

# **Internet Appendix to “Credit Ratings and the Cost of Municipal Financing”<sup>1</sup>**

April 30, 2017

This Internet Appendix contains analyses omitted from the body of the paper to conserve space. Table A.1 displays a sample reconciliation. Section A.1 discusses details regarding Moody’s Primary Algorithm. Section A.2 analyzes changes in the municipal bond (muni) market following the downgrades of the monoline insurers. Section A.3 reports descriptive statistics and robustness analysis for the secondary market tests reported in the paper. Section A.4 reports descriptive statistics and robustness tests for the issuer-level analysis of primary market data reported in the paper. Section A.5 provides an analysis of ratings produced by Standard and Poor’s (S&P) around the time of Moody’s recalibration.

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<sup>1</sup> Cornaggia, Jess, Kimberly J. Cornaggia, and Ryan D. Israelsen, 2017, Internet Appendix to “Credit Ratings and the Cost of Municipal Financing” available on SSRN: [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2304373](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2304373)

## **A.1. Moody's Primary Algorithm**

On March 16, 2010, Moody's published a white paper, "Recalibration of Moody's U.S. Municipal Ratings to its Global Scale". Table 1 on page 2 in this white paper displays Moody's Primary Algorithm for recalibrating bonds ratings. Figure A.1 reproduces this table.

## **A.2. Muni Market Composition**

Because Moody's recalibrations in 2010 followed the monolines' loss of their Aaa ratings, we examine the composition of the muni market (insured versus uninsured issues) around the time of the recalibration event. Panel A of Figure A.2 displays the total par value of Moody's-rated munis issued per month over a six-year period (June 2005 to June 2011) centered on the month of the monoline downgrades (June 2008). Any impact of the changing insurance industry on muni issuance appears approximately two years prior to the recalibration event in spring of 2010.

Panel B displays the dollar volume of insured and uninsured muni issues by month over the sample period we employ in our multivariate regressions (April 2009 to April 2011). The vertical line denotes April 2010, the month with the first and most numerous recalibrations. Uninsured bonds dominate this market over this sample period, which coincidentally spans the Build America Bonds (BAB) program.<sup>2</sup> We split the uninsured bonds by whether they are BABs and include an indicator variable to identify BABs in our regressions.

## **A.3. Secondary Markets**

### *A.3.1. Summary Statistics*

Table A.2 displays summary statistics for the sample of uninsured bonds for which we have complete secondary market data for multivariate tests. (Table A.1 tabulates the sample reconciliation and reports sample size for each analysis.) Panel A reports statistics separately for subsamples of bonds divided by whether the issuer's bonds were upgraded as a result of the recalibration. In secondary market tests, *Raw yield* is the lower of the yield-to-call and the yield-to-maturity. The average yield (4.36%) for the treatment group is lower than the average yield in the control group (4.58%). Credit spreads are likewise lower for the treatment group. Our primary dependent variable, *Spread to after-tax Treasury*<sub>2</sub>, averages 2.31% for upgraded bonds compared to 2.85% among bonds with zero-notch 'Change in Scale' upgrades. Due to preferential tax treatment, munis commonly have negative yield spreads, which is observable at the 25<sup>th</sup> percentile for *Spread to Treasury*<sub>1</sub> in both groups.

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<sup>2</sup> The BAB program ran from April 2009 to December 2010.

We employ a standard numerical transformation of Moody's rating scale ascending in credit quality (Aaa = 21, Aa1 = 20, ..., C = 1). However, our sample contains only investment grade bonds (rated Baa3 or higher). Given that some bonds had Aaa ratings and hence could not be upgraded, the average bond that retained its rating through recalibration had a slightly higher rating prior to recalibration ( $18.0 \approx \text{Aa3}$ ) than the average upgraded bond ( $15.9 \approx \text{A2}$ ). Conditional on an upgrade, the average upgrade was 1.6 notches resulting in an average rating ( $17.7 \approx \text{Aa3}$ ) comparable to that of the control group. The variable *Notches* is not directly comparable to the transition matrix in manuscript Table 2. This is because Table 2 shows individual bonds' ratings immediately before and after recalibration and because Table A.2 uses a filtered sample (see Table A.1 for sample reconciliation). Further, Table A.2 displays the distribution of an issuer-level variable (*Notches*) measuring the difference in average ratings of issuer debt before and after recalibration.

We note a differential proportion of general obligation (GO) bonds in these two subsamples: 48% of upgraded munis are GO, compared to 8% of the control group. The proportions of BABs also differ: 5% (12%) of munis without (with) a rating change due to recalibration are BABs. A smaller percentage of upgraded bonds are callable (85%) relative to the control group (93%). The proportions of bonds issued through negotiated deals are comparable (89% and 88%). The proportions of bonds issued by states are 70% and 63%, although the percentage of bonds issued by cities is twice as high among upgraded bonds (16%) compared to the control group (8%) which is offset by a corresponding higher proportion of bonds issued by counties among the control group (3% versus 15%). Roughly half (53%) of upgraded bonds were upgraded across a broad rating category (implying 47% were upgraded within the same broad category). By definition, no bonds in the control group crossed a regulatory threshold.

Panel B reports summary statistics separately for observations in the 30-day period prior to recalibration and the subsequent 30 days. Only the variables with the potential to vary across time periods (i.e., yields, spreads, and trading frequency) are summarized in the later time period. All other variables are the same in both time periods.

### *A.3.2. Individual Cumulative Returns for Upgraded and Non-upgraded Bonds*

Figure A.3 shows individual cumulative returns for bonds in the upgraded and non-upgraded groups underlying each panel of Figure 1 in the paper.

### *A.3.3. Multivariate OLS Regressions*

Table A.3 replicates the specification reported in column (5) of Table 4 Panel A (employing *Spread to after-tax Treasury*<sub>2</sub> as the dependent variable) separately for each issuer level of government. These secondary market results appear driven by trading in state-issued bonds and bonds issued

by other levels of government. The results in Table A.3 appear to be in contrast with those of Table 7 in the manuscript. Table 7 shows stronger primary market reactions among city-level bonds and weaker reactions among state-level bonds. We believe the difference reflects the liquidity characteristics of the bonds entering the secondary market sample. Municipal bonds do not trade often. In fact, most never trade after they are issued. The bonds that enter our secondary market sample must trade in the 30-day period before Moody's published the Primary Algorithm and in the 30-day period after the bond's rating was recalibrated. In other words, the bonds must trade relatively often. Such bonds are generally large and issued by well-known issuers. These types of issuers tend to be states. Therefore, our secondary market tests are naturally suited for testing the impact of ratings among state-level issuers. The sample underlying the primary market tests does not face the same type of liquidity filter. In order for an issuer to be included in the sample for primary market tests, it must issue at least one bond in the year before Moody's published the Primary Algorithm and the year after the fourth and final recalibration date. This filter does not correlate particularly strongly with an issuer's level of government.

Table A.4 replicates Table 4 in the paper after including separate fixed effects for issuer level of government that vary by pre- and post-treatment windows. The results are robust.

## **A.4. Primary Markets**

### *A.4.1. Issuer Level Summary Statistics*

Table A.5 displays summary statistics for the issuer characteristics and changes in new issue characteristics for the sample for which we have complete primary market data for multivariate tests. (Refer to Table A.1 for the detailed sample reconciliation.) The issuer level analysis in the paper (i.e., Table 6) employs the average change in yield, credit spread, and bond characteristics on new issues for each issuer from the pre- to post-recalibration period; we thus report summary statistics for the average changes rather than average variable levels. We report statistics separately for issuers whose outstanding bonds were upgraded as part of the recalibration (treatment group) and, for comparison, issuers whose outstanding bonds received zero-notch 'Change in Scale' upgrades (control group).

The average change in *Raw yield* is negative in both groups, but more negative in the treatment group (-0.27% compared to -0.14%). The average change in credit spread is positive in both groups but less positive in the treatment group (average change in *Spread to after-tax Treasury*<sub>2</sub> is 0.13% in treatment group versus 0.29% in control group).

