTs, underwriting spreads appear more stable over time, ranging between 82 and 103 bps of the issue size. We convert both profit components to dollar amounts and compute the dollar MLOTs in percent of the total profit for each given issue, which we report in the fifth column. MLOTs as a source of profit for underwriters have sharply declined over time, falling to only 2.59% in the last year of the sample.

Overall, the evidence in this section clearly suggests that muni investors have become increasingly more informed. Both the probability of trading with uninformed investors and the markups charged on uninformed trades have significantly declined. These changes, in turn, shrink the amount of money left on the table by uninformed investors. Meanwhile, competition among underwriters keeps underwriting spreads from increasing fast enough to make up for the shrinking profit from the new issue market. Thus, as the muni market becomes more transparent, underwriters' total profits become more compressed.

6 Implications of Underwriter Exits

The evidence of a secular decline in underwriting profits, especially for national underwriters, is clearly a concerning trend for the underwriters themselves. The recent exit of UBS (in October 2023) and Citigroup (in December 2023) only further emphasizes the inevitable outcome when profit is not on a sustainable path. To municipal issuers and, ultimately, taxpayers, a directly relevant question is whether such exits have an adverse effect on bond yields. To municipal bond investors, it is important to know whether they would have to pay a higher markup for bonds in the new issue market after lower-markup underwriters exit. Understanding these patterns is also relevant and timely given the interest in sustainable finance, especially green bonds (Baker et al., 2022).

On the one hand, if the market has been sufficiently competitive, the void left by an exiting underwriter should be easily filled by other underwriters such that we would not expect to see an increase in bond yields nor a change in markups.[10] On the other hand, the municipal bond market is generally considered as having a high degree of information asymmetry. Issuer-intermediary relationships are important in alleviating such asymmetries, especially when it comes to placing bonds with investors. As a result, the borrowing costs for the issuer are likely to increase after the exit of a relationship underwriter as the issuer searches for a replacement and works on building a new relationship. Moreover, for large bond sales, it might be difficult to find replacement underwriters with equally deep pockets and extensive investor networks, raising the likelihood of the sale not being fully subscribed and higher bond yields. Markups are also likely higher as the new underwriters have a stronger incentive to underprice the issue and make up for some lost underwriting profit by charging a higher markup afterward.

However, because these exits only recently happened (in late 2023), we do not yet have sufficient data in the post-exit period to properly identify the effects of the exit on municipal issuers. To help with identification, we rely on the recent passage of Texas Senate Bills 13/19 (SB-13/19) in September 2021 as a shock to the presence of some large underwriters in the market. Specifically, SB-13/19 prohibits Texas state and local governments from contracting

[10] Doug Hartman, head of Southwest municipal finance at Jefferies, was quoted as saying "competition among underwriters remains strong in the state." (see Heather Gillers, "Texas Ban on 'Woke' Banks Opens Door for Smaller Firms," The Wall Street Journal, May 4, 2024.)

with financial companies that boycott Texas energy and firearm companies. In the eight-month period after these anti-ESG laws came into effect, Garrett and Ivanov (2022) identify five banks that were targeted by the laws and temporarily exited the Texas market, including JP Morgan Chase, Citigroup, Goldman Sachs, Bank of America, and Fidelity.[11] Thus, the passage of the law presents a valuable experiment to identify the effects on municipal issuers when one or more national underwriters are not present in the market. We can then learn from this analysis to anticipate the future effects of underwriter exits on municipal issuers.

We employ the coarsened exact matching (CEM) method developed by Iacus et al. (2011, 2012) to provide a non-parametric estimate of the average treatment effects. The treatment group consists of Texas bonds, while the control group consists of bonds issued in other states with zero or low state tax rates (less than 5%) to be comparable to Texas from a state taxation perspective. We then compute the difference for each outcome variable (yields and markups) between Texas bonds and closely matched non-Texas bonds separately for three periods: 1) the pre-policy period from January 2021 to August 2021, and 2) the policy period from September 2021 to April 2022, as in Garrett and Ivanov (2022), and 3) the after-policy period, from May 2022 to December 2022. We chose such a tight window before and after the implementation of SB-13/19 to alleviate the concern that other events might confound the effects of interest.

For matching, CEM partitions the data into strata based on a multi-dimensional grid of covariates to match upon (dividing each covariate into multiple bins of potentially varying widths), discarding all strata where there are either no treatment bonds or control bonds

[11] The office of Texas Comptroller started publishing the official boycott list in August 2022 and has regularly updated the list since.

to ensure that the treatment effects are identified off of strata with both treatment and control bonds. We match exactly on the bond type (GO, revenue, and other), offering type (negotiated vs. competitive), narrow rating category (including unrated, which counts as a separate category), and in reasonable bins for maturity and bond size. Most importantly, we also match on the issuer-underwriter relationship using a dummy variable for whether an issuer has worked with any of the targeted underwriters identified by Garrett and Ivanov (2022) in the 10-year period prior to the pre-policy period (i.e., 2010-2019). Thus, the treatment effects will be based on a comparison of Texas bonds with non-Texas bonds that have a similar relationship with the targeted underwriter. Any significant difference in yields during the policy period can then be attributable to the absence of these targeted underwriters in Texas.

We report the average treatment effects in Table 5. Different from Garrett and Ivanov (2022), we do not find any significant yield differential among similar bonds that differ only in the presence of relationship underwriters. It seems that the temporary exit of Citigroup and other target banks does not materially affect the borrowing costs for issuers who used to work with these banks in the past. They obtain similar bond yields as those issuers who continue to have access to these underwriters. This evidence suggests that the underwriting business is quite competitive and that the exits of some underwriters are not yet consequential for municipal issuers. Nevertheless, there is some evidence of an increase in markups. The banned underwriters are all large players in the market who have access to a larger and more institutional investor base and, therefore, tend to offer lower markups. It seems that their distribution capability is not perfectly substituted by the distribution capability of the underwriters that remain in the market, resulting in higher markups.

7 Conclusion

Our study provides a comprehensive analysis of the dynamics of the municipal bond market from 2005 to 2023, highlighting significant shifts in market structure, underwriting practices, and profitability trends. First, national underwriters account for the bulk of underwriting activity in terms of both quantity and value of deals. Second, even after controlling for a wide array of bond characteristics, national underwriters also have lower markups, and these have been declining over time. We also find that these markup declines are driven by increased institutionalization and market transparency as predicted by Green (2007).

