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Disclosure and Competition for Capital

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Abstract. Ownership segmentation in the municipal bond market gives rise to competition among local issuers for a limited supply of capital. We consider the disclosure implications of this competition for capital, using Moody's 2010 recalibration of the municipal rating scale. The recalibration placed lowly upgraded issuers at a disadvantage relative to their highly upgraded peers within the same market segment. We develop a model in which two municipal bond issuers compete for investors' capital by choosing bond yields. The model predicts the issuer that is disadvantaged by the recalibration is more likely to improve its disclosure to better compete with its advantaged peer if (i) the rating upgrade that its peer receives is higher and (ii) competition for capital is fiercer. Empirically, we find that the disadvantaged issuers provide more and timelier financial disclosures after the recalibration. This improvement in disclosure quality increases in the extent of the issuer's disadvantage, arises only if we consider peers with whom the issuer directly competes for capital, and is pronounced when the local capital supply is constrained. Our analytical and empirical analyses support the idea that a competitive disadvantage in raising capital in segmented markets can motivate issuers to improve disclosure quality.

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1. Introduction

Capital market segmentation occurs when implicit and explicit barriers limit cross-border capital flows.[1] The implications of segmentation for asset pricing have been studied extensively. Prior studies show that, by limiting the supply of risk-bearing capital, market segmentation results in less efficient risk sharing for investors, higher risk premiums, and greater price sensitivity to changes in idiosyncratic risk (Errunza and Losq 1985, Bekaert and Harvey 2000, Schwert 2017, Babina et al. 2021). However, little is known about how entities operating in segmented markets make disclosure choices when they compete for a limited supply of capital. This paper investigates how municipal bond issuers adjust their disclosure when they are placed at a competitive disadvantage in raising capital.

Several features of the market for U.S. municipal bonds limit the supply of risk-bearing capital. The bonds are generally exempt from federal, state, and local taxation, which appeals to local retail investors but makes the bonds less attractive to institutional (Schwert 2017) and out-of-state retail investors (Babina et al. 2021). The bonds also serve a public purpose (e.g., improving local schools, roads), which amplifies retail investors' preference for local and familiar bonds (Coval and Moskowitz 1999, Massa and Simonov 2006) but limits their appetite for nonlocal bonds. These features constrain the investor pool from which local governments raise capital, making it an apt setting to study competition for capital.

To evaluate the role of competition for capital in disclosure choice, we use Moody's municipal rating scale recalibration. The recalibration resulted in zero-to-three-notch upgrades that merely reflect a change in scale rather than a change in credit quality (Dorer and Van Praagh 2010).[2] The recalibration provides us with a plausibly exogenous change in a bond issuer's competitive position within its segment of the bond market. Issuers that receive significant upgrades (e.g., two or three notches) gain a relative advantage. By contrast, those that receive lower upgrades (e.g., one notch or no upgrade) are placed at a relative disadvantage after the recalibration.

We develop a model to show how competition for capital alters municipal bond issuers' disclosure choices. In the model, two ex ante identical bond issuers compete for a limited supply of capital by separately choosing their bond yields. The recalibration advantages the highly upgraded issuer and disadvantages the lowly upgraded issuer. In response, the disadvantaged issuer raises its bond yield above the advantaged issuer to compete.

The relative increase in bond yields may induce the municipal manager to undertake excessive risks, creating a potential conflict of interest between the issuer and its investors. The demand for improved disclosure arises as a result. Although improving disclosure is costly (e.g., administrative costs and reputational costs for elected officials), it provides investors with information that they can use to evaluate the issuer's project selection and implementation. The improved disclosure facilitates external monitoring from the public, which is beneficial because it enables the disadvantaged issuer to commit not to take excessive risks. In this sense, disclosure reduces investors' assessment of the issuer's credit risk and secures its financing. In other words, better disclosure enhances the credibility of the disadvantaged issuer and allows it to better compete with the advantaged issuer.

Empirically, we consider two dimensions of disclosure quality. The first dimension is the timeliness of disclosure. Timelier information facilitates monitoring by giving stakeholders more time to react, gather other information, or intervene against the issuer's inefficient project choices (Tirole 2006, Ball et al. 2008). The second dimension is the quantity of disclosure provided by the issuer. More disclosure gives stakeholders more information that they can use to evaluate the issuer's riskiness. By aggregating these two dimensions, disclosure quality is a combination of the amount of information that issuers provide to investors and how quickly they provide it.

We identify competing issuers as those in the same state that share a prerecalibration credit rating from Moody's and are of similar size (in the same population quintile). Conditioning on state follows prior research that shows the market for municipal bonds is segmented along state lines (Butler 2008). We condition on the prerecalibration credit rating to group together issuers with the same credit risk ranking before the recalibration. The size condition reflects the idea that underwriting and marketing bonds differ for small and large issuers (Feroz and Wilson 1992, Rivers and Yates 1997) and allows us to hold the cost of disclosure relatively constant within peer groups. We measure each issuer's *abnormal* upgrade as the difference between the issuer's upgrade and its peer group's average upgrade. A negative abnormal upgrade indicates that the recalibration places the issuer at a relative disadvantage within its market segment, even though their credit ratings may have increased in absolute terms.

The model predicts that a disadvantaged issuer is more likely to improve its disclosure quality if the credit rating upgrade that its peer receives is greater. Consistent with the prediction, we find that disadvantaged issuers improve their disclosure quality. The improvement increases in the extent of the issuer's disadvantage. In economic terms, we show that a one-notch increase in the issuer's disadvantage is associated with a 13.2% improvement in disclosure quality.

The model also predicts that a disadvantaged issuer is more likely to improve its disclosure if competition for capital is fiercer. We test the prediction in two ways. First, we conduct falsification tests that minimize the level of competition by grouping together issuers that do not directly compete with one another for capital. Consistent with the prediction, we find no evidence of increased disclosure among issuers that are disadvantaged relative to issuers with whom they do not compete. The insignificance in our falsification tests highlights the importance of competition for capital in our empirical findings. Our primary result only holds when we calculate the issuer's disadvantage among issuers that directly compete with one another for capital.

Our second test of the model's competition prediction uses cross-sectional variation in the extent of competition. In our setting, competition for capital arises because of constraints on the supply of capital. We operationalize fierce competition for capital using the state-level ratio of debt to income. Debt proxies for demand for capital from issuers within a state. Personal income proxies for the supply of capital from local retail investors. In states with high levels of debt (demand) relative to income (supply), the supply of capital is relatively constrained, and competition is fiercer. Consistent with the model's prediction, we find that disadvantaged issuers improve disclosure to a greater extent in states where the ratio of debt-to-income is higher.

The collage of evidence presented in this paper complements a wide literature that studies the effect of competitive forces on disclosure. For example, when product market competition intensifies, the tradeoff between heightened proprietary costs of disclosure and capital market benefits can lead firms to increase or decrease disclosure (Verrecchia 1983, Clinch and Verrecchia 1997, Li 2010). When competition for equity investors' attention intensifies, the heightened capital market benefits of disclosure lead all firms to increase disclosure (Fishman and Hagerty 1989).

Although local governments do not have product-market competitors or equity holders, our results suggest that they face a type of competition that is prevalent in segmented markets, namely competition for capital. When competition for capital intensifies, disadvantaged issuers improve their disclosure quality to mitigate their perceived risk, secure financing, and better compete with their advantaged peers. In the absence of regulatory authority to compel disclosure in the municipal bond market, our finding is important because it shows that market forces, such as tighter competition for capital, can help address the Securities and

Exchange Commission's (SEC) concern that municipal disclosures are untimely and infrequent (SEC 2012). As such, we contribute to the growing literature that documents the costs and benefits of disclosure in the municipal bond market (Baber et al. 2013, Cuny 2016).

Relatedly, our work contributes to the literature that shows entities adjust disclosure in response to changes in their *own* risk perceived by market participants (Leuz and Schrand 2009; Lo 2014; Balakrishnan et al. 2014a; b; Basu et al. 2022). In the corporate bond setting, Sethuraman (2019) shows that issuers improve disclosure when the credit rating agency that rates their debt experiences a loss of reputation. In the municipal bond setting, Gillette et al. (2020) show that Moody's-rated municipal bond issuers reduce disclosure compared with S&P-rated issuers after the recalibration increased Moody's credit ratings.

What is unclear from the literature is how and why an entity would respond to changes in their *peers'* perceived risk. To fill this gap in the literature, we develop a model that explicitly incorporates issuers' competition for capital. Both our theoretical and empirical results demonstrate the importance of competition in understanding disadvantaged issuers' disclosure responses. We find that lowly upgraded issuers improve disclosure to better compete with their highly upgraded peers for capital.[3] This result arises only if we consider peers with whom the issuer directly competes for capital, and is more pronounced when the capital supply is constrained.

Finally, our work contributes to the segmentation literature, which shows adverse market effects of segmentation (Bekaert and Harvey 2000, Karolyi and Stulz 2003). For example, Schwert (2017) argues that municipal bonds' lack of appeal to institutional investors limits the supply of risk-bearing capital and contributes to municipal bonds' high-risk premium. Our paper builds on the observation that the supply of risk-bearing capital is limited in the municipal bond market. Rather than focusing on asset pricing outcomes of this competition, we show that it can incentivize disadvantaged issuers to improve their disclosure quality.

2. Institutional Setting

Before 2010, Moody's maintained a dual-class rating system: the Municipal Rating Scale and the Global Rating Scale. Both scales provide a relative (ordinal) ranking of credit risk.[4] The Municipal Rating Scale ranks municipal bonds based on their distance to distress (i.e., the likelihood of default). It does not account for loss given default, which tends to be small for governmental issuers (Tudela et al. 2012). Under pressure to enhance comparability across asset classes, Moody's recalibrated its municipal credit ratings to the Global Rating Scale in April and May 2010. The Global Rating Scale, used for corporate bonds, sovereign bonds, and structured financial products, ranks financial instruments based on expected loss (i.e., the product of the likelihood of default and loss given default).

Moody's incorporation of expected loss given default in municipal bonds' credit ratings resulted in zero-to-three-notch upgrades for municipal bonds rated by Moody's. The extent of a bond's upgrade varied with the bond's sector and rating. Appendix B provides Moody's primary recalibration algorithm, based on the source of repayment on the bond and the bond's credit rating before the recalibration. Moody's expected the average upgrade for general obligation bonds to be two notches (e.g., from A3 to A1), special tax obligations to be one notch, and housing, healthcare, and other enterprise obligations to not change. Most bonds in the housing, healthcare, and other enterprise sectors received no upgrade because they were already well calibrated with the global scale. The extent of the upgrade also varied with the bond's prerecalibration credit rating. Moody's expected to award the highest upgrades to bonds rated between Aa3 and Baa3. Our empirical tests condition on prerecalibration credit ratings to absorb these differences.

To determine whether actual upgrades are consistent with the plan laid out by Moody's, Appendix B also shows the average number of notches by which each type of bond was upgraded. The actual upgrades for general obligation bonds closely mirror Moody's guidance. As expected, midrated general obligation bonds received the highest upgrades. The actual upgrades for special tax and revenue bonds also broadly mirror Moody's guidance, though it appears Moody's exercised some discretion given the wide variety of revenue sources in these categories.