The change in rating at issuance is greater among the treatment group (1.2 versus 0.1 on average). Because we define the treatment group according to how issuers' outstanding bonds changed as a result of recalibration, this change indicates Moody's gave higher ratings to new issues from the

treated group going forward. Given that some issuers' outstanding bonds had Aaa ratings and hence could not be upgraded, the average municipality that retained its rating through recalibration had a slightly higher rating prior to recalibration ( $19.1 \approx \text{Aa2}$ ) than the average upgraded municipality ( $17.8 \approx \text{Aa3}$ ). Conditional on an upgrade, the average upgrade was 1.3 notches in this sample resulting in an average ( $19.2 \approx \text{Aa2}$ ) comparable to the control group.

Some variables related to issuer information environment differ between the treatment and control groups. 51% of issuers with upgraded bonds did not have S&P ratings on their outstanding bonds; 31% of control group issuers did not have an S&P rating on their outstanding bonds. Control group issuers have a higher proportion of state issuers and a lower proportion of city issuers compared to the issuers with upgraded bonds. However, issuer opacity and corruption measures are similar between the groups.

#### *A.4.2. Issuer Level OLS Regressions*

In Table A.6, we repeat the issuer-level regression analysis after conditioning on issuers' average credit ratings in the pre-recalibration and, separately, post-recalibration periods. This analysis allows us to determine whether the results are widespread, or driven by issuers initiating in or ending up in a particular rating category. We employ the *Upgrade* indicator in Panel A, and the magnitude variable *Notches* in Panel B. We find that the negative coefficient on the interaction term remains significant in two of three subsamples whether we split the sample by initial or final issuer rating. The exception in the pre-recalibration rating divide is the Baa-range. (With issuer-level analyses, we have only 12 observations in this category. This sample size is insufficient to estimate the regression with 8 control variables and numerous fixed effects.) The exception in the post-recalibration rating divide is insignificant coefficient in the A range. Overall, the results in Table A.6 indicate the baseline results reported in Table 6 are stronger for the bonds migrating out of the A and Aa ranges and those migrating into Aa and Aaa territory.

#### **A.5. S&P's Ratings Behavior around Moody's Recalibration**

Our focus in the manuscript is on the behavior of Moody's ratings and how the company's recalibration affected the pricing of municipal debt. However, given that Moody's and S&P are similar in size and together dominate the ratings industry, it is natural to ask whether and to what extent S&P responded to Moody's recalibration by changing its municipal ratings. Unlike Moody's, S&P has long maintained that it never had a dual-class rating system:

*"We have always had one scale, a consistent scale that we have tried to adopt across all our asset classes." -- Deven Sharma, S&P President, July 27, 2011<sup>3</sup>*

Therefore, if S&P's municipal ratings were already on the same scale as corporate and sovereign bonds, S&P should not update its ratings around the time Moody's recalibrated.

We examine S&P's ratings around the time of Moody's recalibration in Table A.7. Panel A contains our full sample of municipal bonds rated by S&P, irrespective of whether they were rated or recalibrated by Moody's. We observe ratings at two points in time for these bonds. The horizontal axis corresponds to S&P's ratings on April 16, 2010 (i.e., Moody's first recalibration date). The vertical axis corresponds to S&P's ratings on the date of its next rating change or April 16, 2011, whichever comes first. In other words, if S&P does not update a bond's rating within one year of Moody's recalibration, the bond remains on the main diagonal of the transition matrix.

The transition matrix reported in Panel A does not suggest an upward migration of S&P ratings over this one-year time horizon to mirror Moody's recalibration. The overwhelming majority of S&P-rated munis retain their original ratings. However, S&P exhibits an unusual proclivity for updating the bonds' ratings to AA+. This shift applies to bonds downgraded from AAA, as well as bonds with lower starting ratings (some upgraded as many as eight notches from BBB-). The total number of issues rated AA+ increased from 26,582 to 32,349 (an increase of 21.7%) in the year following Moody's recalibration.

We repeat this transition matrix in Panel B after restricting the sample to bonds that Moody's recalibrated (i.e., the sample of bonds in Table 2 Panel B). The migration toward AA+ is evident here as well, if less pronounced (an increase of 6.8% from 17,451 to 18,630 bonds). The migration toward AA+ is strongest (a 50% increase from 9,131 to 13,719 bonds) in Panel C which displays the one year migration of S&P's ratings for the sample of bonds not rated or recalibrated by Moody's.

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<sup>3</sup> Testimony before the U.S. House of Representatives, Committee on Financial Services, Oversight and Investigations Subcommittee, 2129 Rayburn Office Building, Washington DC, July 27, 2011.

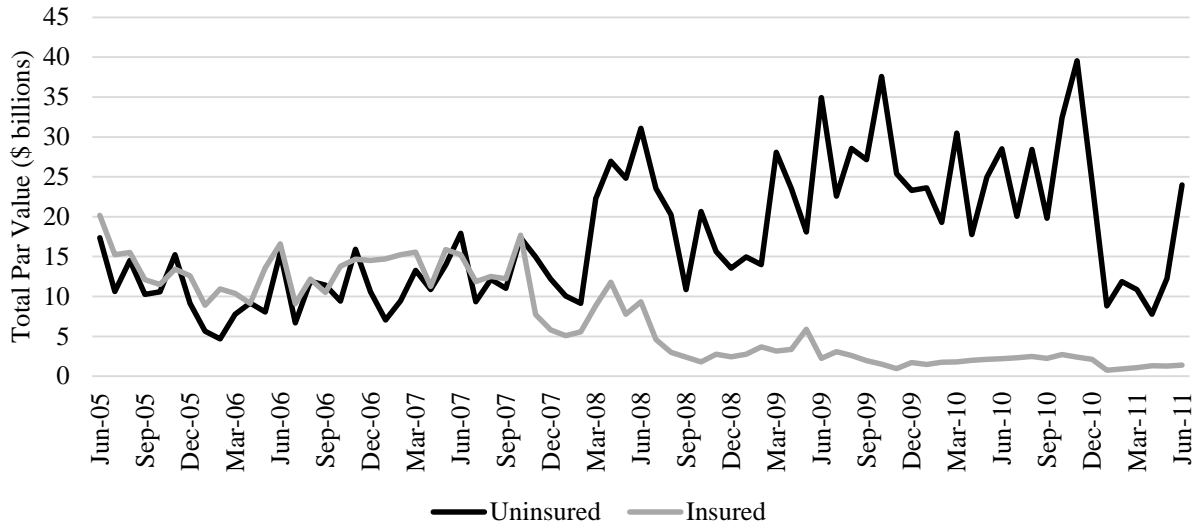
TABLE 1

### Primary Algorithms by Sector

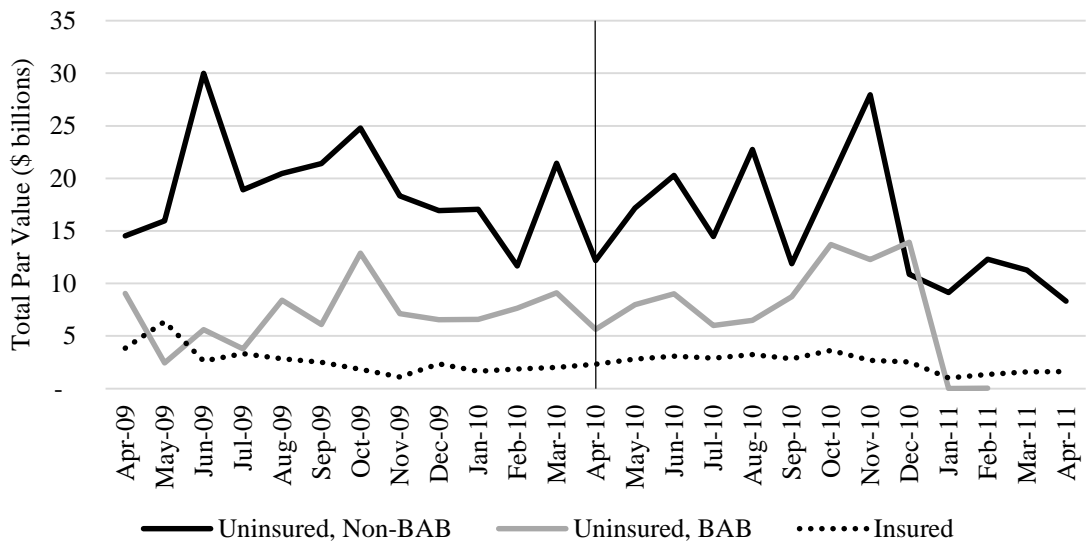
Upward Shift in Ratings (# of notches)