We subsequently discipline our data to a structural model along the line of Green et al. (2007) to study how the profitability of municipal bond underwriters could decline due to increased transparency and an elevated presence of informed traders. Regulatory enhancements and technological advancements have reduced information asymmetries, enabling more investors to trade as informed participants, which naturally compresses the markups underwriters can charge. Additionally, an increased shift of retail investors to institutional-like managed accounts has intensified this effect by expanding the pool of effectively informed participants. Our empirical validation of this model shows a marked decrease in trades involving uninformed investors and a corresponding reduction in the markups on such trades. These developments necessitate a strategic shift for underwriters towards more competitive pricing and enhanced operational efficiencies to sustain profitability in a market where transparency is high, and participants become increasingly more informed.

Future research should continue to track the health of the municipal bond market, particularly entry and exit across the varying categories of underwriters. Further investigation is also warranted into how the concentration of market power among fewer, larger underwriters might affect municipal issuers, particularly smaller, less financially robust municipalities that may struggle with higher access costs to capital markets. Additionally, there is also a promising role of technology and digital platforms (e.g., FinTech) in potentially democratizing access to the municipal bond market, helping to address some of the current market frictions and enhancing efficiency in the absence of some of the larger underwriters.

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Table 1: Sample construction and data filters

This table shows the filters applied in constructing the bond sample and the bond-trade sample. Bond data are from the Mergent municipal fixed-income database. Trade data is from the MSRB. We only consider trades in the new issue market, defined as those within [-30 days; + 14 days] of the offering date or when the bond size is fully absorbed by customer buy trades, whichever is earlier. The sample period is from 2005 to 2023.

Filters	# Issues	# CUSIPs	# Trades
Full Mergent sample	509,163	4,596,452	
Bonds issued since 1/1/2005 and not by US territories	309,283	2,672,141	
0<offering yield<50% and 50<offering price<150		2,565,007	
0<coupon<20% and offering size>0		2,523,419	
Debt-type="BND" and face value = 100		2,299,523	
Fixed rate coupon		2,298,466	
Purpose of issuance either NEW or REF		2,286,565	
Remove bonds with offering date after maturity date		2,286,456	
Underwriter information available	189,373	2,275,525	
Merged with MSRB trade data:			
New issue trades ([-30;+14] of offering date)			18,308,872
Remove trades of less than $5,000 par			18306987
50 ≤ trade price ≤ 150	183,502	2,076,767	18,306,168
Sample for new issue markup analysis:			
Customer buy trades [0; +14] of offering date	183,502	2,076,767	12,389,917
Sample for underwriting spread analysis:			
Issues with underwriting spread data	132,588		

Table 2: Summary statistics of underwriting activity, markups, and spreads

This table reports summary statistics of underwriting activity, markups, and spreads by underwriter type. Underwriters are classified based on how many states they underwrite in a given year: "single state" if one state, "small regional" if between 2 and 19 states, "large regional" if between 20 and 39, and "national" if 40 and above. Panel A reports the summary statistics of underwriting activity in an average year. Panel B presents summary statistics on bond-level markups in the new issues market. Markup is defined as the difference between the customer purchase price and the offering price of the bond, expressed in basis points of the latter. New issue market trades are defined as customer buy trades within 14 days of the offering date. The markup for a given bond is the trade-size-weighted average of markups across all new issue trades in the bond. Panel C shows the summary statistics of underwriting spreads (expressed in basis points of the total issuance amount). Data sources: Mergent municipal fixed income database, MSRB trade data, SDC Platinum, and Bloomberg. Sample period: 2005–2023.

	Single-state	Small regional	Large regional	National
Panel A: Average annual underwriting activity				
Number of states served	1.00	6.87	27.75	44.24
Number of deals per underwriter	6.67	53.48	254.92	654.91
Volume ($m) per underwriter	66	615	5,517	18,509
Number of underwriters	111	97	18	8
Market share (% deal count)	4.65	32.47	28.02	34.86
Market share (% volume)	2.29	18.56	30.16	48.99
Panel B: Markups in the new issues market				
Mean markup (bps)	22.49	14.91	14.38	13.76
Median markup (bps)	0.00	0.00	0.00	0.00
StDev markup (bps)	70.47	61.65	62.19	58.25
Average bond size ($m)	0.66	0.95	3.27	4.39
Number of bonds	100,026	598,503	520,128	802,981
Panel C: Underwriting spreads				
Mean spreads (bps)	160.99	111.99	89.95	74.84
Median spreads (bps)	126.70	89.80	69.90	60.60
StDev spreads (bps)	130.47	88.88	91.26	61.30
Average issue size ($m)	7.00	10.04	37.99	56.08
Number of issues	11,428	63,398	49,106	65,441

Table 3: Markups and Spreads for National Underwriters

This table reports results for regressions of primary market markups (Panel A) and underwriting spreads (Panel B) for national underwriters. *National* is a dummy variable for the underwriter's geographic breadth, indicating that the underwriter of the issue underwrote issues in 40 or more states in a given year. *Post-Markup Rule* indicates bonds issued after SEC amended rules G-15 and G-30 and FINRA Rule 2232 on markup disclosure become effective May 2018. Bond issue data is from the Mergent municipal fixed income database, trade data is from the MSRB, underwriter spreads (as a percent of issue size) are from SDC Platinum and Bloomberg. For markups, we consider only trades in the new issue market, defined as those within 14 days of the offering date or when the bond size is fully absorbed by customer buy trades, whichever earlier. The sample period is from 2005 through December 2023. Regressions include state and year fixed effects, use of proceeds dummies, and ratings dummies for narrow rating categories. Standard errors are clustered by issue.