Moody's highlights that: "Market participants should not view the recalibration of municipal ratings as rating upgrades, but rather as a recalibration of the ratings to a different rating scale" (Dorer and Van Praagh 2010, p. 1). However, empirical evidence shows that the recalibration was consequential for investors, voters, residents, and Moody's itself. Yield spreads on upgraded bonds decreased relative to nonupgraded bonds (Cornaggia et al. 2018), suggesting that investors gleaned some new information from the recalibration. Issuers responded to their increased capacity to issue debt by increasing expenditures that benefit the local economy (Adelino et al. 2017) and municipal managers' election prospects (Cunha et al. 2019). Issuers also responded to reduced investor demand for information by reducing their public disclosure (Gillette et al. 2020). Moody's itself was able to charge higher fees to issuers for their ratings (Beatty et al. 2019) even though these ratings are coarser (Tang et al. 2020). Although these studies primarily focus on the on-average effects of the recalibration, we focus on the segmentation of the market and explore the disparity between the winners and losers within market segments.

3. Theoretical and Hypothesis Development

We develop our hypotheses using a model that explicitly accounts for issuers' competition for capital. We first present the model and its formal results. To get the basic idea of the model, one can examine the numerical example presented after Proposition 1.

Two local government agencies, A and B, sell bonds to investors. Because the municipal bond market is segmented, the supply of risk-bearing capital is limited (Schwert 2017). The two issuers compete with one another for investors' capital by choosing interest rates for their bonds. It is convenient to denote by r_i the payment that issuer $i \in \{A, B\}$ promises to its investors for each dollar they invest. There is a simple one-to-one relation between the bond payment r_i and its implied interest rate $r_i - 1$.

Competition for capital is reflected in the demand for the two issuers' bonds. If issuers A and B choose payments r_A and r_B, respectively, the demand for issuer i's bond is

$$q_i = Rating_i \times r_i - b\,Rating_j \times r_j, \tag{1}$$

where $Rating_i$ is issuer i's credit rating, and $b \in [0, 1]$ reflects the extent to which the two issuers compete with one another. As will be clear later, $Rating_i$ is inversely related to the issuer's default risk in equilibrium. Thus, $Rating_i \times r_i$ in Equation (1) can be thought of as a *risk-adjusted return*. Equation (1) suggests that investors' aggregate demand for i's bond increases in its own credit-rating adjusted return (or, risk-adjusted return), and because of competition $b \geq 0$, decreases in its peer j's credit-rating adjusted return.

The demand function (1) is built on standard Bertrand competition models (Gibbons 1992, p. 21). Similar price-competition models have been used to study banks competing for depositors by choosing interest rates. Egan et al. (2017) provide evidence that the aggregate demand for a bank's deposits increases in its interest rate and decreases in its perceived default risk. Furthermore, they show that a focal bank's deposits decrease if other banks raise their interest rates or lower their default risks. These two features are captured by the first and the second term, respectively, in our demand function (1) (recall that $Rating_i$ is inversely related to the issuer's default risk in equilibrium).[5]

After raising funds from investors, each bond issuer has access to a set of constant return-to-scale investments. Each investment succeeds with probability p, in which case it yields a cash flow $C > 1$ for each dollar invested. With the complementary probability $1 - p$, the investment fails and generates a cash flow of zero. Given the raised funds q_i, the issuer's payoff is

$$\pi_i(r_i, r_j) = q_i[p(C - r_i) + (1 - p)0], \tag{2}$$

which is the expected surplus left to the bond issuer after paying its investors. We assume that the bond issuer prefers more surplus over less.[6]

The bond payments (r_A^*, r_B^*) constitute an equilibrium if, for each issuer $i \in \{A, B\}$, r_i^* solves

$$\max_{r_i} \pi_i(r_i, r_j^*) = \max_{r_i} (Rating_i \times r_i - b\,Rating_j \times r_j^*)\,p(C - r_i).$$

The solution to the issuer i's maximization problem is $r_i^* = \frac{Rating_i C + b\,Rating_j r_j^*}{2Rating_i}$. Therefore, if the bond payment pair (r_i^*, r_j^*) is an equilibrium, the issuers' choices must satisfy $r_A^* = \frac{Rating_A C + b\,Rating_B r_B^*}{2Rating_A}$ and $r_B^* = \frac{Rating_B C + b\,Rating_A r_A^*}{2Rating_B}$. Solving the two equations simultaneously leads to the equilibrium bond payments:

$$\begin{aligned} r_A^* &= \frac{(2Rating_A + b\,Rating_B)C}{Rating_A(4 - b^2)}, \\ r_B^* &= \frac{(2Rating_B + b\,Rating_A)C}{Rating_B(4 - b^2)}. \end{aligned} \tag{3}$$

It follows from Equation (3) that issuers with the same credit ratings offer the same payment $r^* = \frac{C}{2-b}$ in equilibrium, and the payment r^* increases in the degree of competition $b \in [0, 1]$. That is, as the competition for capital becomes fiercer, a bond issuer has to transfer more surplus to its investors to attract their capital. In the limit of extreme competition $b \to 1$, ex ante identical issuers set $r^* = C$, leaving all surplus from the investment to the investors. Equation (3) also makes clear the role of competition for capital in linking an issuer's cost of debt to its *peer's* credit rating. Without such competition (i.e., b = 0), an issuer's cost of debt will depend on its own credit rating alone, and the concept of relative credit ratings would be irrelevant.

We assume that Moody's accounts for a bond issuer's default risk in assigning its credit rating and makes adjustments based on other proprietary information available to Moody's. The rating is modeled as

$$Rating_i = p + \Delta_i, \tag{4}$$

where p is Moody's assessment of the quality of the project that issuer i will undertake (i.e., the probability of success p in Equation (2)), which is inversely related to default risk.[7] The term Δ_i is the adjustment made by Moody's based on its proprietary information. For example, Moody's can make a positive adjustment $\Delta_A > 0$ if it believes that issuer A has a smaller loss given default, a good reputation, or a stronger balance sheet (Diamond 1991).

To capture Moody's recalibration, we assume that issuers A and B are identical before the recalibration in that $\Delta_A = \Delta_B = 0$ and, hence, $Rating_A = Rating_B = p$. Moody's upgrades $\Delta_A > 0$ in the recalibration and maintains $\Delta_B = 0$. Therefore, investors observe $Rating_A > Rating_B = p$ after the recalibration. We refer to A and B as the advantaged and disadvantaged issuers, respectively. The result shows how the recalibration affects the bond payments r_A^* and r_B^* that the issuers offer in equilibrium. All proofs are in Appendix C.

Lemma 1. *As Moody's upgrades $Rating_A$, bond payments r_A^* and r_B^* in Equation (3) satisfy the following:*

- *The equilibrium r_A^* decreases. That is, $\frac{dr_A^*}{dRating_A} < 0$.*
- *The equilibrium r_B^* increases. That is, $\frac{dr_B^*}{dRating_A} > 0$ for any competition parameter $b > 0$.*
- *The equilibrium r_B^* increases more in markets where competition b is fiercer. That is, $\frac{d^2 r_B^*}{dRating_A\, db} > 0$.*

The disadvantaged issuer raises its bond payment r_B^* in response to an upgrade to its peer's credit rating, $Rating_A$. Intuitively, if the payment r_B^* were to remain unchanged, an increase in $Rating_A$ would reduce the capital that the disadvantaged issuer B can raise (see Equation (1)), which then lowers the surplus π_B shown in Equation (2). By promising a higher payment r_B^*, the disadvantaged issuer mitigates the downward pressure on the demand for its bond. By contrast, the advantaged issuer A uses its comparative advantage and lowers its bond payment r_A^* in response.

Although issuer B can mitigate the competitive pressure by increasing its bond payment r_B^*, there is a limit to which this can be done because a high interest rate can trigger the conflict of interest between the bond issuer and its investors. In particular, bond issuers promising high interest rates have a tendency to take excessive risks because bond investors bear the downside default risk but do not enjoy the upside profit. This is the risk-shifting or asset substitution problem examined in prior studies (see Tirole 2006 for a review).[8]

To capture the risk-substitution problem simply, we assume that each issuer has access to two projects: one is low risk and the other is high risk. Following Allen and Gale (2000) and Boyd and De Nicolo (2005), we assume that the high-risk project is less likely to succeed but, conditional on being successful, generates a higher cash flow. In particular, the low-risk project succeeds with probability p and the high-risk project succeeds with probability αp (with $\alpha < 1$). Conditional on being successful, a dollar invested in the low-risk project generates $C = 1 + \Phi$ and a dollar invested in the high-risk project generates $C' = 1 + \beta\Phi$ (with $\beta > 1$). Investors understand that only the low-risk project is viable. That is, the low-risk investment has a positive net present value (i.e., $p(1 + \Phi) > 1$), and the high-risk project has a negative net present value (i.e., $\alpha p(1+\beta\Phi) < 1$).[9]

Because the high-risk project has a negative NPV, an issuer can only secure financing if it can commit *not* to undertake the high-risk project. For the issuer, undertaking the low-risk project is sequentially optimal if $q_i[p(1 + \Phi - r_i)] \geq q_i[\alpha p(1 + \beta\Phi - r_i)]$, or equivalently:

$$r_i \leq \bar{r} \equiv 1 + \frac{(1 - \alpha\beta)\Phi}{1 - \alpha}. \tag{5}$$

That is, a bond issuer's ex post risk-shifting incentive imposes a cap $\bar{r}$ on the payment the issuer can pledge to its investors in the first place. We refer to $\bar{r}$ in Equation (5) as the maximum *pledgable payment* under the status quo.

What happens when the disadvantaged issuer needs to raise its bond payment above $\bar{r}$ to compete, but cannot do so because investors are concerned about the issuer's risk-shifting incentives? This is when an improved disclosure policy can help. Improving disclosure costs c (e.g., transaction costs and reputational costs for the elected official) but supplies investors and voters with information they can use to evaluate the issuer's project selection and implementation. The improved disclosure facilitates external monitoring from the public, which is beneficial because it enables the disadvantaged issuer to *commit not to* take the high-risk project ex post even if the promised bond payment is $r_B^* > \bar{r}$. In other words, by facilitating external monitoring, improving disclosure enhances an issuer's pledgeable payment beyond $\bar{r}$ shown in Equation (5), giving the disadvantaged issuer extra flexibility to compete for capital (i.e., the ability to secure financing for $r_B^* > \bar{r}$.).[10]

The disadvantaged issuer can choose *not* to improve its disclosure and instead secures financing by fixing $r_B^* = \bar{r}$ even if its peer receives a sufficiently large rating upgrade. Doing so saves the disclosure cost c, but comes at the cost of losing competitiveness and, hence, a sharp decrease in investors' demand q_B for the bond. The disadvantaged issuer compares the cost and benefit of improving disclosure relative to the no-response alternative. Proposition 1 summarizes the necessary and sufficient condition for the disadvantaged issuer to improve its disclosure.