MUNICIPAL SCALE RATING	GENERAL OBLIGATION; WATER & SEWER; DISTRIBUTION-ONLY UTILITIES; MUNICIPAL UTILITY DISTRICTS (MUDS)	SPECIAL TAX (NON-GO); MASS TRANSIT; NON-UTILITY ENTERPRISES; TAX INCREMENT FINANCING DISTRICTS (TIFS); GRANT ANTICIPATION REVENUE BONDS (GARVEES)	PUBLIC UNIVERSITIES AND PUBLIC UNIVERSITY FOUNDATIONS	HEALTH CARE; HOUSING; PRIVATE K-12 & CHARTER SCHOOLS; PRIVATE UNIVERSITIES & OTHER NOT-FOR-PROFITS; TRANSPORTATION & OTHER INFRASTRUCTURE ENTERPRISES; POWER GENERATING UTILITIES; STATE REVOLVING FUNDS; BOND BANKS; FEDERAL LEASES
Aaa	0	0	0	0
Aa1	0-1	1	0-1	0
Aa2	1	1	1	0
Aa3	1	1	1	0
A1	2	1	1	0
A2	2	1	1	0
A3	2	1	1	0
Baa1	3	1	1	0
Baa2	3	0	1	0
Baa3	2-3	0	1	0
Ba1	0	0	0	0
Ba2	0	0	0	0
Ba3	0	0	0	0
B1	0	0	0	0
B2	0	0	0	0
B3	0	0	0	0
Caa1	0	0	0	0
Caa2	0	0	0	0
Caa3	0	0	0	0

**Figure A.1. Moody's Primary Algorithm.** This figure depicts Table 1 from, "Recalibration of Moody's U.S. Municipal Ratings to its Global Rating Scale" published by Moody's Investors Service in March 2010.



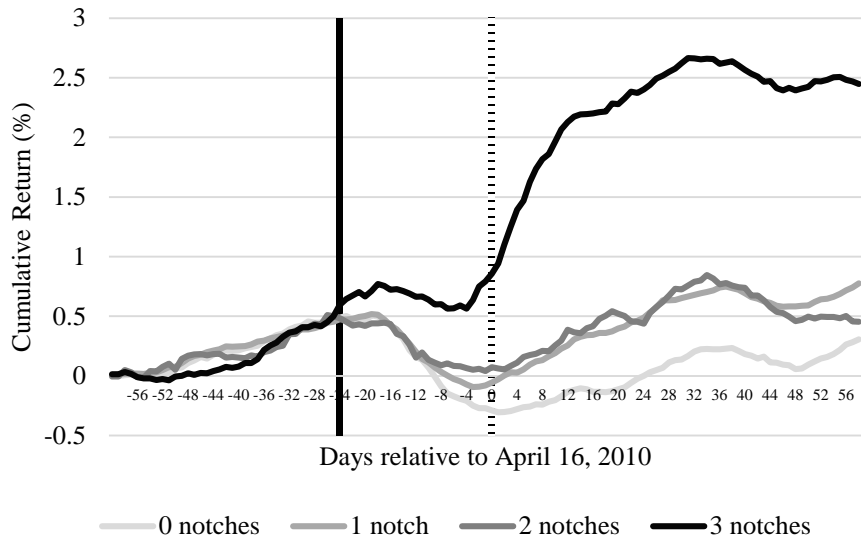
Panel A – June 2005 to June 2011



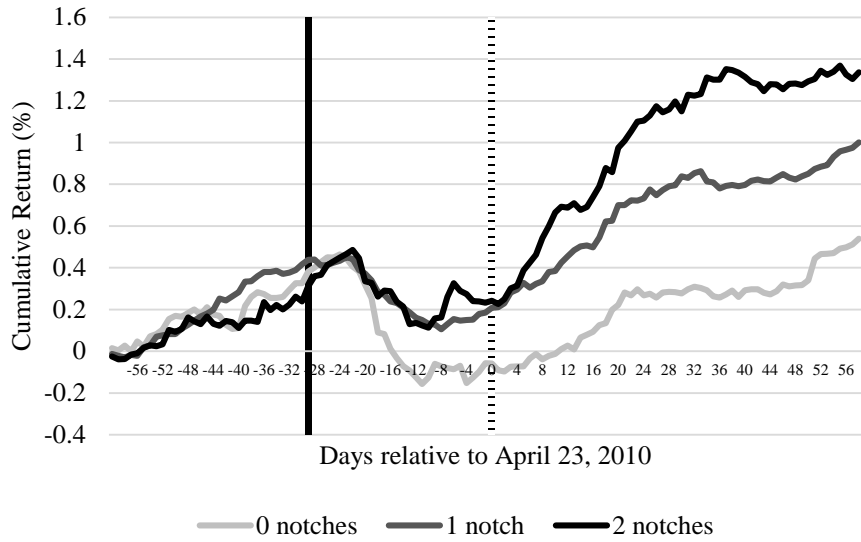
Panel B – April 2009 to April 2011

**Fig. A.2. Dollar volume of issues per month.** Panel A displays the total par value of Moody’s-rated municipal bonds issued per month over a six-year period (June 2005 to June 2011) centered on June 2008. We split the sample by whether the bonds are wrapped with third-party insurance. Panel B displays the total par value of Moody’s-rated municipal bonds issued per month over the time horizon we use in our multivariate regressions (April 2009 to April 2011). We split the sample by whether the bonds are wrapped with third-party insurance. We further split the uninsured bonds by whether they are Build America Bonds. The vertical line denotes April 2010, the month with the first and most numerous recalibrations. The data come from the Ipreo i-Deal new issues database.

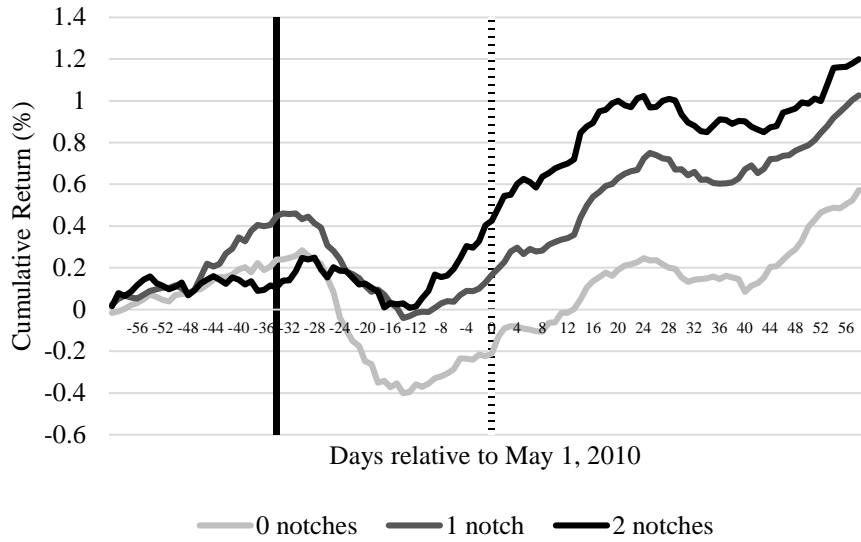




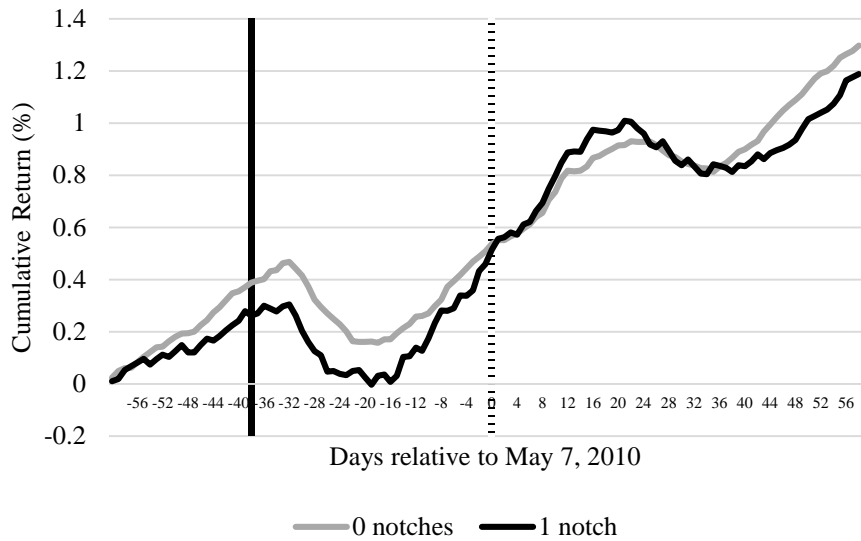
Panel A – First recalibration date, April 16, 2010



