Municipal Bond Insurance after the Financial Crisis: Can It Help Reduce Borrowing Costs for Local Governments?

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ABSTRACT

After achieving peak revenue of $1.5 billion in 2007, the municipal bond insurance business collapsed in the wake of the financial crisis. More recently, the industry has started to recover, with three market participants seeking to write new policies. Our study asks whether municipal bond insurance is a good deal for local government debt issuers. We address this question by analyzing samples of insured and uninsured California municipal bonds with underlying ratings of AA/Aa2 or lower. For these samples, we computed all-in true interest costs and then performed multivariate regressions to determine the extent to which insurance status and other factors were associated with variances in these costs. We found that deal term, issue size, interest rates at time of issuance, and whether the deal included capital appreciation bonds explained changes in all-in true interest costs, but the insurance indicator was insignificant. We conclude that municipal bond insurance does not save issuers money.

JEL codes: G12, G22, G24, H81

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The municipal bond insurance business receives little attention from fiscal policy analysts, but it has had major effects on taxpayers, government officials, and bond investors. At the industry's peak, before the Great Recession, industry players received more than $1.5 billion in premium revenue annually from state and local governments.[1] And when a city faces insolvency, municipal bond insurers play an active role in bankruptcy litigation—sometimes impeding progress toward a final settlement.[2]

Although the industry shrank markedly between 2007 and 2012, it has enjoyed a rebound in recent years. Municipal bond issuers, their financial advisors, and investment bankers continue to grapple with the question of whether purchasing municipal bond insurance is worthwhile. In this paper, we address this question with empirical analysis.

As we discuss in the literature review, researchers have studied this issue since the early 1980s. But because of structural changes in the municipal bond insurance market arising from the financial crisis, data collected before 2010 may no longer be relevant. In this study, we use a sample of bonds issued by California local governments since the beginning of 2012.

Municipal bond insurance companies guarantee the payment of interest and principal on municipal debt obligations. If an issuer of an insured bond fails to make a payment on time or in full, the insurer makes the payment to bondholders. According to the *Bond Buyer*, municipal bond insurers guaranteed $25.21 billion of par (or face value) issued in 2015, accounting for 6.36 percent of the total volume of municipal bond issuance that year. This number represents an

1. Marc D. Joffe, "Doubly Bound: The Cost of Credit Ratings" (Research Report, Haas Institute for a Fair and Inclusive Society, Berkeley, CA, 2017).
2. See, for example, Mary Williams Walsh, "Bond Insurer Files Suit against Detroit in Setback for Bankruptcy Plan," *New York Times*, March 17, 2014. See also Steven Church and Jared Goyette, "Stockton Creditors Dispute City's Insolvency at Trial," *Bloomberg News*, March 16, 2013.

increase from 2012 and 2013, when less than 4 percent of municipal bond issuance was insured.[3]

To obtain insurance, the municipal bond issuer pays the insurance provider an up-front fee, which is typically included in the costs of issuance shown on the offering's official statement. Issuers assume that they will save money in lifetime interest costs by purchasing bond insurance, because investors know that the insurer will intervene if the issuer defaults. The purpose of this study is to investigate whether municipal bond issuers actually receive a savings in present-value terms.

"Issuers assume that they will save money in lifetime interest costs by purchasing bond insurance, because investors know that the insurer will intervene if the issuer defaults."

Insurers typically carry ratings from one or more of the major credit rating agencies, and issuers will typically purchase insurance only if the insurer's rating is better than that of the issuer. When insured bonds are marketed, they are assigned the insurer's bond rating. Before the 2008 financial crisis, several insurers carried Aaa or AAA ratings, whereas the vast majority of municipal issuers were rated below that level. Consequently, most issuers could obtain a rating benefit by insuring.

As of September 2016, two insurers—Assured Guaranty Municipal (AGM)[4] and Build America Mutual (BAM)[5]—had AA ratings from Standard and Poor's. The third active municipal bond insurer, National Public Finance Guarantee Corporation (NPFG),[6] had an S&P rating of AA−. Consequently, municipalities with ratings of AA and higher would not normally purchase insurance under current market conditions.[7]

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3. Aaron Weitzman, "Assured, Orrick Lead the Charge in Banner Year for Bond Insurers, Counsel," *Bond Buyer*, January 13, 2016.
4. S&P Global Ratings, *Assured Guaranty Ltd. and Operating Companies* (New York: Standard and Poor's, July 27, 2016).
5. S&P Global Ratings, *Build America Mutual Assurance Co.* (New York: Standard and Poor's, July 27, 2016).
6. S&P Global Ratings, *National Public Finance Guarantee Corp.* (New York: Standard and Poor's, July 27, 2016).
7. S&P ratings are used here because Moody's assigns lower ratings to AGM and NPFG and does not rate BAM. A smaller agency, Kroll Bond Rating Agency (KBRA), assigns AA+ ratings to AGM and NPFG. The ratings by Moody's and KBRA may be seen at their respective websites, http://www.moodys.com and http://www.krollbondratings.com.