Panel A: Primary Market Markup %

	All Bonds	GO Bonds	Issue $100m+	GO & $100m+
National	0.012***	0.023***	0.028***	0.045***
	(4.78)	(6.97)	(4.14)	(3.17)
National x Post Markup Rule	-0.041***	-0.055***	-0.037***	-0.041**
	(-10.77)	(-10.33)	(-4.42)	(-2.55)
Bond Controls	Yes	Yes	Yes	Yes
Proceeds Dummies	Yes	Yes	Yes	Yes
Ratings Dummies	Yes	Yes	Yes	Yes
State and Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.114	0.106	0.063	0.064
Observations	1,705,648	1,006,900	192,744	59,501

Panel B: Underwriting Spreads %

	All Bonds	GO Bonds	Issue $100m+	GO & $100m+
National	0.004	0.032***	-0.021***	-0.034**
	(1.16)	(6.67)	(-3.48)	(-2.17)
National x Post Markup Rule	-0.047***	-0.083***	-0.010	-0.043
	(-6.92)	(-9.01)	(-0.52)	(-0.65)
Bond Controls	Yes	Yes	Yes	Yes
Proceeds Dummies	Yes	Yes	Yes	Yes
Ratings Dummies	Yes	Yes	Yes	Yes
State and Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.272	0.322	0.103	0.056
Observations	105,002	56,250	11,006	3,062

Table 4: Money Left On The Table by Uninformed Trading

This table reports the amount of money left on the table by uninformed trading, using estimates from the two latent class finite mixture regression model applied to rated bonds for two year periods over the sample. Money left on the table (MLOT) is defined as the average expected difference between uninformed and informed trades, conditional on trading by an uninformed trader. The first column presents the average MLOT per transaction in basis points. The second and third columns are the percent of the bond and issue respectively generated by aggregating the dollar amounts of MLOT. The fourth column is the underwriting spread (in bp) for the issues in the sample, and the last column presents the percentage MLOT of the total issue profit, where total issue profit is defined for each issue as the sum of MLOT and underwriting spread.

	Money Left On The Table				
Year	Per Trade (bps)	Per Bond (bps of Par)	Per Issue (bps of Par)	Underwriting Spread (bps)	MLOT in % of Total Profit
2006	129.79	51.89	14.89	98.05	13.41
2007	129.05	51.84	15.25	99.19	13.18
2008	179.72	73.18	28.39	91.25	20.94
2009	178.66	63.14	22.73	97.86	16.24
2010	173.38	67.61	20.47	95.53	15.45
2011	178.27	70.73	21.42	97.61	16.33
2012	172.41	64.98	17.06	91.02	13.93
2013	177.97	70.35	17.40	89.86	14.30
2014	160.39	63.60	15.91	86.42	13.81
2015	164.38	66.38	17.86	82.98	15.89
2016	155.98	62.89	15.61	82.09	14.15
2017	152.94	63.72	15.68	90.73	13.55
2018	118.48	44.08	10.48	100.50	9.55
2019	117.15	49.15	12.04	91.59	11.02
2020	113.50	52.98	10.20	94.01	8.80
2021	105.85	46.94	8.02	93.39	7.45
2022	110.61	36.83	8.06	102.53	6.22
2023	112.51	30.70	3.06	102.58	2.59
Average	157.64	59.13	14.79	93.11	12.37
Observations	3,518,135	359,840	125,926	125,926	125,926

Table 5: Effects of Texas ESG Policy: Non-Parametric Estimates

This table reports estimates of yields and markups using Coarsened Exact Matching to calculate the ATT of the Texas ESG policy non-parametrically. Panel B provides estimates for the policy period (Sept2021-April2022), and Panels A and C provide estimates for the 8 month periods preceding and following the policy. Only bonds issued during the periods are included in the sample, and we drop all states with a state tax greater than 5%. We balance the sample by placing TX and Other States in strata which match exactly on bond type (GO/REV), offering type (Comp/Neg), and credit rating including unrated as a category, and are locally close with respect to maturity and bond amount. Only strata with both TX and Other State bonds are included, ensuring common support in the sample. Estimates include all matched variables as controls, as well as dummies for month and bank qualification. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

Panel A: Pre-Policy Period

	Off. Yields	Markups
TX	1.228	0.090
Other States	1.238	0.091
Sample ATT	-0.010	-0.001
	(-1.40)	(-0.05)
Observations	36,116	36,116

Panel B: Policy Period

	Off. Yields	Markups
TX	1.878	0.063
Other States	1.869	0.050
Sample ATT	0.008	0.013*
	(0.95)	(1.74)
Observations	24,760	24,760

Panel C: After-Policy Period

	Off. Yields	Markups
TX	3.420	0.118
Other States	3.409	0.050
Sample ATT	0.011	0.067***
	(0.95)	(4.57)
Observations	16,980	16,980

Figure 1: Underwriting activity by underwriter type over time

The figure shows the time series variation in underwriting activity. Underwriters are classified based on how many states they underwrite in a given year: "single state" if one state, "small regional" if between 2 and 19 states, "large regional" if between 20 and 39, and "national" if 40 and above. The upper panel shows the number of deals (left axis) and the fraction underwritten by each underwriter type (right axis). The lower panel shows the total underwriting volume (in $ billion, left axis) and the fraction of volume underwritten by each underwriter type (right axis). Data source: Mergent municipal fixed income database. Sample period: 2005–2023.