Panel B – Second recalibration date, April 23, 2010



Panel C – Third recalibration date, May 1, 2010



Panel D – Fourth recalibration date, May 7, 2010

**Fig. A.3. Cumulative returns around recalibration dates.** This figure displays cumulative returns of outstanding, uninsured municipal bonds with ratings recalibrated by Moody's. We include only bonds purchased by customers (as opposed to dealers) on at least six days during 120-day trading windows centered on the bonds' recalibration dates. Panel A (B, C, D) shows cumulative returns for bonds recalibrated on April 16 (April 23, May 1, May 7), 2010. In each panel, the solid vertical bar indicates March 16, 2010, the day the recalibration was announced, and the dashed vertical bar indicates each of the four implementation dates. We gather secondary market trading data from the MSRB Electronic Municipal Market Access (EMMA) database.

**Table A.1**  
**Sample Reconciliation**

This table displays sample descriptions and the number of observations used in the paper's tables and figures after applying various filters. *Location* contains abbreviations for which tables and figures use the sample. Examples: "T1PA" refers to Table 1 Panel A, "F1" refers to Figure 1, "TA1PA" refers to Table A.1 Panel A (in the Internet Appendix).

Sample	Filter <sub>1</sub>	Filter <sub>2</sub>	Filter <sub>3</sub>	N	Location
<i>Outstanding municipal bonds rated by Moody's with 'Change in Scale' rating actions between 4/16/2010 and 5/7/2010</i>				645,130	T1PA, T2PA
	Uninsured			266,043	T1PB, T2PB
	≥ 1 subsequent rating change after the bond's recalibration to end of data availability (October 2012)			22,788	T3
	≥ 1 subsequent rating change after the bond's recalibration within one year			20,469	T3
	'Change in Scale' rating actions and ≥ 6 trades from t-60 to t+60			5,341	F1
	≥ 8 trading days in the 30 days before Moody's published the Primary Algorithm and after the bond's recalibration			1,910	T4, TA2, TA3, TA4
	≥ 5 trading days in the 30 days before Moody's published the Primary Algorithm and after the bond's recalibration				
	'Change in Scale' rating actions result in 0 or 1 notch upgrades			2,356	T8PA
	'Change in Scale' rating actions result in 0 or 2 notch upgrades			1,618	T8PA
	≥ 1 "customer bought" or "customer sold" trade in the 90 days before and after the bond's recalibration			14,682	T5
<i>New uninsured bonds issued from March 2009 to April 2011, excluding the time between the publication of Moody's Primary Algorithm and the final recalibration date, that are rated by Moody's and are issued by municipalities that a) received a 'Change in Scale' rating action on their outstanding bonds, and b) issue ≥ 1 new bond in the year before and after their outstanding bonds are recalibrated</i>				63,908	F5, FA2PB
	Collapse to issuer level, taking averages of bond characteristics in pre- and post-recalibration periods and compute difference			865	T6, T7, TA5, TA6
	'Change in Scale' rating actions result in 0 or 1 notch upgrades			704	T8PB
	'Change in Scale' rating actions result in 0 or 2 notch upgrades			428	T8PB
<i>Outstanding, uninsured municipal bonds rated by Standard &amp; Poor's between April 16, 2010 and April 16, 2011</i>				170,378	TA9PA
	Moody's rated			88,122	TA9PB, F4
	Moody's did not rate			82,256	TA9PC

## Table A.2

### Summary Statistics of Observations in Secondary Market Regressions

This table displays summary statistics for uninsured municipal bonds appearing in secondary market regressions. *Raw yield* is the lower of the yield-to-call and the yield-to-maturity. *Spread to Treasury<sub>1</sub>* is the bond's raw yield minus duration-matched Treasury, where we calculate duration using the bond's time to maturity regardless of whether the bond is callable. *Spread to Treasury<sub>2</sub>* is the bond's raw yield minus duration-matched Treasury, where we calculate duration using the bond's call date if the bond is callable and the bond's time to maturity if the bond is not callable. *Spread to after-tax Treasury<sub>1</sub>* is the bond's raw yield minus the after-tax yield of duration-matched Treasury, where we calculate duration using the bond's time to maturity regardless of whether the bond is callable. *Spread to after-tax Treasury<sub>2</sub>* is the bond's raw yield minus the after-tax yield of duration-matched Treasury, where we calculate duration using the bond's call date if the bond is callable and the bond's time to maturity if the bond is not callable. For both *Spread to after-tax Treasury<sub>1</sub>* and *Spread to after-tax Treasury<sub>2</sub>*, we assume a tax rate of 35% when calculating after-tax yields for Treasuries. If a bond is a Build America Bond, we substitute its raw yield with its after-tax yield, again assuming a 35% tax rate. Yields and spreads are averaged across transactions in the period 30 days prior to or after the recalibration of the bond's rating. *Number of trades* is the number of times the bond is traded in the 30 days prior to or after the recalibration of its rating. *Rating pre-recalibration (Rating post-recalibration)* is the bond's rating prior to (after) recalibration using a numerical translation of Moody's 21-point alphanumeric scale. Ratings are increasing in credit quality, such that Aaa = 21, Aa1 = 20, ..., C = 1. *Notches* is the difference between *Rating pre-recalibration* and *Rating post-recalibration*. *Par* is the bond's par value measured in millions of dollars. We use the natural log of one plus this value in our regressions. *Duration<sub>1</sub>* is the bond's duration, measured in years, calculated using the bond's time to maturity regardless of whether the bond is callable. *Duration<sub>2</sub>* is the bond's duration, measured in years, calculated using the bond's call date if the bond is callable and the bond's time to maturity if the bond is not callable. *Coupon* is the bond's coupon expressed as a percentage. *Outstanding bonds* is the number of other bonds outstanding for the issuer at the time of issuance. We use the natural log of one plus this value in our regressions. *GO* is an indicator variable taking a value of one if the bond is a general obligation bond and zero if the bond is a revenue bond or other type. *BAB* is an indicator variable taking a value of one if the bond is a Build America Bond and zero if not. *Callable* is an indicator variable taking a value of one if the bond is callable and zero if not. *Negotiated* is an indicator variable taking a value of one if the bond was issued through a negotiated process and zero if the bond was issued through a competitive process. *State (County, City, Other)* is an indicator variable taking a value of one if the bond is issued by a state (county, city, other level of government). *Regulatory status change* is an indicator variable taking a value of one if the bond was upgraded as a result of recalibration and the rating change crossed into a new broad rating category. *Regulatory status change* takes a value of zero for issuers whose bonds were not upgraded as a result of recalibration or whose bonds were upgraded one notch but remained within the same broad rating category. Panel A splits the full sample by whether Moody's upgraded the bonds during the recalibration events. Panel B splits the sample by whether the bonds were traded in the 30 days before the recalibration events or after. Bond characteristics come from the Ipreo i-Deal new issues database. We collect ratings data from Moody's. Bond yields and trades come from the Municipal Securities Rulemaking Board (MSRB) Electronic Municipal Market Access (EMMA) website. Bond prospectuses also come from the MSRB EMMA website.