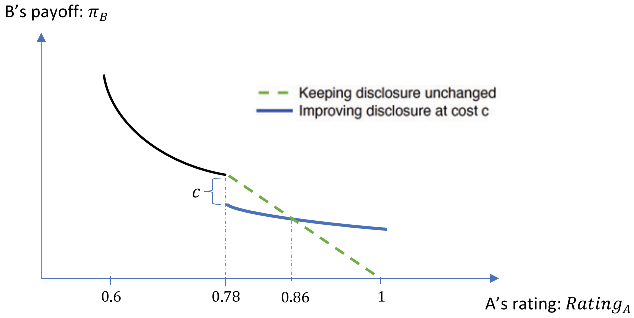
Proposition 1. *The disadvantaged issuer improves its disclosure if and only if the upgrade to $Rating_A$ is sufficiently large and the cost of disclosure is low.*

Figure 1 illustrates the tradeoffs the disadvantaged issuer faces via a numerical example in which $Rating_B = p = 0.6$ and the competition parameter $b = 0.75$. Before the recalibration, the two issuers share the same credit rating $Rating_A = Rating_B = 0.6$, and therefore, offer the same bond payments $r_A^* = r_B^*$. As Moody's upgrades $Rating_A$ above 0.6, the disadvantaged issuer B increases its bond payment r_B^* to compete for capital (shown in Lemma 1), and the higher bond payment reduces the surplus π_B left to B. This process continues until its peer A's rating is upgraded to $Rating_A = 0.78$. At this point, the bond payment B offers in equilibrium is $r_B^* = \bar{r}$ (see Equation (5)), above which the conflict of interest arises because investors are concerned that the issuer has an incentive to undertake the high-risk project.

How can the disadvantaged issuer B respond if its peer's credit rating is upgraded above 0.78? Figure 1 plots the disadvantaged issuer's payoffs under two alternatives. First, the issuer can improve its disclosure at the cost c, and the corresponding payoff is captured by the solid line (for $Rating_A > 0.78$). The discontinuous drop at $Rating_A = 0.78$ is due to the cost of disclosure. The improved disclosure facilitates and invites external monitoring from the investors and voters. The enhanced external monitoring is beneficial because it allows the disadvantaged issuer to commit not to take the high-risk project ex post even if it offers a high bond payment, $r_B^* > \bar{r}$.

Alternatively, the issuer can keep its disclosure at the status quo and hence save the incremental cost c. Without improving disclosure, however, the maximal *pledgeable* payment is capped at $\bar{r}$. Therefore, B has to keep $r_B^* = \bar{r}$ (rather than increasing r_B^* to compete) even though its peer's rating is upgraded beyond 0.78. The inability to raise payment r_B^* is met with a sharp decrease in investors' demand for the disadvantaged issuer's bond. Lower demand q_B from investors contributes to the linear decrease in payoff π_B, as depicted by the dashed line in Figure 1. The disadvantaged issuer will improve its disclosure if the cost c is outweighed by the cost of losing its competitiveness against its peer. Given the cost of disclosure c in Figure 1, issuer B will improve its disclosure if and only if its peer's rating is upgraded beyond 0.86.

Figure 1. (Color online) Disadvantaged Issuer's Payoff and Its Peer's Credit Rating



Notes. This figure illustrates the tradeoffs the disadvantaged issuer B faces using a numerical example in which $\alpha = 0.75, \beta = 1.1, \Phi = 0.8, Rating_B = p = 0.6$, and $b = 0.75$.

The previous cost-benefit analysis enables us to develop the following predictions regarding which disadvantaged issuers are more likely to improve disclosure in response to the recalibration that favors their peers.

Proposition 2 (Empirical Predictions). *A disadvantaged issuer is more likely to improve its disclosure if*

i. *The credit rating upgrade that its peer receives is greater;*

ii. *It faces fiercer competition for capital within its market segment.*

The first prediction follows from Proposition 1. As shown in Figure 1, the disadvantaged issuer will improve its disclosure if and only if its peer's rating is upgraded above 0.86. For sufficiently small upgrades (i.e., $Rating_A < 0.78$ in Figure 1), the disadvantaged issuer B only needs to raise its bond payment slightly to compete (i.e., $r_B^* < \bar{r}$), which does not trigger the risk-shifting problem, and hence, the demand for improving disclosure does not arise. For intermediate upgrades $0.78 < Rating_A < 0.86$, the potential conflict of interest (and, hence the demand for better disclosure) arises, but the cost of improving disclosure is not justified when compared with its alternative. The cost of disclosure is more likely to be justified for sufficiently large upgrades to $Rating_A$.

The second prediction follows from Lemma 1, which shows that, for a given upgrade that its peer receives, the disadvantaged issuer has to raise its bond payment *more* in markets where competition b is fiercer. Recall that a sufficiently high bond payment is what triggers the disadvantaged issuer's risk-shifting incentives and, hence, the demand for improving disclosure. Thus, the disadvantaged issuer is more likely to improve its disclosure in markets where competition for capital is fiercer. The idea can also be illustrated using Figure 1. If one increases the competition parameter b, the thresholds $Rating_A = 0.78$ (that triggers the conflict of interest) and $Rating_A = 0.86$ (that triggers disclosure improvement) decrease. That is, the choice for the disadvantaged issuer to improve disclosure is triggered more easily in markets with fiercer competition.

4. Data and Research Design

4.1. Data

Moody's recalibration resulted in different levels of credit rating upgrades, and no downgrades, across issuers. For example, consider Maplewood, Minnesota, which raised \$2,115,000 for general improvements on August 1, 2005. This issuance includes a series of 15 bonds that range in maturity from 2007 to

2021. All the outstanding bonds in this issuance (collectively called a bond issue) changed rating from Aa2 to Aa1 on April 16, 2010.

On their website, Moody's posted an excel list of all bond issues that were recalibrated. This list includes the following information: Issuer Name (e.g., Maplewood (City of) MN), sale description for the bond issue (e.g., General Obligation Improvement Bonds, Series 2005A), security type (e.g., General Obligation), municipal scale rating of the underlying issue (e.g., Aa2), and the Global Rating Scale Rating of the underlying issue (e.g., Aa1).

Using Moody's list as a starting point, Table 1 describes the sample construction. We limit the list to U.S. local governments (i.e., counties and cities) for several reasons. First, local governments are relatively homogeneous in organizational structure and are more likely to compete with one another for capital than with universities or hospitals. Second, Moody's recalibration results in larger upgrades to bonds backed by local governments than other types of governmental agencies and not-for-profit organizations (see Appendix B). Third, the mapping between Moody's recalibration data and our disclosure data are relatively straightforward for cities and counties.

To study changes in disclosure around the recalibration, we gather disclosure data for fiscal years 2007 to 2012, which corresponds to three years before and three years after the 2010 recalibration. We collect data on municipal disclosure timeliness from the Federal Audit Clearinghouse's Single Audit database (hereafter, Single Audit).[11] Limiting the Single Audit data to cities and counties, we merge these data with Mooody's list. To merge the data, we remove generic words, such as "city," and match based on issuer names. We then manually verify the matches in the merged list.

Next, we drop issuers for whom we cannot measure the test and control variables in all six years (these variables are described in detail in the next section). Then, we require that Single Audit data are available for all six years. These restrictions result in a sample of 7,812 issuer-year observations for 1,302 unique issuers.

Finally, we obtain the quantity of public disclosure from the MSRB's Electronic Municipal Market Access System (EMMA).[12] The EMMA data first became available in 2009, when the system was implemented, so the sample period for tests that require EMMA data are limited to fiscal years 2008 to 2012. The final sample consists of 6,510 issuer-year observations for 1,302 unique issuers.

Table 2 presents the composition of the 1,302 unique issuers, which includes 631 counties and 671 cities, by state. The most represented states in the sample are New York (6.61%), Ohio (6.61%), Texas (6.30%), North Carolina (5.99%), and Florida (5.68%). The only state not represented in our sample is Wyoming.

4.2. Empirical Proxies and Research Design

We examine changes in disclosure quality for disadvantaged issuers relative to nondisadvantaged issuers using the following regression specification:

$$DQ_{i,t+1} = \alpha_i + \lambda_t + \beta_1 Disadvantage_i \times Post_t + \beta_2 Disadvantage_i + \beta_3 Post_t + \varepsilon_{i,t}, \quad (6)$$

where i indexes bond issuers, t indexes fiscal years, α_i denotes issuer fixed effects, and λ_t denotes year fixed effects. The term $DQ_{i,t+1}$ is one of three proxies for disclosure quality: *Timeliness*, *EMMA*, and an aggregate measure *Disclosure Quality*. The three proxies are broadly consistent with previous municipal disclosure research (Cuny 2016, Gillette et al. 2020), and we discuss them in detail here.

Timeliness is the natural logarithm of one plus the number of days between the fiscal year-end and the date that the year t audited financial statements are filed in the Single Audit database during year $t+1$, multiplied by –1. Table 3 shows that local governments, on average, provide financial statements with a 234-day reporting lag (the natural logarithm of $1+234$ days is 5.460).

EMMA is the number of issuer i's financial disclosures posted in the MSRB's EMMA system during year $t+1$. To gather disclosures from EMMA, we search the system by issuer name, which generates a list of bond issues along with their issuance and maturity dates. We impose two restrictions on the

Table 1. Sample Construction

	Bond-issues	Issuers	Issuer-years
Moody's recalibration list	64,919	13,439	N/A
After limiting to cities and counties	24,916	4,506	N/A
After matching with Single Audit	N/A	2,560	11,866
After requiring nonmissing test and control variables	N/A	1,686	9,356
After requiring Single Audit for FY2007 to FY2012	N/A	1,302	7,812
After requiring EMMA for FY2008 to FY2012	N/A	1,302	6,510

Note. We begin with Moody's list of recalibrated bond issues and proceed to measure disclosure quality at the issuer level. N/A, not applicable.

Table 2. Sample Composition

State	County	City	Total	Percentage	State	County	City	Total	Percentage
AK	25	5	30	0.46%	MT	0	20	20	0.31%
AL	50	85	135	2.07%	NC	290	100	390	5.99%
AR	5	15	20	0.31%	ND	20	30	50	0.77%
AZ	15	65	80	1.23%	NE	15	25	40	0.61%
CA	110	220	330	5.07%	NH	5	40	45	0.69%
CO	50	40	90	1.38%	NJ	90	80	170	2.61%
CT	0	70	70	1.08%	NM	25	65	90	1.38%
DE	10	10	20	0.31%	NV	15	10	25	0.38%
FL	175	195	370	5.68%	NY	245	185	430	6.61%
GA	65	35	100	1.54%	OH	245	185	430	6.61%
HI	15	0	15	0.23%	OK	5	10	15	0.23%
IA	65	90	155	2.38%	OR	55	55	110	1.69%
ID	0	15	15	0.23%	PA	85	50	135	2.07%
IL	60	105	165	2.53%	RI	0	45	45	0.69%
IN	35	35	70	1.08%	SC	80	45	125	1.92%
KS	35	50	85	1.31%	SD	10	20	30	0.46%
KY	20	35	55	0.84%	TN	275	55	330	5.07%
LA	0	45	45	0.69%	TX	160	250	410	6.30%
MA	0	195	195	3.00%	UT	35	30	65	1.00%
MD	85	25	110	1.69%	VA	120	130	250	3.84%
ME	5	55	60	0.92%	VT	0	5	5	0.08%
MI	140	130	270	4.15%	WA	90	105	195	3.00%
MN	240	100	340	5.22%	WI	0	120	120	1.84%
MO	30	30	60	0.92%	WV	0	5	5	0.08%
MS	55	40	95	1.46%	WY	0	0	0	0.00%

Note. We present the composition of the sample by state and by issuer type (cities and counties).

search. First, we limit the search to general obligation bonds to ensure that we capture the city or county's general financial information (instead of a special district within the city/county). Second, we require that the bond is issued before 2009 and outstanding until at least 2014 to ensure that we capture disclosures throughout our sample period.[13] We then gather all the disclosures listed under "Continuing Disclosures."[14] Financial disclosures include audited financial statements, annual financial statements (which are typically unaudited), budgets, and quarterly or monthly information.