We begin this study by examining the history of municipal bond insurance and the arguments insurers make for purchasing coverage. We also present data on municipal bond insurance premiums and describe a federal requirement that says underwriters must attest to cost savings from the purchase of insurance. After providing this institutional background, we analyze the existing academic literature on municipal bond insurance. Although we find much research on the topic, there is little recent literature examining the interest-cost effect of municipal bond insurance since the financial crisis that led to the Great Recession. We then describe the data used in this study and present the research methodology and results from the analysis. We close with a short set of conclusions and recommendations.

BRIEF HISTORY OF MUNICIPAL BOND INSURANCE

Although the concept of municipal bond insurance can be traced back to 1897, the first policy was written in 1971 when the American Municipal Bond Assurance Company (AMBAC) insured bonds issued by the Greater Juneau Alaska Borough. In 1973, the Municipal Bond Insurance Association (MBIA) began writing policies after receiving a rating of AAA from S&P. The bond insurance market quickly took off as New York City defaulted in 1975, S&P upgraded AMBAC to AAA in 1978, the Washington Public Power and Supply System defaulted in 1983, and Moody's began assigning Aaa ratings to bond insurers in 1984. These high-profile defaults, and the involvement of two well-regarded insurance providers, demonstrated that municipal bond insurance offered a meaningful benefit. Meanwhile, changes in regulations and tax laws altered the municipal bond market from one in which banks were major participants to one in which individual investors dominated.[8] Because retail investors were less capable of performing their own analysis, the signaling benefit of an insured Aaa/AAA rating became more important.

The use of municipal bond insurance continued to rise through the 1980s and much of the 1990s. High-profile defaults by Orange County, California, in 1994 and the Allegheny Health, Education and Research Foundation (AHERF) in 1998 caused insurers to raise their premiums, triggering a brief decline in insurance market penetration.[9] But growth resumed early in the 2000–2010 period, with the proportion of new municipal par insured reaching a peak of 57 percent in 2005.[10]

8. Natalie R. Cohen, "Municipal Bond Insurance: Past, Present, and Future," *Municipal Finance Journal* 33/34, no. 4/1 (Winter/Spring 2013): 61–75.
9. Ibid.
10. S&P Global Ratings, *The US Bond Insurance Industry Is on a Path to Reemergence, but of a Different Profile* (New York: Standard and Poor's, July 23, 2012).

Although the AHERF default triggered a payout, the low frequency of municipal bond defaults made the insurance business seem quite safe. Insurers responded by increasing their leverage—using less capital to insure more bonds—and diversifying into the more profitable business of insuring structured finance debt instruments such as collateralized debt obligations (CDOs).[11]

Structured finance proved fatal to most insurers during the financial crisis. Defaults on CDOs backed by subprime mortgages resulted in numerous claims on the insurance companies' thin layers of capital, which (at least in the case of MBIA) was less than 1 percent of insured par.[12] As a result, all insurers either became insolvent or suffered multiple notch downgrades. At the beginning of 2008, Moody's rated seven bond insurers Aaa; none carried this rating by the end of 2010.[13]

Since 2012, only three insurers have been active, and none were rated higher than AA/Aa by the major rating agencies. The dominant insurer was Assured Guaranty Municipal. MBIA reorganized itself so that its municipal business, National Public Finance Guarantee, was effectively walled off from the toxic structured finance business. Finally, a new player, Build America Mutual, which presents itself as a mutual insurer (i.e., one owned by its policyholders rather than investors), entered the market and wrote a significant amount of business.[14]

Aside from the entrance of BAM, other attempts to reinvigorate the municipal bond insurance market have been less successful. A notable failure was that of BondFactor LLC. This company, formed by a group of former Goldman Sachs bankers, developed a patented computer-implemented system for structuring risk, which the company hoped to apply to the municipal bond market.[15] The proposed system was to rely on ongoing simulations of the insured portfolio to determine the necessary level of claims-paying resources required, and to obtain these resources through the issuance of contingent capital securities. These securities would pay holders a small spread over the risk-free interest rate unless or until some of the