Panel A: Sample Split by Whether Bonds Are Upgraded During Recalibration

	Mean	SD	25 <sup>th</sup> pctile	Median	75 <sup>th</sup> pctile
<i>No change in ratings due to recalibration (N = 1,010)</i>					
Raw yield	4.5805	1.1508	4.2190	4.8554	5.2553
Spread to Treasury <sub>1</sub>	0.4179	0.9806	-0.0880	0.4827	0.9502
Spread to Treasury <sub>2</sub>	2.0645	1.2476	1.3096	2.1101	2.8352
Spread to after-tax Treasury <sub>1</sub>	1.7776	0.9861	1.2743	1.9537	2.3704
Spread to after-tax Treasury <sub>2</sub>	2.8479	1.1892	2.2175	3.0077	3.5962
Number of trades	28.9	40.6	12	18	30
Rating pre-recalibration	18.0	2.4	16	18	20
Rating post-recalibration	18.0	2.4	16	18	20
Notches	0.0	0.0	0	0	0
Par	12.5	0.8	12.1	12.6	13.1
Duration <sub>1</sub>	12.9	3.2	11.7	13.7	15.0
Duration <sub>2</sub>	5.8	2.8	4.7	5.8	7.0
Coupon	5.19	0.76	5.00	5.00	5.50
Outstanding bonds	576	808	120	354	730
GO	0.08	0.27	0	0	0
BAB	0.05	0.22	0	0	0
Callable	0.93	0.25	1	1	1
Negotiated	0.88	0.32	1	1	1
State	0.63	0.48	0	1	1
County	0.15	0.36	0	0	0
City	0.08	0.27	0	0	0
Other	0.14	0.34	0	0	0
Regulatory status change	0.00	0.00	0	0	0
<i>Ratings upgraded due to recalibration (N = 900)</i>					
Raw yield	4.3634	1.4273	3.6931	4.5692	5.2640
Spread to Treasury <sub>1</sub>	0.4744	1.0859	-0.0956	0.5031	0.9902
Spread to Treasury <sub>2</sub>	1.5929	1.2170	0.7694	1.5865	2.4420
Spread to after-tax Treasury <sub>1</sub>	1.5817	0.9712	1.0495	1.6295	2.2094
Spread to after-tax Treasury <sub>2</sub>	2.3087	1.1814	1.4190	2.3960	3.2095
Number of trades	47.5	125.1	13	20	41
Rating pre-recalibration	15.9	2.3	14	16	18
Rating post-recalibration	17.7	1.6	17	17	19
Notches	1.8	1.0	1	1	3
Par	11.5	1.6	9.9	11.8	13.0
Duration <sub>1</sub>	11.2	4.4	8.5	12.0	14.1
Duration <sub>2</sub>	6.6	3.9	4.4	6.4	7.3
Coupon	4.89	1.59	4.75	5.00	5.50
Outstanding bonds	813	626	232	735	1522
GO	0.48	0.50	0	0	1
BAB	0.12	0.33	0	0	0
Callable	0.85	0.35	1	1	1
Negotiated	0.89	0.32	1	1	1
State	0.70	0.46	0	1	1
County	0.03	0.17	0	0	0
City	0.16	0.36	0	0	0
Other	0.11	0.32	0	0	0
Regulatory status change	0.53	0.50	0	1	1

Panel B: Sample Split by Pre- or Post-Recalibration Window

	Mean	SD	25 <sup>th</sup> pctile	Median	75 <sup>th</sup> pctile
<i>Observations from 30 days before bond's recalibration date (N = 955)</i>					
Raw yield	4.5593	1.3334	4.0984	4.8165	5.3885
Spread to Treasury <sub>1</sub>	0.3861	1.0546	-0.2101	0.4335	0.9308
Spread to Treasury <sub>2</sub>	1.8221	1.2855	0.9623	1.8654	2.6589
Spread to after-tax Treasury <sub>1</sub>	1.6712	0.9960	1.1355	1.7698	2.3083
Spread to after-tax Treasury <sub>2</sub>	2.6046	1.2400	1.7606	2.7797	3.4508
Number of trades	46.1	122.7	13	20	39
Rating pre-recalibration	17.0	2.6	15	17	19
Rating post-recalibration	17.9	2.1	17	18	19
Notches	0.9	1.1	0	0	1
Par	12.0	1.3	11.5	12.4	13.1
Duration <sub>1</sub>	12.1	3.9	10.4	13.0	14.6
Duration <sub>2</sub>	6.3	3.3	4.7	6.2	7.2
Coupon	5.05	1.23	5.00	5.00	5.50
Outstanding bonds	688	738	148	500	1099
GO	0.27	0.44	0	0	1
BAB	0.08	0.28	0	0	0
Callable	0.90	0.31	1	1	1
Negotiated	0.88	0.32	1	1	1
State	0.66	0.47	0	1	1
County	0.09	0.29	0	0	0
City	0.12	0.32	0	0	0
Other	0.13	0.33	0	0	0
Regulatory status change	0.25	0.43	0	0	0
<i>Observations from 30 days after bond's recalibration date (N = 955)</i>					
Raw yield	4.3971	1.2462	3.9710	4.6546	5.1392
Spread to Treasury <sub>1</sub>	0.5029	1.0054	0.0271	0.5281	0.9926
Spread to Treasury <sub>2</sub>	1.6993	0.9716	1.1848	1.7942	2.3030
Spread to after-tax Treasury <sub>1</sub>	1.8625	1.2245	1.0429	1.8661	2.7027
Spread to after-tax Treasury <sub>2</sub>	2.5830	1.1909	1.7488	2.7491	3.4343
Number of trades	29.2	38.2	12	18	31

### Table A.3

#### Secondary Market Regressions Split by Issuer Level of Government

*Spread to after-tax Treasury*<sub>2</sub> as the dependent variable. This variable is defined in the legend of Table A.2. We average it across transactions by bond during either the 30-day window before or after the bond's recalibration date. The sample in Table 4 in the paper contains 1,910 uninsured bonds with trading in both the 30-day periods before Moody's published the Primary Algorithm and after the bond's recalibration date. We split this sample by the bonds' issuers' levels of government. *Upgrade* is an indicator variable taking a value of one if the bond experienced an upgrade during the recalibration event and zero if the bond experienced no change in ratings. *Post recalibration* is an indicator variable taking a value of one if the observation is from the 30-day window after the bond's recalibration date and zero if the observation is from the 30-day period prior to Moody's publication of its Primary Algorithm. We exclude data from the day of the bond's recalibration. Other control variables are defined in the legend of Table A.2. *Issue rating pre-recalibration FE* are fixed effects based on the bond's rating before the bond's recalibration. *Issuer level of government FE* are fixed effects based on whether the issuer is a state, county, city, or other. *Issuer state FE* are fixed effects based on the issuer's state. *Moody's sector FE* are fixed effects based on the four sectors into which Moody's classifies bonds in its Primary Algorithm. Standard errors are clustered at the issuer level and are presented in parentheses below coefficient estimates. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	Issuer level of government			
	State (1)	County (2)	City (3)	Other (4)
Post recalibration × Upgrade	-0.22 (0.09)**	-0.10 (0.07)	-0.02 (0.07)	-0.19 (0.04)***
Post recalibration	0.06 (0.02)***	0.09 (0.03)**	-0.03 (0.05)	0.08 (0.03)***
Upgrade	-0.63 (0.35)	0.51 (0.32)	-0.29 (0.22)	0.85 (0.53)
Par	0.06 (0.05)	-0.11 (0.12)	0.08 (0.05)	-0.15 (0.09)
Duration <sub>2</sub>	-0.04 (0.02)**	-0.09 (0.05)	0.00 (0.03)	-0.06 (0.05)
Coupon	-0.08 (0.06)	0.47 (0.20)**	0.08 (0.14)	-0.03 (0.09)
Outstanding bonds	0.05 (0.08)	0.05 (0.10)	-0.09 (0.22)	-0.02 (0.09)
GO	0.68 (0.67)	-1.98 (0.71)***	0.25 (0.56)	-1.99 (1.04)*
BAB	-0.71 (0.22)***	-1.06 (0.39)***	-1.40 (0.34)***	-0.51 (0.32)
Callable	0.60 (0.21)***	-0.04 (0.88)	0.40 (0.21)*	0.76 (0.21)***
Negotiated	-0.17 (0.15)	0.95 (0.36)**	0.08 (0.24)	-0.66 (0.72)
Issue rating pre-recal. FE?	Yes	Yes	Yes	Yes
Issuer level of govt. FE?	No	No	No	No
Issuer state FE?	Yes	Yes	Yes	Yes
Moody's sector FE?	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	0.49	0.89	0.66	0.75
N	1,266	180	224	240