Table 3. Descriptive Statistics

	Observations	Mean	Standard deviation	P10	P25	P50	P75	P90
Disclosure quality	6,510	0.418	0.137	0.272	0.337	0.407	0.491	0.569
Timeliness	7,812	−5.460	0.307	−5.811	−5.609	−5.455	−5.247	−5.118
EMMA	6,510	1.573	1.650	0.000	0.000	1.000	2.000	3.000
Upgrade	7,812	1.536	0.750	0.667	1.000	2.000	2.000	2.000
Abnormal	7,812	0.000	0.222	−0.111	0.000	0.000	0.000	0.178
Disadvantage	1,494	0.232	0.236	0.000	0.035	0.143	0.417	0.632
Post	7,812	0.598	0.490	0.000	0.000	1.000	1.000	1.000
New Issue	7,812	0.542	0.498	0.000	0.000	1.000	1.000	1.000
ΔGSP	7,812	−0.189	2.581	−4.500	−1.500	0.000	1.600	2.900
ΔUnemployment	7,812	11.623	26.848	−12.821	−8.081	0.000	27.523	53.521
Debt/income	7,812	0.217	0.050	0.153	0.178	0.208	0.249	0.280

Notes. This table describes the variables in the study. *Disclosure Quality* is our primary dependent variable. It is an equal-weighted aggregate measure of normalized *Timeliness* and *EMMA*. *Timeliness* is the natural logarithm of one plus the number of days between issuer *i*'s fiscal year-end and the filing date of the year *t* financial statements in the Single Audit database, multiplied by –1. The sample period for *Timeliness* spans FY2007 to FY2012. *EMMA* is the number of financial disclosures posted by issuer *i* on EMMA during year $t+1$. The sample period for *EMMA* spans FY2008 to FY2012. *Post* and *Disadvantage* are our primary independent variables of interest. *Post* is an indicator equal to one if the issuer *i* signs its year *t* audited financial statements after Moody's recalibration, and zero otherwise. *Disadvantage* is equal to the average *Upgrade* of issuer *i*'s market segment minus issuer *i*'s *Upgrade* if issuer *i*'s *Upgrade* is less than the segment average, and zero otherwise. We define segments as issuers with the same Moody's prerecalibration credit rating in the same state and the same population quintile. *Upgrade* is the average number of notches issuer *i*'s bond issues rated by Moody's are upgraded. *Abnormal* is issuer *i*'s *Upgrade* minus that of all issuers in issuer *i*'s market segment. For descriptive purposes in this table, we summarize *Disadvantage* for issuers with a nonzero *Disadvantage*. All variables are defined in Appendix A.

Local governments post a mean of 1.573 (and a median of 1) financial disclosures in EMMA annually during our sample period. The average for our sample is higher than prior literature (Gillette et al. 2020) because all issuers in our sample are subject to the Single Audit Act.[15]

Disclosure Quality is an aggregate measure that combines *Timeliness* and *EMMA*. To aggregate the two proxies, we normalize *Timeliness* and *EMMA* to values between zero and one, and equally-weight the normalized values of *Timeliness* and *EMMA*.[16] The mean of *Disclosure Quality* is 0.418.

Although disclosure choices are made at the issuer level, the recalibration was enacted at the bond issue level. Thus, we measure each issuer's *Upgrade* as the average upgrade across all the issuer's bond issues that are rated by Moody's.[17] The average *Upgrade* from Moody's recalibration is 1.536 notches.

To measure the extent to which an issuer is advantaged or disadvantaged by the recalibration, we compare the issuer's *Upgrade* to that of competing issuers in the same market segment. We define "segments" as issuers with the same prerecalibration credit rating from Moody's in the same state and the same quintile of population size.[18] *Abnormal* is equal to issuer *i*'s *Upgrade* minus that of all issuers in issuer *i*'s segment. By definition, the average abnormal upgrade within a segment is zero.

Our model predictions are specific to issuers that are disadvantaged by the recalibration. Thus, we create a variable, *Disadvantage*, that is equal to the absolute value of *Abnormal* if *Abnormal* is negative. If *Abnormal* is positive or zero, the issuer is not disadvantaged by the recalibration, so *Disadvantage* is set to zero. Approximately 19% of issuers (1,494 observations) are disadvantaged within their market segments. Among the disadvantaged issuers, the average size of the disadvantage is 0.232.

The variable of interest is the interaction between *Disadvantage* and *Post*. *Post* is an indicator equal to one if the issuer signs year *t*'s audited financial statements after Moody's recalibrated the municipal credit rating scale, and zero otherwise. The coefficient on the interaction between *Disadvantage* and *Post* estimates the change in issuer *i*'s disclosure quality after the recalibration, based on the extent of its disadvantage within its market segment.

In terms of controls, issuer fixed effects absorb the issuer-specific determinants of disclosure quality. Year fixed effects absorb time trends and market-wide shocks. We also control for other changes that took place around the recalibration (such as those documented in Adelino et al. 2017) that could lead to changes in *Disclosure Quality*. We control for new bond issuances that take place during the year $t + 1$ (*New Issue*) because disclosure quality is likely to improve around a new bond issuance. To control for changes in the local economy, we include changes in Gross State Product (ΔGSP) and changes in the state unemployment rate ($\Delta Unemployment$).[19]

5. Empirical Results

We begin by testing the model's first prediction: A disadvantaged issuer is more likely to improve its disclosure if the credit rating upgrade that its peer receives is greater.

5.1. Univariate Analysis

Table 4 provides univariate evidence of changes in *Disclosure Quality* and its components around the recalibration. We separate all issuers into three categories based on the extent of their disadvantage relative to their peers. *High Disadvantage* includes issuers in the top quartile of *Disadvantage* among the disadvantaged issuers. *Low Disadvantage* includes issuers in the bottom three quartiles of *Disadvantage*. *No Disadvantage* includes issuers whose *Disadvantage* is zero.

Panel A shows that *High Disadvantage* issuers improve their *Disclosure Quality* by 24% (from 0.366 to 0.453), whereas *Low Disadvantage* and *No Disadvantage* issuers improve their *Disclosure Quality* by 12% and 11%, respectively. These statistics provide preliminary evidence that issuers that are highly disadvantaged by the recalibration improve their overall disclosure quality both in absolute terms and relative to other more advantaged issuers.

Panels B and C provide univariate evidence of changes in the components of *Disclosure Quality*. Panel B shows that *High Disadvantage* issuers improve their *Timeliness* by 1% (from −5.548 to −5.482, which represents 256 days to 239 days), whereas *Low Disadvantage* and *No Disadvantage* peers do not statistically or economically change their *Timeliness*. Panel C shows that *High Disadvantage* issuers provide 2.4 times as many financial disclosures annually in *EMMA* in the postperiod than they did in the preperiod (from 0.944 to 2.258). This increase exceeds the increase for *No Disadvantage* issuers by 0.472 financial disclosures per year. The general increase in *Disclosure Quality* for all issuers (i.e., *High Disadvantage*, *Low Disadvantage*, and *No Disadvantage*) is driven by the increase in EMMA filings over time, consistent with Cuny (2016) and Gillette et al. (2020).

To get a sense for the detailed time series of changes in *Disclosure Quality*, we plot the mean of *Disclosure Quality* for *High Disadvantage*, *Low Disadvantage*, and *No Disadvantage* issuers in Appendix D. The recalibration takes effect in fiscal year 2009 or 2010 depending on the date the issuer signs the audited financial statements (if the fiscal year 2009 statements are signed after March 2010, fiscal year 2009 is postrecalibration). The difference in *Disclosure Quality* between the disadvantaged issuers and the nondisadvantaged issuers is

Table 4. Univariate Statistics

		(1) Observations	(2) Pre	(3) Post	(4) (3)–(2) Post – Pre
		Panel A: Disclosure quality			
(i)	High disadvantage	315	0.366	0.453	0.087***
(ii)	Low disadvantage	930	0.404	0.451	0.047***
(iii)	No disadvantage	5,265	0.384	0.426	0.042***
(i)–(iii)	High–no disadvantage		−0.019	0.027***	0.045***
		Panel B: Timeliness			
(i)	High disadvantage	378	−5.548	−5.482	0.067**
(ii)	Low disadvantage	1,116	−5.401	−5.406	−0.005
(iii)	No disadvantage	6,318	−5.466	−5.467	−0.001
(i)–(iii)	High–no disadvantage		−0.082**	−0.014	0.068**
		Panel C: *EMMA*			
(i)	High disadvantage	315	0.944	2.258	1.313***
(ii)	Low disadvantage	930	1.018	1.902	0.884***
(iii)	No disadvantage	5,265	0.938	1.779	0.841***
(i)–(iii)	High–no disadvantage		0.007	0.479***	0.472**

Notes. This table summarizes the change in issuers' disclosure quality, based on the issuer's disadvantage within its market segment around Moody's recalibration. *Disclosure Quality* is an equal-weighted aggregate measure of normalized *Timeliness* and *EMMA*. *Timeliness* is the natural logarithm of one plus the number of days between issuer *i*'s fiscal year-end and the filing date of the year *t* financial statements in the Single Audit databse, multiplied by –1. The *Timeliness* sample period spans FY2007 to FY2012. *EMMA* is the number of financial disclosures posted by issuer *i* on EMMA during year $t+1$. The sample period for *EMMA* spans FY2008 to FY2012. Observations appear in the *Post* column if the issuer *i* signs its year *t* audited financial statements after Moody's recalibration, and in the *Pre* column otherwise. *Disadvantage* is equal to the average *Upgrade* of issuer *i*'s market segment minus issuer *i*'s *Upgrade* if issuer *i*'s *Upgrade* is less than the segment average, and zero otherwise. We define segments as issuers with the same Moody's prerecalibration credit rating in the same state and the same population quintile. *High Disadvantage* includes issuers in the top quartile of *Disadvantage* among the disadvantaged issuers. *Low Disadvantage* includes issuers in the bottom three quartiles of *Disadvantage*. *No Disadvantage* includes issuers whose *Disadvantage* is zero.
*, **, and ***Statistical significance at the 10%, 5%, and 1% levels using two-tailed tests, respectively.

not significantly different in the preperiod (2008 or 2009).[20] Moreover, the trends in *Disclosure Quality* in the preperiod are parallel for *High Disadvantage*, *Low Disadvantage*, and *No Disadvantage* issuers.