11. Joseph M. Pimbley, "Bond Insurers," *Journal of Applied Finance* 22, no. 1 (2012): 36–43.
12. Gotham Partners Management, *Is MBIA Triple A?* (New York: Gotham Partners Management, December 9, 2002). This piece made the argument for downgrading a municipal bond insurer several years before the rating agencies took action.
13. Marc D. Joffe, "Public Disservice: The Negative Impact of Credit Ratings on U.S. Municipal Bond Issuers," *Journal of Law in Society* 17, no. 1 (2015): 121–48.
14. BAM is unlikely to pay dividends to municipal policyholders and cedes much of its premium income to a for-profit reinsurer based in Bermuda. Hence, BAM's marketing as a mutual insurer, while true on its face, may not represent a meaningful distinction. This situation is discussed further in Marc D. Joffe, "Costs of the Municipal Bond Rating System" (Berkeley, CA: Haas Institute for a Fair and Inclusive Society, University of California at Berkeley, forthcoming).
15. Oliver Renick, "President Out as Bond Insurance Startup BondFactor Struggles for Capital," *Bond Buyer*, December 16, 2013.

capital was required to cover defaults.[16] Although its idea was innovative, BondFactor was unable to raise sufficient startup capital, preventing it from obtaining an investment-grade bond rating.[17]

STATED BENEFITS AND COSTS OF BOND INSURANCE IN TODAY'S MARKET

Bond insurers market their product to municipal issuers as a way to reduce financing costs. For example, Assured Guaranty Municipal's website states,

> Bond insurance is designed to save issuers money. For appropriate credits, municipal bonds issued with insurance trade at lower yields than they would if not insured. The bond insurance premium absorbs some of the spread; the issuer keeps the rest.[18]

The site also suggests that smaller, lesser-known issuers may not be able to access the municipal bond market in the absence of an insurance policy.[19] Testing that assertion is beyond the scope of this study but would be an interesting topic for future research.

To assess the validity of insurers' cost-saving claims, it is useful—although not essential, as our statistical methodology will show—to know the cost of municipal bond insurance, that is, the premium. Municipal bond insurance premiums are payable at the time of issuance. They are included with legal fees, rating agency fees, and other charges in the "costs of issuance" reported in the bond's official statement. In most cases, official statements do not show the components of total issuance costs, so the bond insurance premiums are not readily available.

Bond insurance premium information can be obtained through Public Records Act or Freedom of Information Act requests sent to the issuer,[20] but this is a time-consuming process. In late 2015, the California Debt and Investment Advisory Commission (CDIAC) began publishing a comprehensive set of California bond issuance data that includes bond insurance premiums.[21]

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16. Mark Adelson and George H. Butcher III, "Bond Insurance: Introducing a Better Model," *Municipal Finance Journal* 36, no. 2 (Summer 2015): 25–44.
17. Ibid.
18. Assured Guaranty Ltd., "Benefits for Municipal Bond Issuers," accessed March 22, 2017.
19. Ibid.
20. This technique was used in Marc Joffe, "Doubly Bound."
21. California State Treasurer, "DebtWatch Raw Data Export," accessed March 22, 2017, https://data.debtwatch.treasurer.ca.gov/browse?category=Raw+Data&utf8=%E2%9C%93.

The CDIAC dataset contains 954 insured bond issues with sale dates on or after January 1, 2012. The median insurance premium is 0.489 percent of total par. Values range from 0.001 percent to 6.042 percent. Many of the extreme values are likely the result of data errors: in some cases, issuers submitting reports for an offering consisting of multiple series may have assigned premiums to the wrong series. Some of the lower values may also be attributable to situations in which only a portion of the issue is insured.

Simple regression analysis confirms the intuition that premium as a percentage of par is positively associated with the tenor of the issue (the length of time between the sale date and the final maturity date) and negatively associated with the bonds' underlying rating (i.e., issuers with lower underlying ratings must pay higher premiums). In other words, it is more expensive to keep insurance in force for longer periods and more expensive to insure riskier bonds.

When evaluating the costs and benefits of municipal bond insurance, it is useful to think about the premium in annualized terms, making it comparable to the annual coupon rate for the issue. As noted earlier, the median premium in the CDIAC dataset is 0.489 percent of total par. The median term of insured issues is 20.2 years. Assuming a 4 percent discount rate, the annualized equivalent of a 0.489 percent payment over 20.2 years is 3.6 basis points.