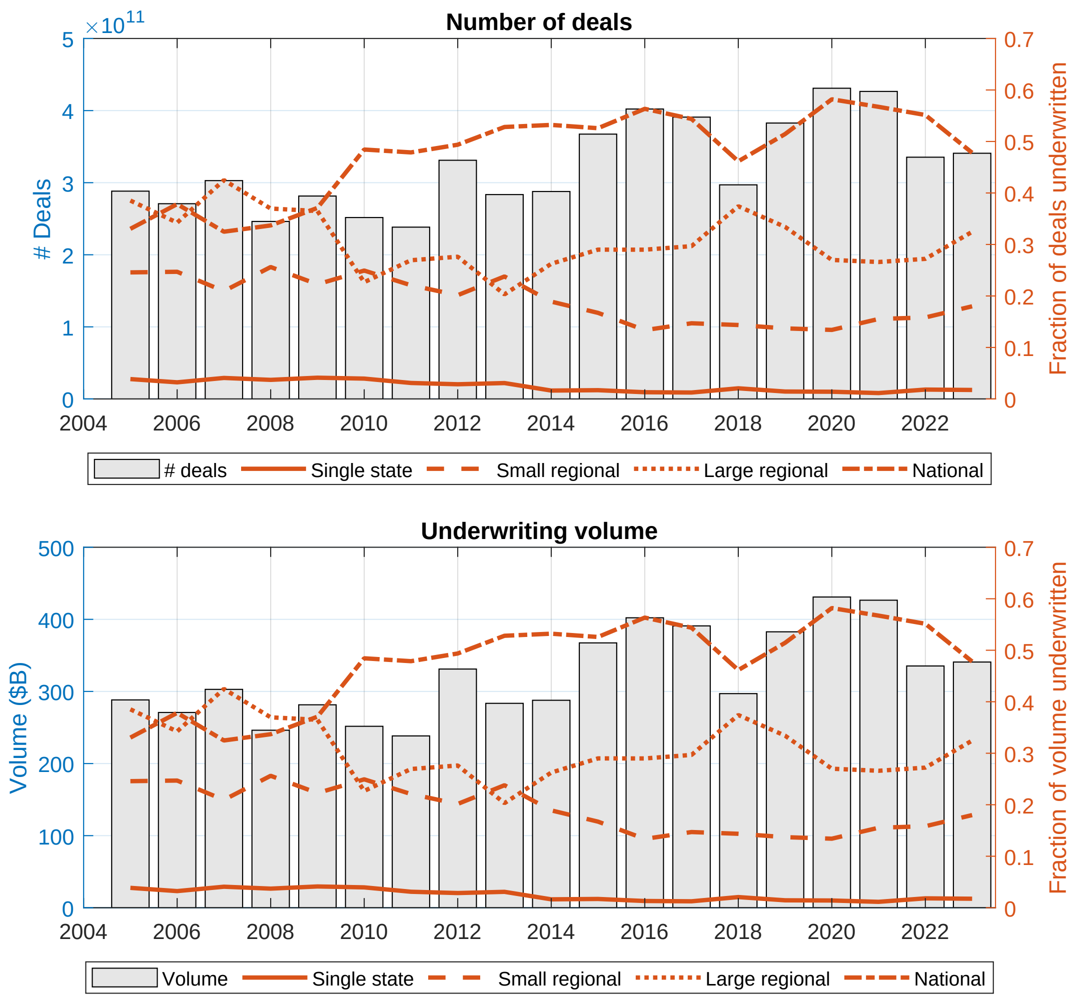


Figure 2: Time series variation in markups and spreads by underwriter type

This figure presents the average markups and spreads over time by underwriter type. Underwriters are classified based on how many states they underwrite in a given year: "single state" if one state, "small regional" if between 2 and 19 states, 'large regional" if between 20 and 39, and "national" if 40 and above. Panel A shows the year-by-year average bond-level markups over offering price in the new issue period (within 14 days of the offering date). Panel B plots the year-by-year average underwriting spreads. Data sources: Mergent, MSRB, SDC Platinum, and Bloomberg. Sample period: 2005–2023.

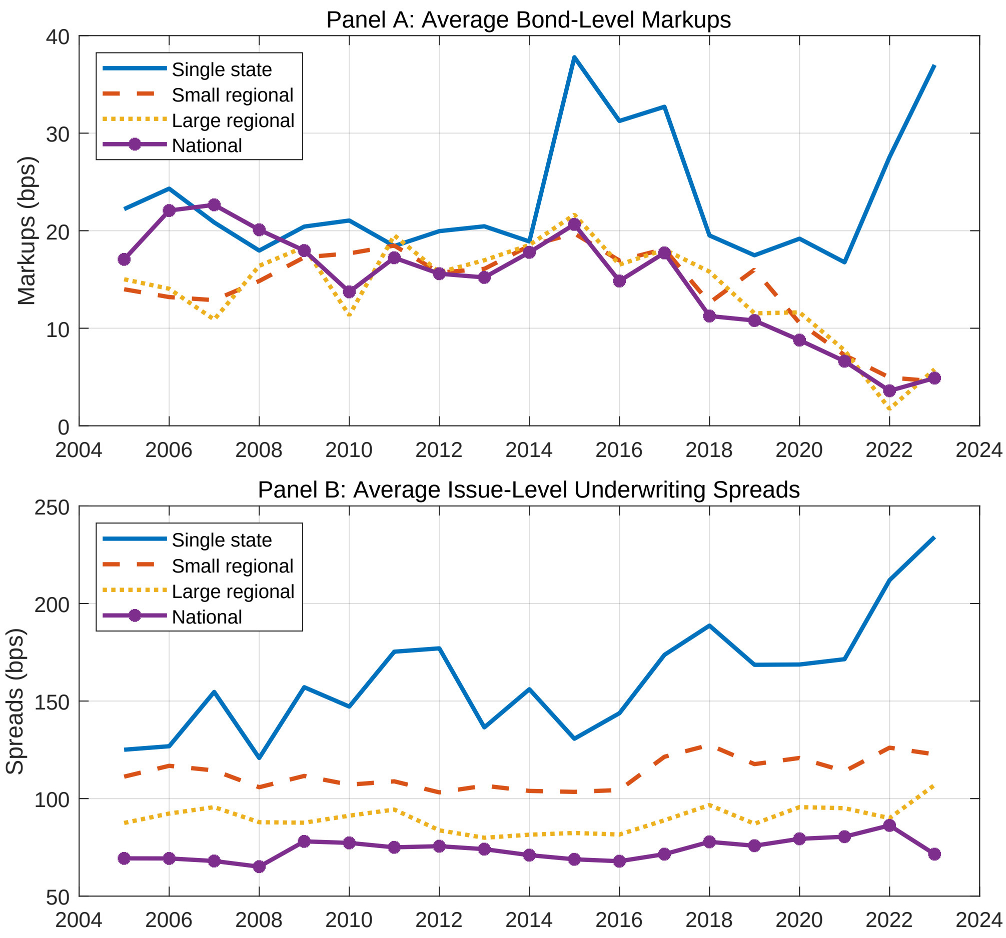
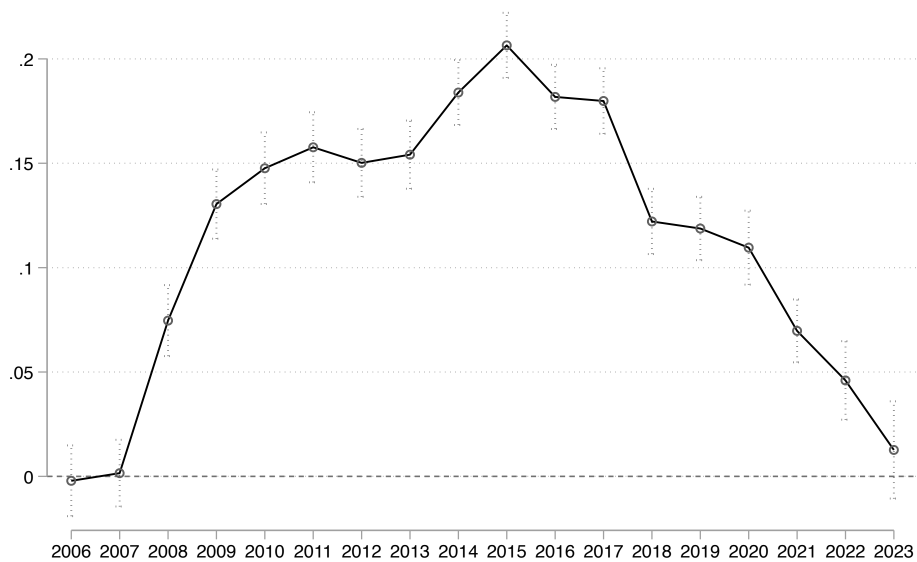
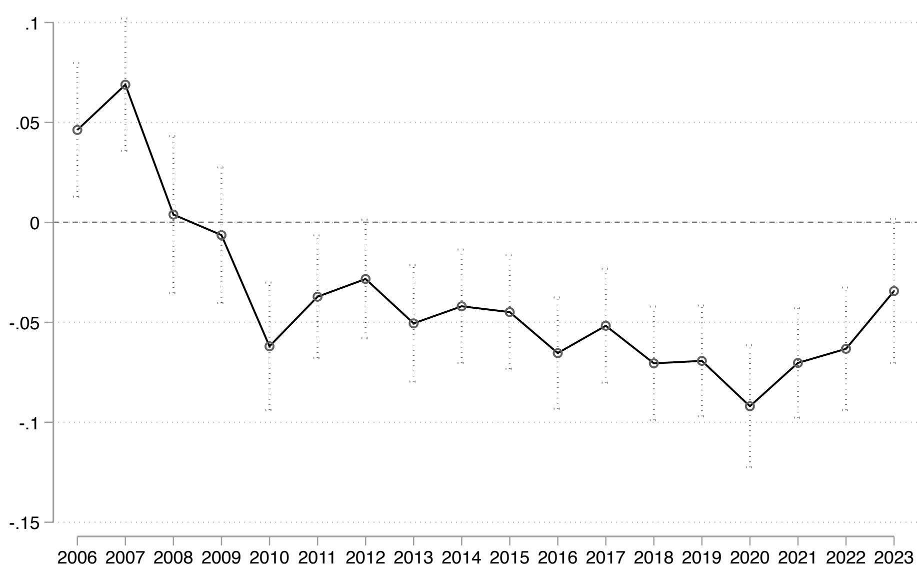