The *High Disadvantage* issuers begin providing statistically higher quality disclosures in the fiscal years after the recalibration (2011 and 2012). The *Low Disadvantage* issuers do not show the same increase, which is consistent with our model's first prediction that disclosure only increases if the extent of the disadvantage is large.

5.2. Regression Results

We use regression analysis to formally test the model's first prediction: A disadvantaged issuer is more likely to improve its disclosure if the credit rating upgrade that its peer receives is greater. Table 5 presents the results. The positive and significant coefficient on *Disadvantage* × *Post* across all three columns supports the prediction. Specifically, Column (1) shows that disadvantaged issuers increase their *Disclosure Quality* relative to other issuers. In economic terms, a one-notch increase in *Disadvantage* is associated with a 13.2% increase in *Disclosure Quality* relative to *No Disadvantage* issuers after the recalibration.[21]

The coefficient on *Post* is negative, consistent with the finding of Gillette et al. (2020) that Moody's-rated issuers reduce disclosure quality after the recalibration. Also consistent with prior literature, *New Issue* is positively correlated with *Disclosure Quality* because issuers improve disclosure quality when they issue new bonds (Cuny 2016). Δ*Unemployment* is negatively correlated with *Disclosure Quality*, which is also consistent with prior literature that shows disclosure quality decreases when economic conditions deteriorate. The negative coefficient on Δ*GSP* is due to the fixed effect structure and has a positive correlation (as expected) with *Disclosure Quality* without the fixed effects (untabulated).

Columns (2) and (3) provide results for the components of *Disclosure Quality* (*Timeliness* and *EMMA*). In Column (2), the positive coefficient of 0.091 on *Disadvantage* × *Post* indicates that disadvantaged issuers improve their disclosure timeliness relative to issuers that are not disadvantaged. Specifically, a one-notch increase in *Disadvantage* is associated with an 8.7% increase in *Timeliness* relative to *No Disadvantage* issuers.[22] Column (3) shows that disadvantaged issuers increase disclosure in EMMA. Issuers that are disadvantaged by one notch increase their annual financial disclosures in EMMA by 40% relative to the *No Disadvantage* issuers after the recalibration.[23]

Overall, the findings presented in Table 5 provide evidence that issuers' change in disclosure quality increases in the extent of their disadvantage relative to their peers.

Table 5. Disclosure Quality and Credit Rating Disadvantage

	(1) Disclosure quality	(2) Timeliness	(3) EMMA
Disadvantage × *Post*	0.055**	0.091***	0.626**
	(0.023)	(0.035)	(0.311)
Post	−0.043***	−0.118***	−0.189**
	(0.007)	(0.013)	(0.083)
New Issue	0.015***	0.005	0.238***
	(0.004)	(0.006)	(0.049)
Δ*GSP*	−0.003***	−0.001	−0.040***
	(0.001)	(0.001)	(0.010)
Δ*Unemployment*	−0.000***	0.000	−0.007***
	(0.000)	(0.000)	(0.002)
Issuer fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	6,510	7,812	6,510
R^2	0.618	0.696	0.525

Notes. $DQ_{i,t} = \alpha_i + \lambda_t + \beta_1 Disadvantage_i \times Post_t + \beta_2 Disadvantage_i + \beta_3 Post_t + \varepsilon_{i,t}$

This table presents the relationship between disclosure quality and the extent to which Moody's recalibration disadvantaged an issuer within its market segment. The dependent variable in Column (1), *Disclosure Quality*, is an equal-weighted aggregate measure of normalized *Timeliness* and *EMMA*. The dependent variable in Column (2), *Timeliness*, is the natural logarithm of one plus the number of days between issuer *i*'s fiscal year-end and the filing date of the year *t* financial statements in the Single Audit database, multiplied by −1. The sample period for *Timeliness* spans FY2007 to FY2012. The dependent variable in Column (3), *EMMA*, is the number of financial disclosures posted by issuer *i* on EMMA during year $t+1$. The *EMMA* sample period spans FY2008 to FY2012. *Disadvantage* is equal to the average *Upgrade* of issuer *i*'s market segment minus issuer *i*'s *Upgrade* if issuer *i*'s *Upgrade* is less than the segment average, and zero otherwise. We define segments as issuers with the same Moody's prerecalibration credit rating in the same state and the same population quintile. *Post* is an indicator equal to one if the issuer *i* signs its year *t* audited financial statements after Moody's recalibration, and zero otherwise. Standard errors clustered at the issuer level are reported in parentheses underneath the coefficient estimates. All variables are defined in Appendix A.

*, **, and ***Statistical significance at the 10%, 5%, and 1% levels using two-tailed tests, respectively.

5.3. Variation in Competition

We now test the model's second prediction: A disadvantaged issuer is more likely to improve its disclosure if it faces *fiercer competition* for capital within its market segment.

5.3.1. Falsification. In our model, issuers respond to changes to their *peers'* credit ratings because of the latent competition for capital. If we group together issuers that do not compete with one another for capital, we essentially take away the underlying competition. In this case, our theoretical analysis predicts that disadvantaged issuers will not change their disclosure regardless of their placebo peers' relative credit rating upgrade.

Our primary results in Table 5 define competing issuers as those that share a prerecalibration credit rating from Moody's, state, and size quintile. We begin our falsification analyses by ignoring market segmentation altogether. In Column (1) of Table 6, we group all issuers in our sample together. $Abnormal_{All}$ for each issuer is measured relative to all issuers in the sample. $Disadvantage_{All}$ is equal to the average *Upgrade* for the whole sample minus issuer *i*'s upgrade if $Abnormal_{All}$ is negative, and zero otherwise.

We rerun Equation (6), where the variable of interest is $Disadvantage_{All} \times Post$. The statistically and economically insignificant coefficient on $Disadvantage_{All} \times Post$ means that if we ignore market segments and pool all issuers together, *Disclosure Quality* does *not* change differently for disadvantaged issuers (relative to nondisadvantaged issuers) after the recalibration.

We continue our falsification tests by considering each of the three aspects of segmentation (i.e., rating, state, and size) in isolation. In Columns (2) through (4), we define each issuer's disadvantage based only on their prerecalibration credit rating, state, or size. For example, in Column (2), we pool all issuers with the same prerecalibration credit rating, without considering state or size.[24] The coefficients on $Disadvantage_{Rating} \times Post$, $Disadvantage_{State} \times Post$, and $Disadvantage_{Size} \times Post$ are all statistically and economically insignificant.

The insignificance across these four falsification tests highlights the importance of competition in determining the disadvantaged issuers' disclosure choices. Collectively, Table 6 shows that municipal bond issuers that do not compete with one another for capital do not change their disclosure behavior in response to a relative increase in others' credit ratings.

Our falsification tests also help to alleviate the concern that the results in Table 5 simply capture the well-known inverse relation between disclosure and cost of capital (Easley and O'Hara 1987, Lambert et al. 2007). In particular, an alternative explanation for our main result is built on the belief that highly upgraded issuers' cost of capital declines more than that of lowly upgraded issuers. To the extent that disclosure quality and cost of capital are inversely related, the highly upgraded issuers reduce disclosure more than the lowly upgraded issuers. If our results were driven by this inverse relation (rather than issuers competing for capital), how we empirically construct groups of competing issuers would be irrelevant.

5.3.2. Cross-Sectional Variation in Competition for Capital. In our setting, competition for capital arises because of constraints on the supply of capital. Therefore, we explore variation in competition by constructing state-level ratios of debt to personal income. Debt proxies for the demand for capital from all issuers within the state. We obtain debt outstanding across all levels of government within the state from the Bureau of Economic Analysis (BEA)'s 2010 Annual Survey of

Table 6. Falsification

	(1) Unconditional	(2) Rating only	(3) State only	(4) Size only
$Disadvantage_{All} \times Post$	0.009			
	(0.007)			
$Disadvantage_{Rating} \times Post$		0.003		
		(0.010)		
$Disadvantage_{State} \times Post$			0.007	
			(0.007)	
$Disadvantage_{Size} \times Post$				0.001
				(0.008)
Post	−0.044***	−0.041***	−0.043***	−0.041***
	(0.007)	(0.007)	(0.007)	(0.007)
Controls	Yes	Yes	Yes	Yes
Issuer fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	6,510	6,510	6,510	6,510
R^2	0.618	0.618	0.618	0.618

Notes. $DQ_{i,t} = \alpha_i + \lambda_t + \beta_1 Disadvantage_i \times Post_t + \beta_2 Disadvantage_i + \beta_3 Post_t + \varepsilon_{i,t}$
This table presents the relationship between disclosure quality and the extent to which Moody's recalibration disadvantaged an issuer within four placebo market segments. The sample period spans FY2008 to FY2012. The dependent variable, *Disclosure Quality*, is an equal-weighted aggregate measure of normalized *Timeliness* and *EMMA*. *Timeliness* is the natural logarithm of one plus the number of days between issuer *i*'s fiscal year-end and the filing date of the year *t* financial statements in the Single Audit database, multiplied by –1. *EMMA* is the number of financial disclosures posted by issuer *i* on EMMA during year $t+1$. *Disadvantage* is equal to the average *Upgrade* of issuer *i*'s market segment minus issuer *i*'s *Upgrade* if issuer *i*'s *Upgrade* is less than the segment average, and zero otherwise. In Column (1), there are no segments. $Disadvantage_{All}$ is calculated relative to all issuers in the sample. In Column (2), segments are based on credit rating only. $Disadvantage_{Rating}$ is calculated such that each issuer is a peer of all other issuers with the same Moody's prerecalibration credit rating. In Column (3), segments are based on state only. $Disadvantage_{State}$ is calculated such that each issuer is a peer of all other issuers in the same state. In Column (4), segments are based on size only. $Disadvantage_{Size}$ is calculated such that each issuer is a peer of all other issuers in the same size quintile. *Post* is an indicator equal to one if the issuer *i* signs its year *t* audited financial statements after Moody's recalibration, and zero otherwise. Standard errors clustered at the issuer level are reported in parentheses underneath the coefficient estimates. All variables are defined in Appendix A.
*, **, and ***Statistical significance at the 10%, 5%, and 1% levels using two-tailed tests, respectively.

Local Government Finances. Personal income proxies for the supply of capital from local retail investors. We obtain each state's aggregate personal income from the BEA. The mean *Debt/Income* for our sample is 0.217 (Table 3).

In states with high levels of debt (demand) relative to personal income (supply), the supply of capital is constrained. By contrast, in states with low levels of debt (demand) relative to income (supply), the supply of capital is less constrained. Therefore, a higher debt-to-income ratio (*Debt/Income*) indicates a relatively limited supply of capital, and thus, fiercer competition. We expect the relation between *Disclosure Quality* and *Disadvantage* × *Post* to be stronger in states with greater *Debt/Income*.