#### **Table A.4**

##### **Secondary Market Regressions Controlling for Level of Government Pre/Post Fixed Effects**

This table displays OLS regression results with various measures of secondary market yields and spreads as the dependent variable. The dependent variables appear at the top of each column. The dependent variables are defined in the legend of Table A.2 and are averaged across transactions by bond during either the 30-day window before Moody's published the Primary Algorithm or after the bond's recalibration date. We include in the regressions uninsured bonds with trading in both the 30-day periods before Moody's published the Primary Algorithm and after the bond's recalibration date. Panel A captures the effect of recalibration on bond yields and spreads with *Upgrade*, an indicator variable taking a value of one if the bond experienced an upgrade as a result of its recalibration and zero if the bond experienced no change in ratings. *Post recalibration* is an indicator variable taking a value of one if the observation is from the 30-day window after the bond's recalibration date and zero if the observation is from the 30-day period prior to the publication of Moody's Primary Algorithm. We exclude data from the day of the bond's recalibration. Other control variables are defined in the legend of Table A.2. *Issue rating pre-recalibration FE* are fixed effects based on the bond's rating before the bond's recalibration. *Notches* represents the change in the rating around the recalibration in terms of number of notches. Panel B captures the effect of recalibration on changes in average yields and spreads with *Notches*. *Issuer level of government FE* are fixed effects based on whether the issuer is a state, county, city, or other. *Issuer state FE* are fixed effects based on the issuer's state. *Moody's sector FE* are fixed effects based on the four sectors into which Moody's classifies bonds in its Primary Algorithm. Standard errors are in parentheses below coefficient estimates. We cluster standard errors by the issuer. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Recalibration Effect Captured with Upgrade Indicator (*Upgrade*)

	Raw yield	Spread to Treasury <sub>1</sub>	Spread to Treasury <sub>2</sub>	Spread to after-tax Treasury <sub>1</sub>	Spread to after-tax Treasury <sub>2</sub>
	(1)	(2)	(3)	(4)	(5)
Post recalibration × Upgrade	-0.05 (0.07)	-0.33 (0.08)***	-0.27 (0.07)***	-0.22 (0.07)***	-0.18 (0.07)**
Post recalibration	-0.14 (0.03)***	0.25 (0.02)***	0.14 (0.02)***	0.11 (0.02)***	0.05 (0.02)*
Upgrade	-0.16 (0.17)	-0.03 (0.16)	-0.33 (0.22)	-0.11 (0.16)	-0.37 (0.21)*
Par	0.07 (0.04)*	0.08 (0.04)**	0.06 (0.04)	0.08 (0.04)**	0.06 (0.04)
Duration <sub>1</sub>	0.18 (0.02)***	-0.03 (0.01)***		0.04 (0.01)***	
Duration <sub>2</sub>			-0.13 (0.02)***		-0.04 (0.02)**
Coupon	0.01 (0.06)	-0.01 (0.04)	-0.01 (0.04)	-0.01 (0.05)	-0.01 (0.05)
Outstanding bonds	-0.03 (0.04)	-0.05 (0.04)	0.00 (0.05)	-0.04 (0.04)	0.01 (0.05)
GO	0.23 (0.47)	0.10 (0.35)	-0.11 (0.53)	-0.14 (0.40)	-0.05 (0.56)
BAB	1.47 (0.17)***	1.28 (0.14)***	1.25 (0.19)***	-0.64 (0.12)**	-0.74 (0.14)***
Callable	0.05 (0.13)	-0.24 (0.13)*	0.59 (0.16)***	-0.12 (0.11)	0.69 (0.15)***
Negotiated	0.00 (0.15)	0.05 (0.12)	-0.16 (0.17)	0.05 (0.12)	-0.14 (0.15)
Issue rating pre-recal. FE?	Yes	Yes	Yes	Yes	Yes
Issuer level of govt. pre/post-recal. FE?	Yes	Yes	Yes	Yes	Yes
Issuer state FE?	Yes	Yes	Yes	Yes	Yes
Moody's sector FE?	Yes	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	0.58	0.45	0.46	0.41	0.47
N	1,910	1,910	1,910	1,910	1,910

Panel B: Recalibration Effect Captured with Upgrade Magnitude (*Notches*)

	Raw Yield	Spread to Treasury <sub>1</sub>	Spread to Treasury <sub>2</sub>	Spread to after-tax Treasury <sub>1</sub>	Spread to after-tax Treasury <sub>2</sub>
	(1)	(2)	(3)	(4)	(5)
Post recalibration × Notches	-0.07 (0.03)**	-0.18 (0.02)***	-0.16 (0.02)***	-0.14 (0.02)***	-0.12 (0.02)***
Post recalibration	-0.09 (0.03)***	0.28 (0.02)***	0.17 (0.02)***	0.15 (0.02)***	0.08 (0.02)***
Notches	-0.09 (0.09)	0.01 (0.08)	-0.11 (0.10)	-0.05 (0.08)	-0.13 (0.10)
Par	0.07 (0.04)	0.08 (0.04)**	0.06 (0.04)	0.08 (0.04)**	0.06 (0.04)
Duration <sub>1</sub>	0.18 (0.02)***	-0.03 (0.01)***		0.04 (0.01)***	
Duration <sub>2</sub>			-0.13 (0.02)***		-0.03 (0.02)**
Coupon	0.02 (0.07)	0.00 (0.05)	0.00 (0.05)	-0.01 (0.05)	0.00 (0.05)
Outstanding bonds	-0.03 (0.04)	-0.05 (0.04)	0.00 (0.06)	-0.04 (0.04)	0.00 (0.06)
GO	-0.02 (0.22)	0.10 (0.35)	-0.11 (0.51)	0.14 (0.39)	-0.05 (0.55)
BAB	1.45 (0.17)***	1.27 (0.14)***	1.22 (0.19)***	-0.66 (0.13)***	-0.77 (0.14)***
Callable	0.04 (0.13)	-0.24 (0.13)*	0.59 (0.16)***	-0.13 (0.12)	0.69 (0.15)***
Negotiated	0.00 (0.14)	0.05 (0.12)	-0.18 (0.17)	0.04 (0.12)	-0.16 (0.15)
Issue rating pre-recal. FE?	Yes	Yes	Yes	Yes	Yes
Issuer level of govt. pre/post-recal. FE?	Yes	Yes	Yes	Yes	Yes
Issuer state FE?	Yes	Yes	Yes	Yes	Yes
Moody's sector FE?	Yes	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	0.58	0.45	0.46	0.42	0.46
N	1,910	1,910	1,910	1,910	1,910