Figure 3: Regression Analysis of Markups Over Time

The figure shows the average markups over time after controlling for determinants of markups using the regression model in Equation (2). Panel A plots the Year fixed effects. Panel B plots the National x Year fixed effects. Markup on a customer buy trade is computed as the difference between the price paid and the offering price of the bond, expressed as a percentage of the offering price. The average markup in the new issue market for a given bond is the trade-size-weighted average markups on all trades in that bond within 14 days of issuance or until the total bond amount is fully sold, whichever earlier. Underwriters are classified based on how many states they underwrite in a given year. National underwriters are those that do business in 40 or more states in a given year. Data sources: Mergent municipal fixed income database and MSRB trade data. Sample period: 2005–2023.



Panel A: Year Fixed Effects



Panel B: National x Year Fixed Effects

Figure 4: Share of institutional participation in the new issue market

The figure shows the time series variation in the fraction of bond issuance purchased by institutional investors in the new issue market. Institutional trades are trades of $100,000 or greater. Underwriters are classified based on how many states they underwrite in a given year: "single state" if one state, "small regional" if between 2 and 19 states, "large regional" if between 20 and 39, and "national" if 40 and above. The upper panel shows the number of deals (left axis) and the fraction underwritten by each underwriter type (right axis). Data sources: Mergent municipal fixed income database and MSRB trade data. Sample period: 2005–2023.