Table 7 partitions the sample into quartiles, based on *Debt/Income*. We find a monotonic increase in the coefficient on *Disadvantage* × *Post*, as *Debt/Income* increases. Column (1) includes issuers in the highest quartile of *Debt/Income*. The coefficient on *Disadvantage* × *Post* of 0.106 is nearly twice as large as the full-sample coefficient presented in Table 5, Column (1). Consistent with our prediction, this result shows that the disadvantaged issuers' disclosure response is the most pronounced in segments where competition for capital is the highest.

The coefficient on *Disadvantage* × *Post* becomes smaller as the competition for capital weakens. The coefficient lowers to 0.086 in the third quartile (Column (2)) and 0.059 in the second quartile (Column (3)). Column (4) includes issuers in the lowest quartile of *Debt/Income*, implying a relatively large supply of risk-bearing capital. The coefficient on *Disadvantage* × *Post* is economically and statistically insignificant in Column (4), suggesting that competition for capital is limited among these issuers. The monotonic increase in the relation between *Disclosure Quality* and *Disadvantage* × *Post*, as competition for capital intensifies, provides support for the second hypothesis.

In sum, our empirical evidence supports the predictions from the analytical model. The evidence in Tables 5, 6, and 7 indicates that issuers that are placed at a disadvantage in raising capital improve their disclosure quality, especially when competition for capital is fierce.

5.4. Robustness and Additional Analysis

5.4.1. Additional Analysis. Although the primary predictions of the model pertain to disclosure choices made by disadvantaged issuers, the model also generates an intermediate step prediction about relative changes in bond yields. In the model, the disadvantaged issuer

Table 7. Variation in Competition for Capital

	(1)	(2)	(3)	(4)
	Capital supply constraint quartile			
	Q4 Highest debt/income	Q3	Q2	Q1 Lowest debt/income
Disadvantage × *Post*	0.106**	0.086**	0.059**	−0.003
	(0.046)	(0.035)	(0.025)	(0.057)
Post	−0.040***	−0.045***	−0.028**	−0.080***
	(0.012)	(0.013)	(0.014)	(0.016)
Controls	Yes	Yes	Yes	Yes
Issuer fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	1,570	1,680	1,615	1,645
R^2	0.630	0.598	0.627	0.631

Notes. $DQ_{i,t} = \alpha_i + \lambda_t + \beta_1 Disadvantage_i \times Post_t + \beta_2 Disadvantage_i + \beta_3 Post_t + \varepsilon_{i,t}$
This table presents cross-sectional variation in the relationship between disclosure quality and the extent to which Moody's recalibration disadvantaged an issuer within its market segment. We proxy for competition for capital using constraints on the supply of capital in the issuer's state. Specifically, *Debt/Income* is the ratio of debt outstanding for all governmental entities in issuer *i*'s state to the aggregate personal income for all residents of the state. Higher *Debt/Income* suggests larger constraints on the supply of capital. Column (1) includes issuers in the top quartile of *Debt/Income*, where the capital supply is most constrained. Column (2) includes issuers in the third quartile of *Debt/Income*. Column (3) includes issuers in the second quartile of *Debt/Income*. Column (4) includes issuers in the bottom quartile of *Debt/Income*, where the capital supply is least constrained. The sample period spans FY2008 to FY2012. The dependent variable, *Disclosure Quality*, is an equal-weighted aggregate measure of normalized *Timeliness* and *EMMA*. *Timeliness* is the natural logarithm of one plus the number of days between issuer *i*'s fiscal year-end and the filing date of the year *t* financial statements in the Single Audit database, multiplied by −1. *EMMA* is the number of financial disclosures posted by issuer *i* on EMMA during year $t+1$. *Disadvantage* is equal to the average *Upgrade* of issuer *i*'s market segment minus issuer *i*'s *Upgrade* if issuer *i*'s *Upgrade* is less than the segment average, and zero otherwise. *Post* is an indicator equal to one if the issuer *i* signs its year *t* audited financial statements after Moody's recalibration, and zero otherwise. Standard errors clustered at the issuer level are reported in parentheses underneath the coefficient estimates. All variables are defined in Appendix A.
*, **, and ***Statistical significance at the 10%, 5%, and 1% levels using two-tailed tests, respectively.

raises its bond yield to compete with its more advantaged peer. The implication is that the recalibration shocks the issuers' competitive position so that the difference between the disadvantaged and the advantaged issuers' yields increases after the recalibration. We conduct an additional empirical analysis on bond yields in this section.

In Appendix E, we compare changes in offering yield spreads-to-treasuries for *High Disadvantage* issuers relative to *No Disadvantage* issuers. We obtain bond offering yields from the Mergent Municipal Bond database. Treasury yields come from the Federal Reserve of St. Louis. To calculate yield spreads-to-treasuries, we match municipal bonds to treasuries with the same issuance date and similar time to maturity. Because municipal bond offerings are infrequent, the sample window spans 2004 to 2016.

Column (1) shows that before the recalibration, *High Disadvantage* issuers had larger yield spreads than *No Disadvantage* issuers, but the difference was economically small (0.124%) and marginally statistically significant.[25] Column (2) shows that after the recalibration, the gap widens. *High Disadvantage* issuers' yield spreads are both statistically and economically larger than those of *No Disadvantage* issuers (0.281%).

Column (3) quantifies the change in yield spreads. Yield spreads generally increase. However, they increase more for highly disadvantaged issuers. Specifically, the yield spreads on *High Disadvantage* issuers' bonds increase by 0.688%, which is an 0.157% increase relative to the *No Disadvantage* issuers' increase of 0.531%.[26] The comparisons indicate that the highly disadvantaged issuers' cost of capital increases relative to that of the nondisadvantaged issuers, lending additional support to our model.

5.4.2. Robustness. We now examine the robustness of our primary analyses to a variety of alternative empirical choices. Table 8 presents the results. First, we consider alternative measures of *Disadvantage*. Throughout the paper, *Disadvantage* is a continuous variable equal to the average *Upgrade* of all issuers in issuer *i*'s market segment minus issuer *i*'s *Upgrade* if issuer *i*'s *Upgrade* is less than the segment average, and zero otherwise.

In Column (1), we measure *Disadvantage* as an indicator equal to one if the issuer is in the top quartile of *Disadvantage* among the disadvantaged issuers (consistent with the way we define *High Disadvantage* in the univariate analyses). In Column (2), we use *Abnormal* × −1 as an alternative measure of *Disadvantage*. *Abnormal* is issuer *i*'s *Upgrade* minus that of all issuers in issuer *i*'s market segment. We multiply *Abnormal* by −1 so that it increases in the issuer's

Table 8. Robustness

	(1) Indicator	(2) Abnormal × −1	(3) EMMA Size	(4) Separate Advantaged	(5) Exclude Fitch-rated
Disadvantage × Post	0.040**	0.030**	1,361.439**	0.056**	0.048*
	(0.016)	(0.015)	(615.489)	(0.023)	(0.026)
Advantage × Post				0.003	
				(0.023)	
Post	−0.043***	−0.040***	−415.713*	−0.044***	−0.046***
	(0.006)	(0.006)	(230.629)	(0.007)	(0.007)
Controls	Yes	Yes	Yes	Yes	Yes
Issuer fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	6,510	6,510	6,510	6,510	5,155
R^2	0.618	0.618	0.435	0.618	0.613

Notes. $DQ_{i,t} = \alpha_i + \lambda_t + \beta_1 Disadvantage_i \times Post_t + \beta_2 Disadvantage_i + \beta_3 Post_t + \varepsilon_{i,t}$
This table examines the robustness of our primary results. The sample period spans FY2008 to FY2012. The dependent variable, *Disclosure Quality*, is an equal-weighted aggregate measure of normalized *Timeliness* and *EMMA*. *Timeliness* is the natural logarithm of one plus the number of days between issuer *i*'s fiscal year-end and the filing date of the year *t* financial statements in the Single Audit database, multiplied by –1. *EMMA* is the number of financial disclosures posted by issuer *i* on EMMA during year $t+1$. Columns (1) and (2) use alternative measures of *Disadvantage*. In Column (1), *Disadvantage* is an indicator equal to one if issuer *i* is in the top quartile of *Disadvantage* among the disadvantaged issuers. In Column (2), we use the continuous variable *Abnormal* × −1, equal to issuer *i*'s *Upgrade* minus the segment average *Upgrade*. In Column (3), the dependent variable is the file size of all disclosures posted in EMMA during year $t+1$. Column (4) separately examines advantaged (*Abnormal* > 0) and disadvantaged (*Abnormal* < 0) issuers, using neutral issuers (*Abnormal*=0) as the control group. Column (5) excludes Fitch-rated issuers to avoid potentially confounding effects of Fitch's recalibration. *Post* is an indicator equal to one if the issuer *i* signs its year *t* audited financial statements after Moody's recalibration, and zero otherwise. All columns include issuer and year fixed effects. Standard errors clustered at the issuer level are reported in parentheses underneath the coefficient estimates. All variables are defined in Appendix A.
*, **, and ***Statistical significance at the 10%, 5%, and 1% levels using two-tailed tests, respectively.

disadvantage. This measure of disadvantage differs from our primary measure because our primary measure is bounded at zero from below (i.e., *Disadvantage* is equal to zero for issuers that are not disadvantaged), whereas *Abnormal* can be negative or positive. The coefficient on *Disadvantage* × *Post* remains statistically positive and economically meaningful in Columns (1) and (2).

Third, we use an alternative measure of disclosure quality. Specifically, we measure the aggregate file size of the financial disclosures filed in EMMA during the year. If no disclosures are filed during the year, *EMMA Size* takes a value of zero. In Column (3), the coefficient on *Disadvantage* × *Post* is statistically positive and economically meaningful.

In Column (4), we address the potential concern that our regression specifications pool together issuers that are advantaged (*Abnormal* > 0) and those that are neither advantaged nor disadvantaged (*Abnormal* = 0) by the recalibration. We create a variable *Advantage*, which is equal to issuer *i*'s average upgrade minus the average upgrade across issuer *i*'s market segment if *Abnormal* is positive, and zero otherwise. The control group in this test is issuers that are neither advantaged nor disadvantaged by the recalibration (i.e., issuers with *Abnormal* = 0). The coefficient on *Post* is significantly negative, showing that neutrally affected issuers (*Abnormal* = 0) reduce disclosure quality. The coefficient on *Advantage* × *Post* is insignificant, indicating that advantaged issuers do not change disclosure *differently* than neutrally affected issuers (i.e., both groups reduce disclosure quality to the same extent).

The coefficient on *Disadvantage* × *Post* is significantly positive, and its magnitude (0.056) is similar to the magnitude (0.055) in the main results presented in Table 5, where we pool together the advantaged and neutrally affected issuers. The results suggest that, for the purposes of examining disadvantaged issuers' relative disclosure change, it is without loss of generality to pool the advantaged and neutrally affected issuers together.

Finally, we acknowledge that Fitch also recalibrated some bonds in 2010. In Column (5), we exclude issuers with bonds rated by Fitch from the analysis. The coefficient on *Disadvantage* × *Post* continues to be positive and statistically significant, alleviating concerns about the coincident Fitch recalibration.