## Table A.5 Summary Statistics of Observations in Primary Market Regressions

This table displays summary statistics for the average change in characteristics of bonds issued by municipalities who issued at least one bond in the year before March 16, 2010 (the date Moody's published its Primary Algorithm) and the year after May 7, 2010 (the fourth and final recalibration date). The sample consists of 865 issuers. We split the sample by whether the issuer's outstanding bonds were upgraded during the recalibration events. *Raw yield* is the offer yield. *Spread to Treasury<sub>1</sub>* is a bond's raw yield minus duration-matched Treasury, where we calculate duration using the bond's time to maturity regardless of whether the bond is callable. *Spread to Treasury<sub>2</sub>* is a bond's raw yield minus duration-matched Treasury, where we calculate duration using the bond's call date if the bond is callable and the bond's time to maturity if the bond is not callable. *Spread to after-tax Treasury<sub>1</sub>* is a bond's raw yield minus the after-tax yield of duration-matched Treasury, where we calculate duration using the bond's time to maturity regardless of whether the bond is callable. *Spread to after-tax Treasury<sub>2</sub>* is a bond's raw yield minus the after-tax yield of duration-matched Treasury, where we calculate duration using the bond's call date if the bond is callable and the bond's time to maturity if the bond is not callable. For both *Spread to after-tax Treasury<sub>1</sub>* and *Spread to after-tax Treasury<sub>2</sub>*, we assume a tax rate of 35% when calculating after-tax yields for Treasuries. If a bond is a Build America Bond, we substitute its raw yield with its after-tax yield, again assuming a 35% tax rate. *Rating at issuance* is a numerical translation of Moody's 21-point alphanumeric scale. Ratings are increasing in credit quality, such that Aaa = 21, Aa1 = 20, ..., C = 1. *Par* is a bond's par value measured in millions of dollars. We use the average change of the natural log of one plus this value in our regressions. *Duration<sub>1</sub>* is a bond's duration, measured in years, calculated using the bond's time to maturity regardless of whether the bond is callable. *Duration<sub>2</sub>* is a bond's duration, measured in years, calculated using the bond's call date if the bond is callable and the bond's time to maturity if the bond is not callable. *Coupon* is a bond's coupon expressed as a percentage. *Outstanding bonds* is the number of other bonds outstanding for the issuer at the time of issuance. We use the average change of the natural log of one plus this value in our regressions. *GO* is an indicator variable taking a value of one if a bond is a general obligation bond and zero if a bond is a revenue bond or other type. *BAB* is an indicator variable taking a value of one if a bond is a Build America Bond and zero if not. *Callable* is an indicator variable taking a value of one if a bond is callable and zero if not. *Negotiated* is an indicator variable taking a value of one if a bond was issued through a negotiated process and zero if the bond was issued through a competitive process. We calculate the average rating of all outstanding bonds for each issuer before (*Issuer rating pre-recalibration*) and after (*Issuer rating post-recalibration*) the recalibration dates. *Notches* represents the change in this number rounded to the nearest whole number. *Opacity* is a state-level index developed by U.S. PIRG which evaluates the 50 states by the extent to which they provide online access to government spending data. The opacity index is from 2010. *Not rated by S&P* is an indicator variable taking a value of one if any of the issuer's bonds were rated by S&P in the year prior to Moody's recalibration and zero otherwise. *CorruptRisk index from SII* is an indicator variable taking a value of one if the issuer is, or is located within, a state with above-median corruption risk. We measure corruption risk with a state-level corruption risk index developed by the State Integrity Investigation. The corruption risk index is a snapshot from 2013. *CorruptConvictions 2010* is the number of public officials convicted of corruption in the issuer's state in 2010 divided by the state's population in the same year, standardized to follow a mean-zero, unit-variance distribution. *CorruptConvictions 2010-2012* is the average number of public officials convicted of corruption in the issuer's state from 2010 to 2012 divided by the state's average population over the same time period, standardized to follow a mean-zero, unit-variance distribution. Convictions data are available on an annual basis from the U.S. Department of Justice's website. Bond characteristics come from the Ipreo i-Deal new issues database. We collect ratings data from Moody's.

	Mean	SD	25 <sup>th</sup> pctile	Median	75 <sup>th</sup> pctile
<i>No change in issuers' ratings due to recalibration (N = 285 issuers)</i>					
Δ Raw yield	-0.1423	1.1193	-0.6760	-0.2689	0.2364
Δ Spread to Treasury <sub>1</sub>	0.4776	0.8304	0.0161	0.4461	0.8122
Δ Spread to Treasury <sub>2</sub>	0.5140	0.8527	0.0782	0.4832	0.9028
Δ Spread to after-tax Treasury <sub>1</sub>	0.2727	0.7463	-0.1070	0.1941	0.5684
Δ Spread to after-tax Treasury <sub>2</sub>	0.2964	0.7769	-0.1360	0.2651	0.6269
Δ Rating at issuance	0.1	0.4	0.0	0.0	0.0
Δ Par	8.7	105.6	-1.5	0.0	1.5
Δ Duration <sub>1</sub>	0.1	2.7	-1.1	-0.2	1.0
Δ Duration <sub>2</sub>	0.2	2.0	-0.5	0.1	0.8
Δ Coupon	-0.08	0.82	-0.47	-0.11	0.28
Δ Outstanding bonds	12	38	0	11	26
Δ GO	-0.02	0.26	0	0	0
Δ BAB	0.01	0.38	0	0	0
Δ Callable	-0.05	0.38	-0.16	0	0.05
Δ Negotiated	-0.01	0.29	0	0	0
Issuer rating pre-recalibration	19.1	1.9	18	19	21
Issuer rating post-recalibration	19.1	1.9	18	19	21
Notches	0.0	0.0	0	0	0
State	0.38	0.49	0	0	1
County	0.21	0.41	0	0	0
City	0.26	0.44	0	0	1
Other	0.15	0.36	0	0	0
Opacity score	69.0	19.4	62	73	82
Not rated by S&P	0.31	0.46	0	0	1
Corrupt <sub>Risk index from SII</sub>	71.1	9.6	66	71	75
Corrupt <sub>Convictions 2010</sub>	3.35	4.53	1.18	2.78	4.12
Corrupt <sub>Convictions 2010-2012</sub>	3.19	4.45	1.22	2.72	3.62
<i>Issuers' ratings upgraded due to recalibration (N = 580 issuers)</i>					
Δ Raw yield	-0.2749	1.0877	-0.8138	-0.2989	0.2212
Δ Spread to Treasury <sub>1</sub>	0.2644	0.7944	-0.1512	0.2422	0.6254
Δ Spread to Treasury <sub>2</sub>	0.3145	0.8764	-0.1755	0.2994	0.6962
Δ Spread to after-tax Treasury <sub>1</sub>	0.0991	0.6957	-0.2604	0.0893	0.4315
Δ Spread to after-tax Treasury <sub>2</sub>	0.1316	0.7529	-0.2710	0.1157	0.4993
Δ Rating at issuance	1.2	0.6	1.0	1.0	1.8
Δ Par	0.9	31.9	-0.6	0.0	0.7
Δ Duration <sub>1</sub>	0.2	2.2	-0.8	0.1	1.1
Δ Duration <sub>2</sub>	0.2	1.6	-0.5	0.1	0.8
Δ Coupon	-0.11	0.96	-0.64	-0.16	0.33
Δ Outstanding bonds	8	40	-1	7	20
Δ GO	0.03	0.27	0	0	0
Δ BAB	-0.01	0.43	0	0	0

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$\Delta$ Callable	-0.01	0.46	-0.17	0	0.10
$\Delta$ Negotiated	-0.06	0.31	0	0	0
Issuer rating pre-recalibration	17.8	1.4	17	18	19
Issuer rating post-recalibration	19.2	1.1	19	19	20
Notches	1.3	0.5	1	1	2
State	0.14	0.35	0	0	0
County	0.18	0.38	0	0	0
City	0.44	0.50	0	0	1
Other	0.24	0.43	0	0	0
Opacity score	66.7	20.4	61	73	78
Not rated by S&P	0.51	0.50	0	1	1
Corrupt <sub>Risk index from SII</sub>	71.1	8.1	67	70	75
Corrupt <sub>Convictions 2010</sub>	3.23	4.50	1.23	2.50	4.05
Corrupt <sub>Convictions 2010-2012</sub>	3.08	4.34	1.65	2.51	3.56

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## Table A.6

### Primary Market Regressions Split by Pre- or Post-Recalibration Ratings

This table displays OLS regression results with  $\Delta \text{Spread to after-tax Treasury}_2$  as the dependent variable. This variable is defined in the legend of Table A.5. The first set of columns restrict the treatment and control samples to municipalities with average ratings prior to recalibration of A3, A2, or A1 (column (1)); and Aa3, Aa2, or Aa1 (column (2)). The second set of columns restrict the treatment and control samples to municipalities with average ratings after to recalibration of A3, A2, or A1 (column (3)); Aa3, Aa2, or Aa1 (column (4)); and Aaa (column (5)). Panel A captures the effect of the recalibration on average changes in spreads with *Upgrade*, an indicator variable taking a value of one if the issuer of the bond experienced an upgrade on its outstanding bonds during any of the recalibration events and zero if the issuer's bonds experienced no change in ratings. Panel B captures the effect of the recalibration with *Notches*. *Notches* and control variables are defined in the legend of Table A.5. *Issuer level of government FE* are fixed effects based on whether the issuer is a state, county, city, or other. *Issuer state FE* are fixed effects based on the issuer's state. Standard errors are in parentheses below coefficient estimates. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Recalibration Effect Captured with Upgrade Indicator (*Upgrade*)