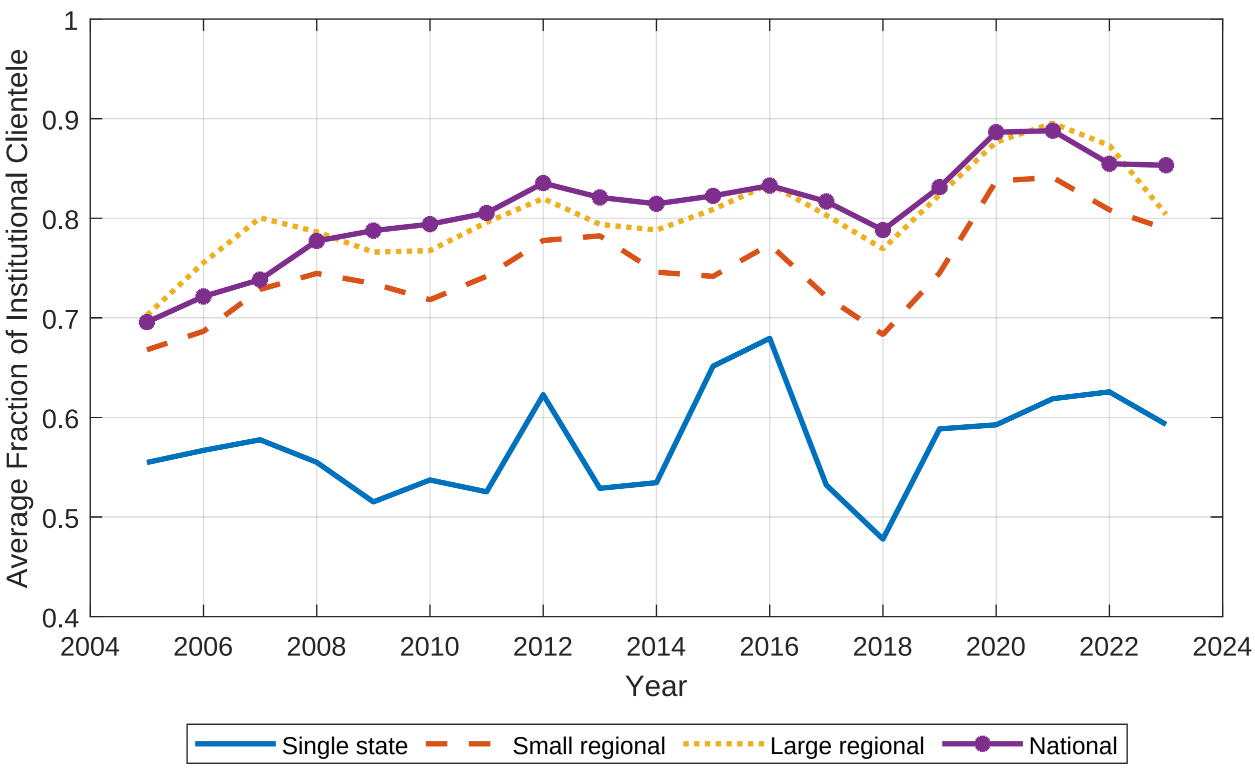
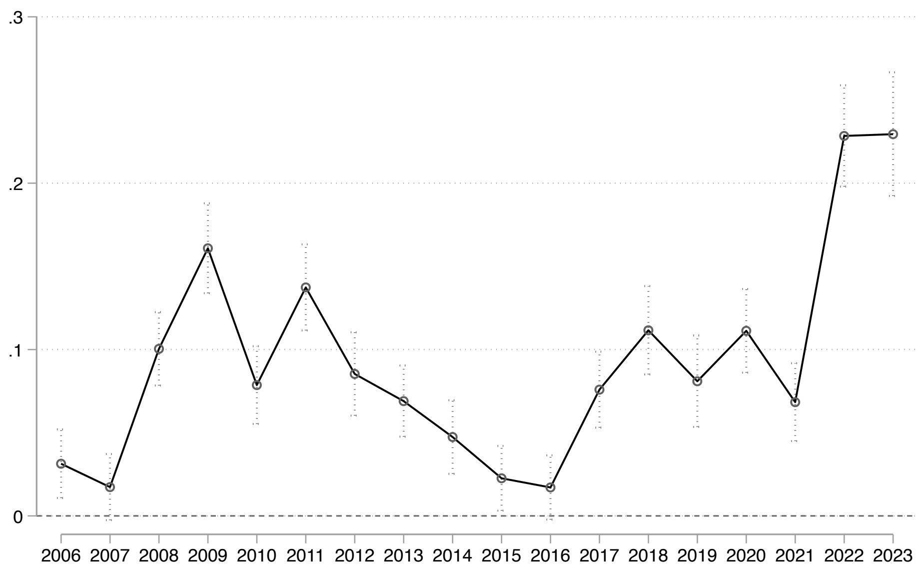
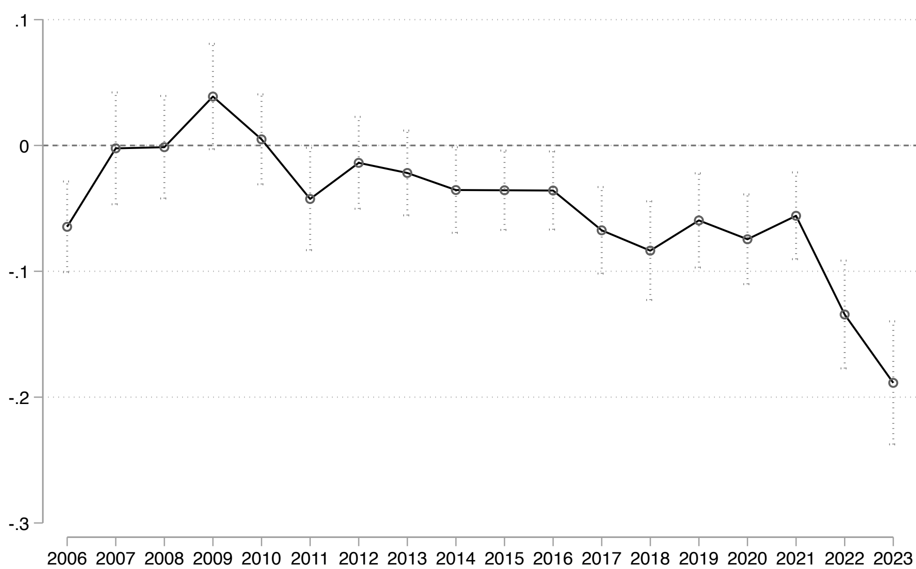


Figure 5: Regression Analysis of Underwriting Spreads Over Time

The figure shows the average underwriting spreads over time after controlling for determinants of spreads using the regression model in Equation (3). Panel A plots the Year fixed effects. Panel B plots the National x Year fixed effects. Spreads are dollar amounts per $100 of issuance. Underwriters are classified based on how many states they underwrite in a given year. National underwriters are those that do business in 40 or more states in a given year. Data sources: Mergent municipal fixed income database, SDC Platinum, and Bloomberg. Sample period: 2005–2023.



Panel A: Year Fixed Effects



Panel B: National x Year Fixed Effects

Figure 6: Probability of Uninformed Trade

The figure plots the mean probability of uninformed trades by subperiod and their standard errors, based on the classification regression of the mixture model with informed and uninformed investors. Estimates are based on all trades within 14 days of the offering date or until the bond size is fully absorbed, whichever earlier. The model is estimated separately for non-overlapping two-year periods beginning in 2006. Data sources: Mergent municipal fixed income database, MSRB trade data, SDC Platinum and Bloomberg. Sample period: 2005–2023.