6. Conclusion

We demonstrate that a competitive disadvantage in raising capital is a disclosure incentive in the market for municipal bonds. Schwert (2017) and Babina et al. (2021) provide evidence suggesting that municipal bonds are less attractive to institutional and out-of-state investors because these bonds are often exempt from federal, state, and local taxes. The limited supply of capital gives rise to local issuers' competition for capital. We develop a model to show that, when facing competition for capital, an issuer responds not only to its own rating change but also to its peer's rating change. When the rating upgrade that its peers receive is large enough, the disadvantaged issuer will improve its disclosure to mitigate investors' assessed risk, secure its financing, and better compete with the advantaged peer.

We test and support our predictions using Moody's 2010 recalibration of the municipal rating scale. Although the recalibration resulted in higher ratings for many issuers, it did not equally advantage all issuers within a market segment. The issuers whose bonds received small upgrades (i.e., disadvantaged issuers) became less attractive to investors than their peers with higher upgrades (i.e., advantaged issuers).

We find that issuers disadvantaged by the recalibration within their market segment improve the timeliness and quantity of their financial disclosures relative to their advantaged peers. Importantly, the results hold only when the disadvantage is calculated among issuers that directly compete with one another for capital (i.e., operate in the same market segment). The result is pronounced in market segments where the supply of capital is limited, and hence, competition for capital is fierce.

This evidence supports the idea that a competitive disadvantage in raising capital can motivate issuers to improve disclosure quality. Taken together, the empirical and analytical findings add to our understanding of disclosure incentives in segmented markets in which entities compete for a limited supply of capital.

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Appendix A. Variable Definitions

Variable	Definition
Abnormal	Issuer *i*'s *Upgrade* minus that of all issuers in issuer *i*'s market segment.
Advantage	Issuer *i*'s *Upgrade* minus that of all issuers in issuer *i*'s market segment if *Abnormal* ≥ 0, and zero otherwise.
Debt/Income	The ratio of debt outstanding for all governmental entities in issuer *i*'s state to the aggregate personal income for all residents of the state.
Disclosure Quality	The equal-weighted value of issuer *i*'s *Timeliness* and *EMMA*. *Timeliness* and *EMMA* are normalized to continuous variables between 0 and 1.
Disadvantage	The average *Upgrade* of issuer *i*'s market segment minus issuer *i*'s *Upgrade* if issuer *i*'s *Upgrade* is less than the segment average, and zero otherwise.
EMMA	The number of issuer *i*'s financial disclosures posted on the MSRB's Electronic Municipal Market Access System (EMMA) during year $t+1$.
ΔGSP	The percentage change in gross state product for issuer *i*'s state in year *t*.
New issue	An indicator equal to one if issuer *i* issues a municipal bond in year $t+1$, and zero otherwise.
Post	An indicator equal to one if the issuer *i* signs its year *t* audited financial statements after Moody's recalibration, and zero otherwise.
Timeliness	The natural logarithm of one plus the number of days between issuer *i*'s fiscal year-end and the filing date of the year *t* financial statements in the Single Audit database, multiplied by −1.
Upgrade	The average number of notches that issuer *i*'s bond issues rated by Moody's are upgraded.
$\Delta Unemployment$	The percentage change in the unemployment rate for issuer *i*'s state in year *t*.

Appendix B. Moody's Recalibration

In March of 2010, Moody's published a report detailing its plans to recalibrate its long-term U.S. municipal bond ratings to its global rating scale (Dorer and Van Praagh 2010). Table 1 of the report includes the number of notches it expected bond issues to be upgraded, based on the source of repayment and the issue's credit rating before the recalibration. We reproduce Table 1 of the report here (in the columns labeled "Planned") and tabulate the average actual upgrade for each rating/source of repayment category ("Actual"). To classify bond issues into Moody's four broad categories, we search the issuer names and descriptions in Moody's list for keywords (e.g., Utility, University). Using the keyword search, we are able to classify 77.2% of the bond issues in Moody's recalibration list into the four categories. Column "GO" contains the following types of bonds: General Obligation, Water & Sewer, Distribution only Utilities, and Municipal Utility Districts. Column "Special Tax" contains the following types of bonds: Special Tax (Non-GO), Mass Transit, Non-Utility Enterprises, Tax Increment Financing Districts (Tifs), and Grant Anticipation Revenue Bonds. Column "Public Universities" contains public universities. Column "Revenue" includes the following: Healthcare, Housing, Private K-12 & Charter Schools, Private Universities & Other Not-For-Profits, Transportation & Other Infrastructure Enterprises, Power Generating Utilities, State Revolving Funds, Bond Banks, and Federal Leases.

	GO		Special tax		Public universities		Revenue	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Aaa	0	0.00	0	0.00	0	N/A	0	0.00
Aa1	0-1	0.74	1	0.41	0-1	N/A	0	0.04
Aa2	1	0.98	1	0.51	1	1.00	0	0.09
Aa3	1	0.98	1	0.85	1	1.00	0	0.29
A1	2	1.93	1	0.98	1	N/A	0	0.44
A2	2	1.99	1	1.08	1	N/A	0	0.49
A3	2	1.99	1	1.10	1	N/A	0	0.54
Baa1	3	2.97	1	1.17	1	N/A	0	0.45
Baa2	3	2.99	0	0.40	1	N/A	0	0.60
Baa3	2-3	2.38	0	0.37	1	N/A	0	0.84
Ba1	0	0.13	0	0.00	0	N/A	0	0.26
Ba2	0	0.00	0	0.00	0	N/A	0	0.00
Ba3	0	0.21	0	0.00	0	N/A	0	0.00
B1	0	0.00	0	0.00	0	N/A	0	0.00
B2	0	0.00	0	0.00	0	N/A	0	0.00
B3	0	N/A	0	0.00	0	N/A	0	0.00
Caa1	0	0.00	0	0.00	0	N/A	0	0.00
Caa2	0	N/A	0	N/A	0	N/A	0	N/A
Caa3	0	N/A	0	N/A	0	N/A	0	0.00

Note. N/A, not applicable.

Appendix C. Model Proofs

Proof of Lemma 1. We show in the text that the equilibrium bond payments are

$$r_A^* = \frac{(2Rating_A + bRating_B)C}{Rating_A(4-b^2)}, r_B^* = \frac{(2Rating_B + bRating_A)C}{Rating_B(4-b^2)}. \quad \text{(C.1)}$$

One can verify that (recall $b \in [0,1]$)

$$\frac{dr_A^*}{dRating_A} = \frac{b\, Rating_B\, C}{Rating_A^2(b^2-4)} < 0,$$

and, for any competition parameter $b > 0$,

$$\frac{dr_B^*}{dRating_A} = \frac{b\, C}{Rating_B(4-b^2)} > 0.$$

The third part of the lemma follows from

$$\frac{d^2 r_B^*}{dRating_A\, db} = \frac{(4+b^2)C}{Rating_B(4-b^2)^2} > 0.$$

Collecting these conditions proves Lemma 1. □

Proof of Proposition 1. It is in the issuer's own interest to undertake the low-risk project if $q_i[p(1+\Phi-r_i)] \geq q_i[\alpha p(1+\beta\Phi - r_i)]$, or, equivalently,

$$r_i \leq \bar{r} \equiv 1 + \frac{(1-\alpha\beta)\Phi}{1-\alpha}. \quad \text{(C.2)}$$

Prior to the recalibration, the two issuers share the same credit rating and, hence, offer the same payment $r = \frac{C}{2-b}$. We assume the parameters are such that $\frac{C}{2-b} < \bar{r}$ to rule out the trivial case in which issuers never want to undertake the low-risk project. Consider, without loss of generality, that the recalibration upgrades $Rating_A$ while keeping $Rating_B$ unchanged. Because $\frac{dr_B^*}{dRating_A} > 0$ (shown in Lemma 1), we know there exists a unique $Rating_A = \bar{R}$ at which point r_B^* shown in (C.1) increases to $\bar{r}$. We solve $\bar{R}$ as

$$\bar{R} = \frac{(4-b^2)\bar{r} - 2C}{bC} \times Rating_B. \quad \text{(C.3)}$$

We know that $r_B^* > \bar{r}$ if and only if $Rating_A > \bar{R}$. In this case, the disadvantaged issuer B has incentives to undertake the high-risk investment ex post.

If the disadvantaged issuer chooses to improve its disclosure at cost c, it can set $r_B^* > \bar{r}$ when its peer's rating is upgraded to $Rating_A > \bar{R}$. Substituting the optimal bond payments r_B^* and r_A^* from Equation (C.1), we obtain the disadvantaged issuer's payoff U_B^d for $Rating_A > \bar{R}$ as (the superscript d stands for disclosure):

$$\begin{aligned} U_B^d &= \pi_B(r_A^*, r_B^*) - c \\ &= \frac{pC^2[bRating_A - (2-b^2)Rating_B]^2}{Rating_B(4-b^2)^2} - c, \end{aligned}$$

where π_B is shown in Equation (2), and c is the cost of improving disclosure from the status quo.

The disadvantaged issuer can choose not to improve its disclosure for $Rating_A > \bar{R}$. In this case, the disadvantaged issuer has to keep its bond payment at $r_B = \bar{r}$ as opposed to raising it according to r_B^* in Equation (C.1). Anticipating $r_B = \bar{r}$, the advantaged issuer A chooses r_A to maximize $\pi_A(r_A, r_B = \bar{r})$. The solution to A's optimization problem is

$$r_A(\bar{r}) = \frac{Rating_A\, C + b\, Rating_B\, \bar{r}}{2Rating_A}. \quad \text{(C.4)}$$

Substituting $r_B = \bar{r}$ and $r_A(\bar{r})$ shown above, we obtain B's payoff *without* improving its disclosure as

$$U_B^{nd} = \pi_B(r_A(\bar{r}), \bar{r}).$$

The superscript *nd* means no disclosure improvement, and the closed form of U_B^{nd} is omitted for brevity.