The Internal Revenue Code requires that municipal bond insurance (and other guarantees) result in a net savings to the issuer for the issue to qualify for a tax exemption. The relevant section of the regulation, 1.148-4(f), reads as follows:

> As of the date the guarantee is obtained, the issuer must reasonably expect that the present value of the fees for the guarantee will be less than the present value of the expected interest savings on the issue as a result of the guarantee. For this purpose, present value is computed using the yield on the issue, determined with regard to guarantee payments, as the discount rate.[22]

Normally, it is the underwriter's responsibility to represent that the guarantee provides the required savings. The underwriter provides a certificate that is included among the documents the issuer submits to the IRS. Figure 1 shows the form of an underwriter certificate used in Florida.[23]

22. 26 C.F.R. § 1.148-4(f) (2016).
23. City of Riviera Beach, Florida, *Official Notice of Sale: Stormwater Management Utility Revenue Bonds Series 2016*, March 18, 2016.

FIGURE 1. UNDERWRITERS' CERTIFICATE REGARDING BOND INSURANCE

EXHIBIT A

UNDERWRITERS' CERTIFICATE REGARDING BOND INSURANCE

The undersigned duly authorized officer of _____, senior managing underwriter, as representative of the syndicate (collectively, the "Underwriters") listed in the response submitted in the successful bid for the $_____ City of Riviera Beach, Florida Stormwater Management Utility Revenue Bonds, Series 2016 (the "Series 2016 Bonds"), HEREBY CERTIFIES that:

1. The Series 2016 Bonds will be secured by a municipal bond insurance policy (the "Policy") provided by _____ ("_____"), for which _____ will be paid a premium by the Underwriters of $_____ on the date of issuance of the Series 2016 Bonds.

2. In connection with the sale of the Series 2016 Bonds, we compared the debt service on the Series 2016 Bonds secured by the Policy with the debt service on the Series 2016 Bonds that would have existed if the Series 2016 Bonds had not been insured by _____, as estimated by us based on similar issues marketed at the same time and on our marketing experience in connection with the marketing of similar municipal bonds.

3. We then calculated the present value of the interest reasonably expected to be saved as a result of the Policy on the issuance of the Series 2016 Bonds. In determining the present value of the interest savings, we used the yield on the Series 2016 Bonds (determined with regard to the premium paid to _____), as the discount rate. As used in this Certificate, the term "yield" means the discount rate that, as of the date of issuance of the Series 2016 Bonds, produces a present value of all the unconditionally payable payments of principal and interest equal to the initial offering price of the Series 2016 Bonds to the public, as reflected on the inside cover page of the Official Statement for the Series 2016 Bonds, treating the premium paid to _____ for the Policy as additional interest paid on the Series 2016 Bonds on the date of issuance of the Series 2016 Bonds.

4. As shown on the schedules attached to this Certificate as Exhibit "A," the present value of the premium payable to _____ is less than the present value of the interest reasonably expected to be saved as a result of the issuance of the Policy, using the yield on the Series 2016 Bonds as the discount rate in computing such present value.

5. Based on our experience with similar transactions, the premium paid to _____ does not exceed a reasonable arm's-length charge for the transfer of credit risk to _____ resulting from the issuance by _____ of the Policy securing the Series 2016 Bonds.

IN WITNESS WHEREOF, the undersigned has caused this Certificate to be executed in its name, on its behalf and on behalf of the Underwriters, by its duly authorized officer this ____ day of _____, 2016.

_____
[Name of Senior Managing Underwriter]

By: _____
Name and Title:

A-1

LITERATURE REVIEW

The academic literature on municipal bond insurance dates to the late 1970s. Most of the early work was descriptive or analyzed reoffering yields of individual bonds. One of the first published academic works to examine the impact of bond insurance on financing costs was that of Charles Cole and Dennis Officer.[24] They calculated the true interest cost of a sample of 89 municipal serial bond issues sold without insurance between 1976 and 1978 in Florida, Pennsylvania, New Jersey, New York, Connecticut, and California with a maximum par value of $25 million and a rating of Aa or below (Cole and Officer used a "holdout" sample of 29 bonds for assessing the goodness of fit for their final model; therefore, the "test" sample was 60 bonds). They collected several potential control variables, including the Moody's credit rating, various issuer characteristics, and market conditions. A stepwise linear regression was used to "select" the model with the best fit; the resulting model included only the maturity, market interest rates, and the issue's credit rating. This model was then used to predict the true interest cost for a sample of 93 issues insured by MBIA. Using the Wilcoxon signed-rank test, Cole and Officer found that the interest costs on the insured bond issues were significantly lower than the interest costs predicted by their model. They concluded that MBIA insurance played a significant role in reducing interest costs.