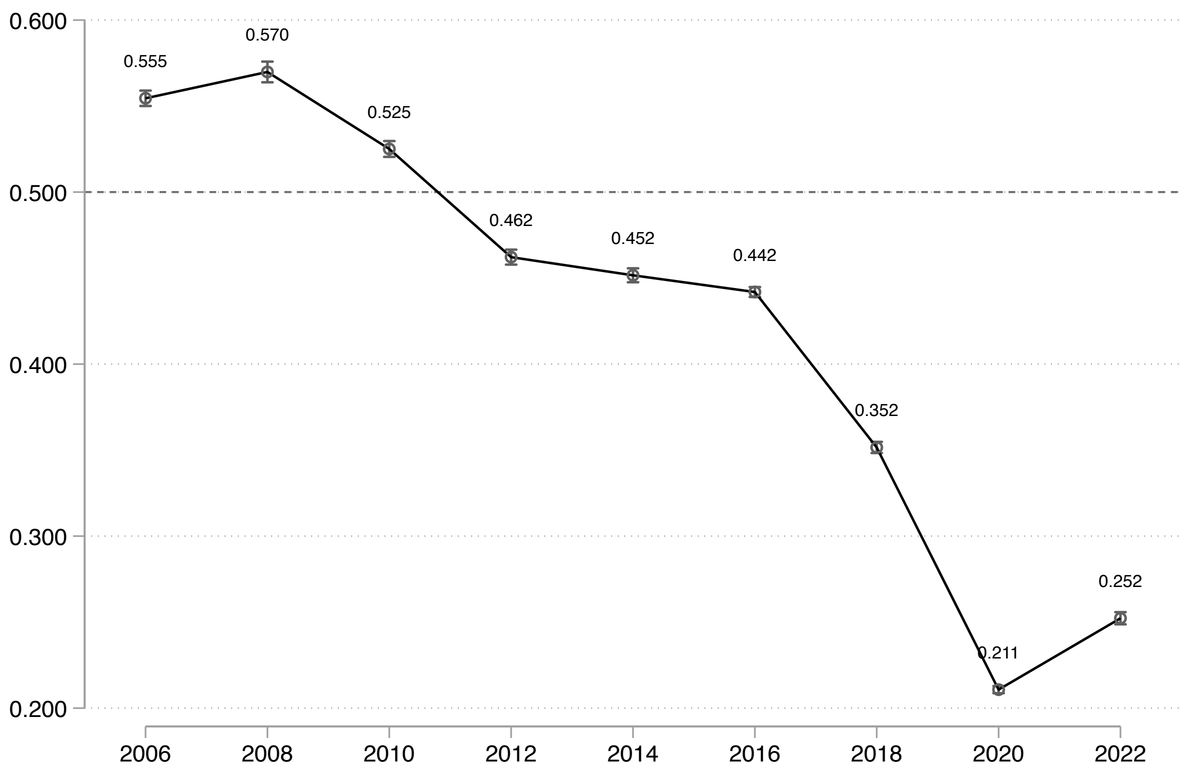


Figure 7: Markups on Uninformed Trades

The figure plots the mean markups (in percentage points) on uninformed trades and their standard errors, based on the outcome regression of the mixture model with informed and uninformed investors. Estimates are based on all trades within 14 days of the offering date or until the bond size is fully absorbed, whichever earlier. The model is estimated separately for non-overlapping two-year periods beginning in 2006. Data sources: Mergent municipal fixed income database, MSRB trade data, SDC Platinum and Bloomberg. Sample period: 2005–2023.

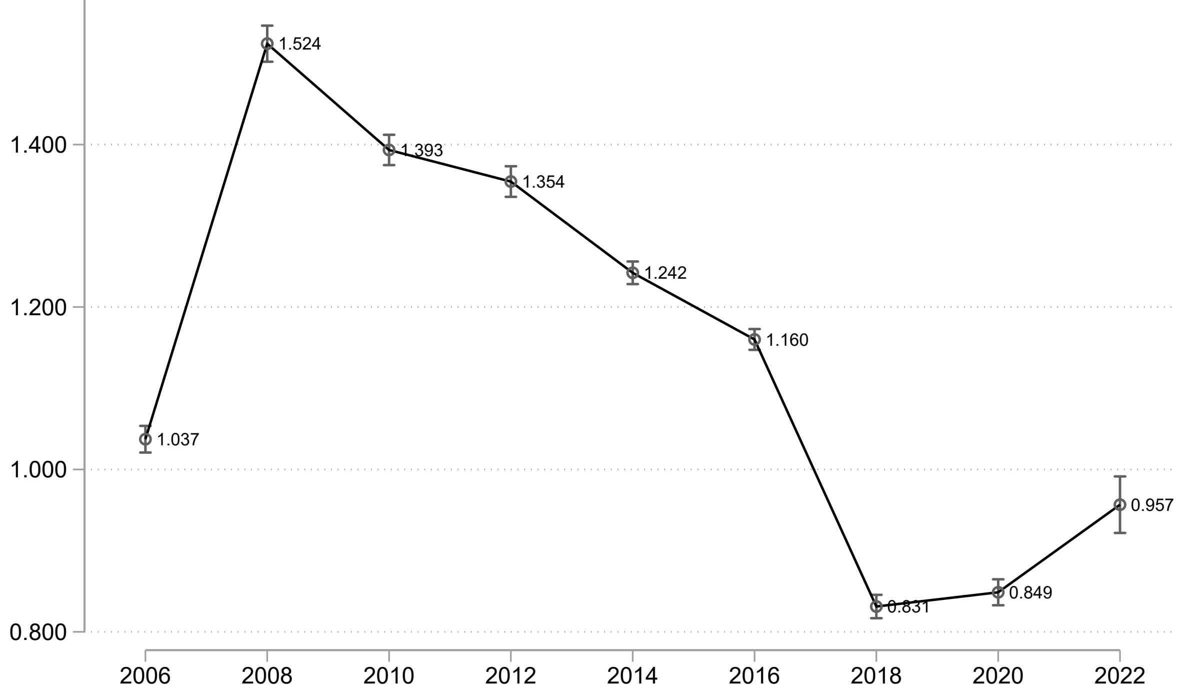


Figure 8: Effects of National Underwriter on the Probability of Uninformed Trades

The figure plots the effects of the National Underwriter dummy variable on the probability of a trade with uninformed investors. The estimate is from the classification regression of the mixture model with informed and uninformed investors. National underwriters are those that underwrite bonds in 40 or more states in a given year. Estimates are based on all trades within 14 days of the offering date or until the bond size is fully absorbed, whichever earlier. The model is estimated separately for non-overlapping two-year periods beginning in 2006. Data sources: Mergent municipal fixed income database, MSRB trade data, SDC Platinum and Bloomberg. Sample period: 2005–2023.