Both U_B^d and U_B^{nd} are functions of $Rating_A$ and are defined for $Rating_A \geq \bar{R}$. One can verify that (i) $U_B^d = U_B^{nd} - c$ (hence,

$U_B^d < U_B^{nd}$) at $Rating_A = \bar{R}$, (ii) U_B^d is continuous and convex in $Rating_A$, and (iii) U_B^{nd} decreases in $Rating_A$ linearly and reaches zero at $Rating_A = \frac{(2-b^2)p(1-\alpha+\Phi(1-\alpha\beta))}{b(1-\alpha)(1+\Phi)}$. We can therefore conclude that U_B^d and U_B^{nd} intersect only once. Let R^d be the unique intersection at which $U_B^d = U_B^{nd}$. It follows from the argument that

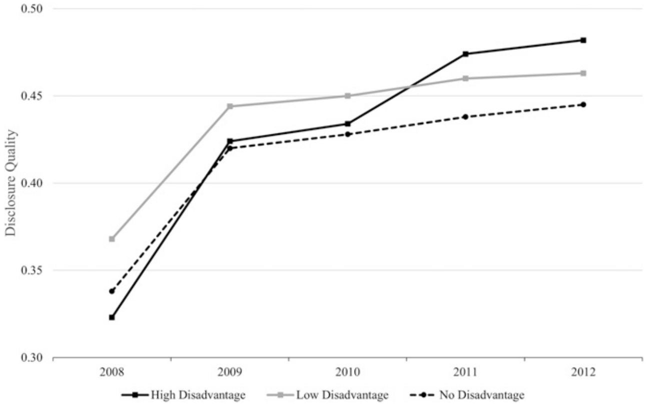
$$U_B^d \geq U_B^{nd} \text{ if and only if } Rating_A \geq R^d.$$

The disadvantaged issuer will choose to improve its disclosure if (i) $U_B^d \geq U_B^{nd}$, and (ii) $U_B^d \geq 0$ is satisfied at the indifference point $Rating_A = R^d$ constructed earlier. Condition (i) equivalent to $Rating_A \geq R^d$. Condition (ii) is added because the disadvantaged issuer can ensure a minimum payoff of zero in the no-improvement alternative and hence will not choose to improve disclosure if doing so yields a negative payoff. One can verify that $U_B^d \geq 0$ at R^d is equivalent to $c \leq \pi_B(r_A^*, r_B^*)$, evaluated at $Rating_A = R^d$. Collecting the upper bound on c and $Rating_A \geq R^d$ completes the proof. □

Proof of Proposition 2. The argument is given in the text. □

Appendix D. Time Series of *Disclosure Quality*

This figure plots the mean of our variable of interest, *Disclosure Quality*, by fiscal year. *Disclosure Quality* is an equal weighted aggregate measure of normalized *Timeliness* and *EMMA*. The sample period spans FY2008 to FY2012. *Timeliness* is the natural logarithm of one plus the number of days between issuer *i*'s fiscal year-end and the filing date of the year *t* financial statements in the Single Audit database, multiplied by –1. *EMMA* is the number of financial disclosures posted by issuer *i* in EMMA during year $t+1$. *Disadvantage* is equal to the average *Upgrade* of issuer *i*'s market segment minus issuer *i*'s *Upgrade* if issuer *i*'s *Upgrade* is less than the segment average, and zero otherwise. We define segments as issuers with the same Moody's pre-recalibration credit rating in the same state and the same population quintile. *High Disadvantage* (represented by the dark solid line) includes issuers in the top quartile of *Disadvantage* among the disadvantaged issuers. *Low Disadvantage* (represented by the light solid line) includes issuers in the bottom three quartiles of *Disadvantage*. *No Disadvantage* (represented by the dark dashed line) includes issuers whose *Disadvantage* is zero.



Appendix E. Bond Offering Yield Spread Validation

The primary predictions of the model relate to disadvantaged issuers' disclosure choice. However, the model also generates an intermediate step prediction about relative changes in bond yields. In the model, the disadvantaged issuer raises its bond yield to compete with its more advantaged peer. The implication is that the recalibration shocks the issuers' competitive position so that the difference between the disadvantaged and the advantaged issuers' yields increases after the recalibration. In this table, we compare bond offering yield spreads to maturity-matched treasuries before and after the recalibration (from 2004 to 2016). Column 1 reports the issuer's average yield spread on bonds that are issued before Moody's recalibration. The *Pre* period refers to the years before (and including) calendar year 2010. Column 2 reports the issuer's average yield spread on bonds that are issued after Moody's recalibration. The *Post* period corresponds to the years after calendar year 2010. Column 3 reports the change in the issuer's average yield spread from the *Pre* to the *Post* period. *Disadvantage* is equal to the average *Upgrade* of issuer *i*'s market segment minus issuer *i*'s *Upgrade* if issuer *i*'s *Upgrade* is less than the segment average, and zero otherwise. We define segments as issuers with the same pre-recalibration credit rating in the same state in the same population quintile. *High Disadvantage* refers to issuers that are in the top quartile of *Disadvantage*. *Low Disadvantage* refers to issuers that are in the bottom three quartiles of *Disadvantage*. *No Disadvantage* refers to issuers for which *Disadvantage* = 0. *, **, and ***Statistical significance at the 10%, 5%, and 1% levels using two-tailed tests, respectively.

		(1) Pre	(2) Post	(3) (2)–(1) Post–Pre
(i)	High disadvantage	−0.034	0.654	0.688***
(ii)	Low disadvantage	−0.138	0.380	0.518***
(iii)	No disadvantage	−0.158	0.373	0.531***
(i)–(iii)	High–no disadvantage	0.124*	0.281***	0.157*

Endnotes

[1] These barriers include tax, regulation, currency, information, and investor preference (Merton 1987, Karolyi and Stulz 2003, French and Poterba 1991).

[2] A notch is a one-unit change in rating, based on a 19-unit scale (e.g., Aa2 to Aa1).

[3] The mechanisms in Gillette et al. (2020) and our paper are not mutually exclusive. Instead, the studies focus on different mechanisms, which are both relevant in this setting.

[4] See https://www.sec.gov/comments/4-622/4622-15.pdf. Moody's notes that "our rating system is a relative (or ordinal) rather than an absolute (or cardinal) ranking system."

[5] Egan et al. (2017) also discuss depositors' underlying preferences that give rise to demand functions that feature these two properties. One critical condition is the presence of depositors' idiosyncratic preferences over different banks. We see a parallel to the municipal bond setting: just as depositors' bank choices are influenced by their idiosyncratic preferences such as nearby branches, residents' municipal bond investments are influenced by their idiosyncratic preferences such as local municipalities.

6 All else equal, having more surplus enables the municipal bond managers to take on more projects in accordance with their personal and political preferences that would enhance their reelection prospects (e.g., maintaining support from their political constituents and gaining acceptance from voters).

7 Equation (4) offers a way to endogenize $Rating_i$ and relate it to the risk profile of the investment issuer i makes in equilibrium. If i has access to multiple investments with different risks, Moody's forms a conjecture about the investment the issuer will take. In our model (with a low-risk and a high-risk project), issuers are ensured to choose the low-risk project that succeeds with probability p. Therefore, Moody's conjecture p in determining $Rating_i = p + \Delta_i$ is correct in equilibrium.

8 Keeley (1990) argues that an increase in competition among banks leads to a decrease in banks' profits, which in turn increases their incentives to undertake excessive risks.

9 A sufficient condition is $\Phi < 1, \alpha\beta < 1$, and $\frac{1}{1+\Phi} < p < \frac{1}{\alpha(1+\beta\Phi)}$. The implication is that only the low-risk project is funded in equilibrium. Therefore, the probability of success, p, in Equations (2) and (4) is a known parameter in equilibrium.

10 Our model focuses on the monitoring role of disclosure rather than its informative role. The informative role of disclosure (in assessing the posterior mean or variance) is well studied in settings where the distribution of cash flow is given exogenously (Diamond and Verrecchia 1991, Lambert et al. 2007, Hughes et al. 2007). We focus on the monitoring role of disclosure, which prevents an issuer from taking excessive risks and hence endogenously lowers the issuer's perceived risk. Because lower risk is related to a higher credit rating in Equation (4), disclosure in our model affects the bond demand function (1) indirectly.

11 A Single Audit is required of all local governments that expend more than $750,000 of federal funds in a fiscal year. It is intended to provide assurance to the Federal Government that a non-federal entity has adequate internal controls in place and is generally in compliance with program requirements.

12 Local governments agree in their bond offering documents to provide financial updates to EMMA at least annually.

13 For example, we search the term "City of Maplewood, MN." All the bonds issued by the city of Maplewood are listed on the EMMA site. Maplewood, MN, issued general obligation bonds on July 1, 2008 (GO BDS 2008-A). The bonds were prerefunded in 2016, so the disclosures span our entire sample period.

14 If a financial disclosure is listed twice in multiple categories (i.e., a document with the same period end date, posting date, and file size is listed in both the *Audited Financial Statements* category and the *Annual Financial Statements* category), we count the disclosure once. We also eliminate *Failure to File* notices because these generally do not contain financial information.

15 In unreported analyses, we manually collect a sample of 319 issuers that are not subject to the Single Audit Act to understand whether the main results are different for issuers that are not required to comply with the Single Audit Act. We find that our primary results are pronounced in the sample that is not subject to Single Audit. This comparison suggests that our estimates represent a lower-bound on the effect of competition for capital on disclosure.

16 For example, consider an issuer that takes 280 days to file its audited financial statements in the Single Audit database and does not disseminate any financial disclosures in EMMA in the next year. For this issuer, *EMMA* is equal to zero, and *Timeliness* is equal to $-ln(280+1) = -5.64$. To calculate *Disclosure Quality*, we first normalize *EMMA* and *Timeliness* to values between zero and one. Given the minimum and maximum values of *EMMA* are zero and eight, respectively, normalized *EMMA* is equal to $[(0)-(0)]/[(8)-(0)] = 0$. The minimum and maximum values for *Timeliness* are –6.55 and –4.83, respectively, so normalized *Timeliness* is equal to $[(-5.64)-(-6.55)]/[(-4.83)-(-6.55)] = 0.53$. Then, we equally weight the two values to calculate *Disclosure Quality* as $[0.5\times 0]+[0.5\times 0.53] = 0.265$.

17 Consider an issuer that has two bond issues rated by Moody's. Before the recalibration, both issues are rated A3. After the recalibration, one issue is rated A1, and the other is rated A2. In other words, one issue was upgraded one notch, and the other was upgraded two notches. The issuer's *Upgrade* is the average of the two bond issues, 1.5.

18 We collect the population in the city/county from the 2010 U.S. Census, which we supplement with data from the American Community Survey provided by the U.S. Census Bureau. See https://www.census.gov/2010census.

19 We obtain gross state product from the U.S. Bureau of Economic Analysis (BEA) and the unemployment rate from the U.S. Bureau of Labor Statistics (BLS).

20 Our preperiod is limited because the EMMA financial statement repository was introduced in July 2009.

21 The economic significance of 13.2% is calculated as the coefficient of 0.055 on *Disadvantage* × *Post* divided by the sample mean *Disclosure Quality* of 0.418.

22 A one-notch increase in *Disadvantage* associates with a reduction in the reporting lag of 20.4 days $((\exp(-1\times(-5.460+0.091))-1)-((\exp(-1\times -5.460)-1)))$. We divide this reduction of 20.4 days by the sample mean reporting lag of 234.1 $((\exp(-1\times -5.460)-1))$ days.

23 The coefficient of 0.626 on *Disadvantage* × *Post* divided by the mean of *EMMA* of 1.573.

24 $Disadvantage_{Rating}$ is equal to the average *Upgrade* for all issuers with the same pre-recalibration credit rating as issuer i minus issuer i's *Upgrade* if $Abnormal_{Rating}$ is negative, and zero otherwise.

25 AAA-rated municipal bond yields are typically lower than treasury yields (because of the tax benefit). This is the case in the preperiod, when treasury-adjusted yield spreads are negative. However, around the financial crisis, municipal bond yields rose, whereas treasury yields fell, and the yield spread was positive in the postperiod.

26 The comparisons are qualitatively similar using raw offering yields and tax-adjusted yield spreads to maturity-matched treasuries, though the differences are not statistically significant.

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