	Ratings in the pre-recalibration period		Ratings in the post-recalibration period		
	A-range (1)	Aa-range (2)	A-range (3)	Aa-range (4)	Aaa (5)
Upgrade	-0.29 (0.15)*	-0.15 (0.06)**	-0.12 (0.21)	-0.15 (0.07)**	-0.17 (0.08)**
Δ Par	0.21 (0.08)**	0.04 (0.04)	0.33 (0.13)**	0.04 (0.04)	0.11 (0.07)
Δ Duration <sub>2</sub>	0.06 (0.03)*	-0.03 (0.02)	0.03 (0.06)	0.01 (0.02)	-0.09 (0.03)***
Δ Coupon	0.31 (0.06)***	0.40 (0.04)***	0.29 (0.13)**	0.32 (0.03)***	0.45 (0.07)***
Δ Outstanding bonds	-0.30 (0.33)	0.12 (0.16)	-0.76 (0.52)	0.14 (0.17)	0.12 (0.20)
Δ GO	-0.21 (0.17)	-0.44 (0.11)***	0.05 (0.33)	-0.41 (0.11)***	-0.34 (0.17)**
Δ BAB	-1.04 (0.13)***	-0.55 (0.07)***	-0.95 (0.24)***	-0.65 (0.07)***	-0.46 (0.09)***
Δ Callable	0.13 (0.12)	0.33 (0.07)***	-0.00 (0.27)	0.24 (0.07)***	0.25 (0.09)***
Δ Negotiated	-0.03 (0.18)	-0.07 (0.09)	-0.32 (0.42)	-0.04 (0.09)	-0.13 (0.12)
Issuer level of govt. FE?	Yes	Yes	Yes	Yes	Yes
Issuer state FE?	Yes	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	0.41	0.39	0.50	0.33	0.49
N	246	507	101	592	167



Panel B: Recalibration Effect Captured with Upgrade Indicator (*Notches*)

	Ratings in the pre-recalibration period		Ratings in the post-recalibration period		
	A-range (1)	Aa-range (2)	A-range (3)	Aa-range (4)	Aaa (5)
Notches	-0.15 (0.07)**	-0.13 (0.05)**	0.02 (0.12)	-0.11 (0.04)***	-0.14 (0.06)**
$\Delta$ Par	0.22 (0.08)***	0.05 (0.04)	0.35 (0.13)***	0.04 (0.04)	0.13 (0.07)*
$\Delta$ Duration <sub>2</sub>	0.06 (0.03)*	-0.03 (0.02)	0.03 (0.06)	0.01 (0.02)	-0.09 (0.02)***
$\Delta$ Coupon	0.32 (0.06)***	0.40 (0.04)***	0.30 (0.13)**	0.32 (0.03)***	0.44 (0.07)***
$\Delta$ Outstanding bonds	-0.29 (0.33)	0.11 (0.16)	-0.67 (0.53)	0.14 (0.17)	0.11 (0.20)
$\Delta$ GO	-0.14 (0.17)	-0.41 (0.11)***	0.02 (0.33)	-0.36 (0.11)***	-0.30 (0.17)*
$\Delta$ BAB	-1.07 (0.13)***	-0.56 (0.07)***	-0.99 (0.24)***	-0.67 (0.07)***	-0.46 (0.09)***
$\Delta$ Callable	0.12 (0.12)	0.34 (0.07)***	0.01 (0.28)	0.24 (0.07)***	0.26 (0.09)***
$\Delta$ Negotiated	-0.03 (0.18)	-0.07 (0.09)	-0.32 (0.43)	-0.03 (0.09)	-0.13 (0.12)
Issuer level of govt. FE?	Yes	Yes	Yes	Yes	Yes
Issuer state FE?	Yes	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	0.41	0.40	0.50	0.34	0.49
N	246	507	101	592	167

**Table A.7****Standard & Poor's Ratings Behavior around Moody's Recalibration**

This table displays ratings migration matrices for Standard & Poor's credit ratings around the time Moody's recalibrated its municipal bond ratings. We examine uninsured municipal bonds that were outstanding from April 16, 2010 to April 16, 2011. Panel A shows how the bonds' ratings transition for all bonds rated by S&P, irrespective of whether Moody's also rated the bonds. Panels B and C display the same for subsamples of Panel A, according to whether Moody's recalibrated (i.e., upgraded zero to four notches) the bonds' ratings. The horizontal axis represents the bonds' ratings from Standard & Poor's before the first recalibration date (April 16, 2010) and the vertical axis represents the bonds' outstanding ratings at the earlier of April 16, 2011 or when S&P assigned a new rating. We collect ratings data on bonds issued by state or local governments from Moody's and Standard & Poor's.

Panel A: All Municipal Bonds Rated by S&amp;P

		Rating before scale change											
		AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	Sum	
Rating after scale change	AAA	38,984	705	83	21	1		3				39,797	
	AA+	2,435	25,155	2,590	613	946	461	133		1	15	32,349	
	AA	96	589	32,112	861	145	41					33,844	
	AA-	36	42	753	22,783	836	250	43				24,743	
	A+	62	31	17	916	13,745	943	68	3	9		15,794	
	A	19	59	23	38	193	10,298	218	96	88		11,032	
	A-	45			29	2	671	5,126	177	94	3	6,147	
	BBB+						33	135	39	2,224	199	10	2,640
	BBB	3	1				3	1,376	1	84	1,313	143	2,924
	BBB-									46	16	1,046	1,108
	Sum	41,680	26,582	35,578	25,261	15,904	14,175	5,631	2,630	1,720	1,217	170,378	
	% Upgraded	0.0	2.7	7.5	5.9	12.1	12.0	8.3	10.5	22.7	14.1		
	% Downgraded	6.5	2.7	2.2	3.9	1.5	15.4	0.7	4.9	0.9	0.0		

Panel B: Moody's Recalibrated

		Rating before scale change										
		AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	Sum
Rating after scale change	AAA	29,756	496	2	1	1						30,256
	AA+	292	16,479	1,777	28	27	13	14				18,630
	AA	71	440	18,638	509	78						19,736
	AA-	1	15	202	8,558	196	6					8,978
	A+				576	3,963	101	7				4,647
	A	1	21		36	67	2,402	58	2	15		2,602
	A-						47	1,583	32			1,662
	BBB+					33	29	29	952	55	7	1,105
	BBB						46		34	245	52	377
	BBB-										129	129
	Sum	30,121	17,451	20,619	9,708	4,365	2,644	1,691	1,020	315	188	88,122
	% Upgraded	0.0	2.8	8.6	5.5	6.9	4.5	4.7	3.3	22.2	31.4	
	% Downgraded	1.2	2.7	1.0	6.3	2.3	4.6	1.7	3.3	0.0	0.0	

Panel C: Moody's Did Not Recalibrate

		Rating before scale change										
		AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	Sum
Rating after scale change	AAA	9,228	209	81	20			3				9,541
	AA+	2,143	8,676	813	585	919	448	119		1	15	13,719
	AA	25	149	13,474	352	67	41					14,108
	AA-	35	27	551	14,225	640	244	43				15,765
	A+	62	31	17	340	9,782	842	61	3	9		11,147
	A	18	38	23	2	126	7,896	160	94	73		8,430
	A-	45			29	2	624	3,543	145	94	3	4,485
	BBB+						106	10	1,272	144	3	1,535
	BBB	3	1			3	1,330	1	50	1,068	91	2,547
	BBB-								46	16	917	979
	Sum	11,559	9,131	14,959	15,553	11,539	11,531	3,940	1,610	1,405	1,029	82,256
	% Upgraded	0.0	2.3	6.0	6.2	14.1	13.7	9.8	15.0	22.8	10.9	
	% Downgraded	20.2	2.7	4.0	2.4	1.1	17.9	0.3	6.0	1.1	0.0	