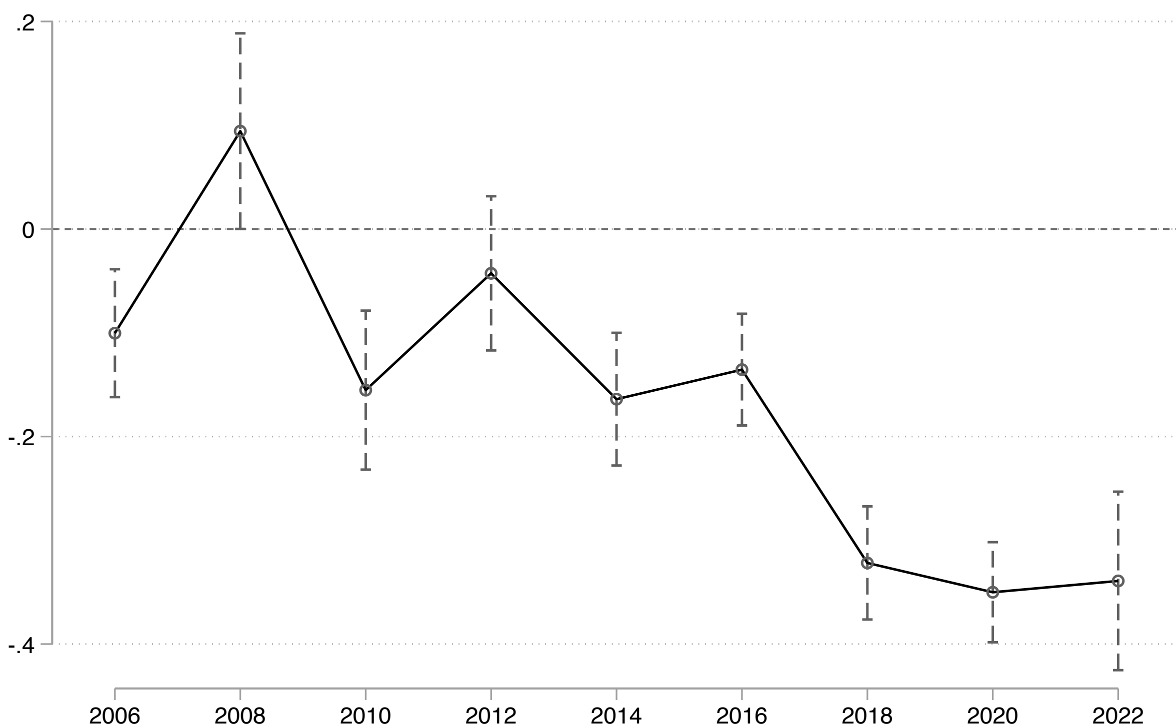


Figure 9: Effects of National Underwriter on the Markups on Uninformed Trades

The figure plots the coefficient of the National Underwriter dummy in the markup outcome equation in the uninformed regime. National underwriters are those that underwrite bonds in 40 or more states in a given year. Markups are expressed in percentage points. Estimates are based on all trades within 14 days of the offering date or until the bond size is fully absorbed, whichever earlier. The model is estimated separately for non-overlapping two-year periods beginning in 2006. Data sources: Mergent municipal fixed income database, MSRB trade data, SDC Platinum and Bloomberg. Sample period: 2005–2023.

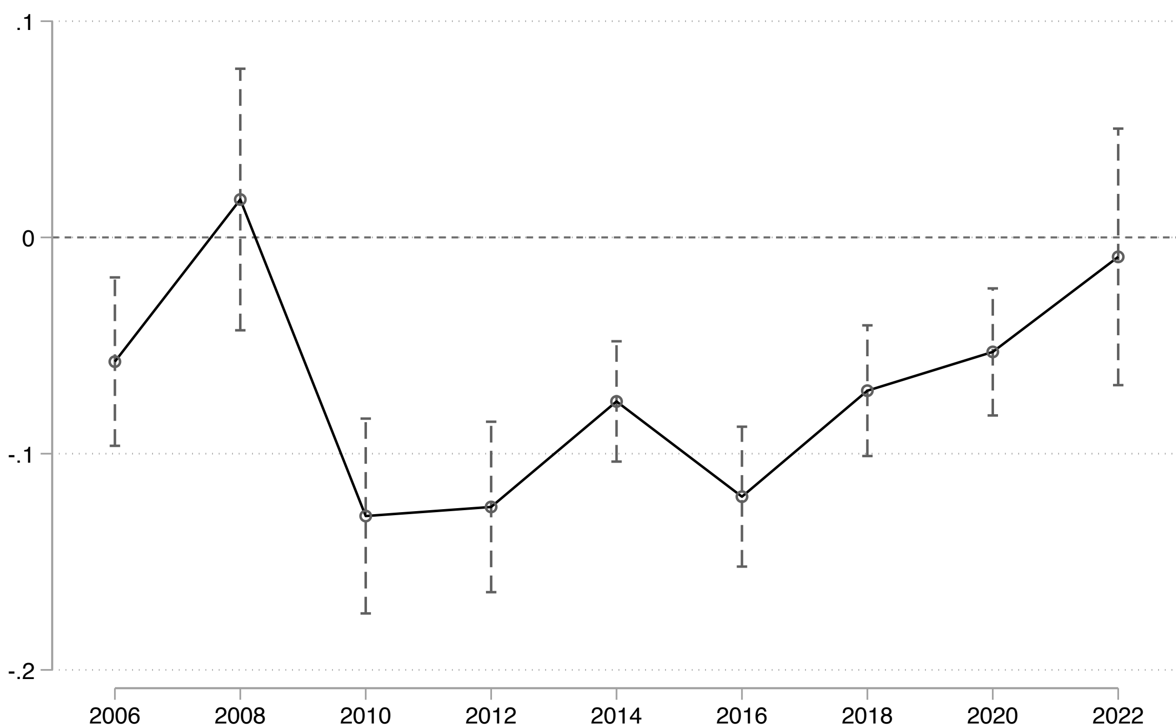


Figure 10: Effects of Underwriter Spreads on the Probability of Uninformed Trades

The figure plots the coefficient of the underwriting spread on the probability of a trade with uninformed investors. The estimate is from the classification regression of the mixture model with informed and uninformed investors. Estimates are based on all trades within 14 days of the offering date or until the bond size is fully absorbed, whichever earlier. The model is estimated separately for non-overlapping two-year periods beginning in 2006. Data sources: Mergent municipal fixed income database, MSRB trade data, SDC Platinum and Bloomberg. Sample period: 2005–2023.