During the 1980s and early 1990s, there was a proliferation of studies examining the effects of bond insurance. A 2002 review paper on the topic of municipal bond insurance identified no fewer than 10 studies during this period that examine secondary market yield spreads, reoffering yields, and new issue interest costs.[25] Some of the theoretical justification for the use of bond insurance was developed during this time by Anjan Thakor.[26] In his model, there is an informational asymmetry between buyers and sellers of debt as well as differences in risk aversion. Subject to a few relatively weak assumptions, the provision of debt insurance can establish a "separating" equilibrium where weaker borrowers are not able to obtain debt insurance but stronger issuers can do so. Therefore, the

24. Charles W. Cole and Dennis T. Officer, "The Interest Cost Effect of Private Municipal Bond Insurance," *Journal of Risk and Insurance* 48, no. 3 (September 1981): 435–49.
25. Jonathan B. Justice and Stewart Simon, "Municipal Bond Insurance: Trends and Prospects," *Public Budgeting and Finance* 22, no. 4 (Winter 2002): 114–37.
26. Anjan V. Thakor, "An Exploration of Competitive Signalling Equilibria with 'Third Party' Information Production: The Case of Debt Insurance," *Journal of Finance* 37, no. 3 (June 1982): 717–39.

provision of bond insurance provides a potential signaling effect to bond purchasers. The signal points to the underlying credit quality of the issue.

Three of the foundational empirical papers published during this period were coauthored by L. Paul Hsueh, David Kidwell, or both. The first, published in 1987, built on the theoretical framework set forth by Thakor. Kidwell, Eric Sorensen, and John Wachowicz Jr.[27] build a model relating the net interest cost of bond issues to a set of variables capturing issue characteristics such as Moody's credit rating and maturity, market characteristics including market interest rates and interest rate volatility, and regional factors including state dummy variables and relative bond supply. Using a linear regression model, they find an average insurance benefit of 22 basis points for the entire sample, with greater benefits accruing to lower-rated issues. Other influential research using similar variables and finding effects of a similar magnitude was contributed by Hsueh and Y. Angela Liu,[28] Hsueh and Kidwell,[29] Robert Bland,[30] and Hsueh and P. R. Chandy.[31] In his research, Bland did find that state guarantees could provide greater reduction in interest costs than could private bond insurance. However, private bond insurance did provide some interest-cost benefits.

Municipal bond insurance research was largely dormant in the 1990s. In the early 2000–2010 period, Dwight V. Denison[32] published two papers on the topic. In the first, he investigates the use of bond insurance and the yield spread between Aaa-rated and Baa-rated municipal bonds using quarterly time-series data. He finds that as percentages of insured issues increase, the credit spread between Aaa-rated and Baa-rated municipal bonds tightens by about six basis points. In the second paper, Denison[33] analyzes the determinants of municipal bond insurance provision. Using logistic regression on a sample of MBIA-insured bond issues from 1989 to 1992 and a matched sample of uninsured bonds,

27. David S. Kidwell, Eric H. Sorensen, and John M. Wachowicz Jr., "Estimating the Signaling Benefits of Debt Insurance: The Case of Municipal Bonds," *Journal of Financial & Quantitative Analysis* 22, no. 3 (September 1987): 299–313.
28. L. Paul Hsueh and Y. Angela Liu, "The Effectiveness of Debt Insurance as a Valid Signal of Bond Quality," *Journal of Risk and Insurance* 57, no. 4 (December 1990): 691–700.
29. L. Paul Hsueh and David S. Kidwell, "The Impact of a State Bond Guarantee on State Credit Markets and Individual Municipalities," *National Tax Journal* 41, no. 2 (June 1988): 235–45.
30. Robert L. Bland, "The Interest Cost Savings from Municipal Bond Insurance: The Implications for Privatization," *Journal of Policy Analysis and Management* 6, no. 2 (Winter 1987): 207–19.
31. L. Paul Hsueh and P. R. Chandy, "An Examination of the Yield Spread between Insured and Uninsured Debt," *Journal of Financial Research* 12, no. 3 (Fall 1989): 235–44.
32. Dwight V. Denison, "Bond Insurance Utilization and Yield Spreads in the Municipal Bond Market," *Public Finance Review* 29, no. 5 (September 2001): 394–411.
33. Dwight V. Denison, "An Empirical Examination of the Determinants of Insured Municipal Bond Issues," *Public Budgeting & Finance* 23, no. 1 (Spring 2003): 96–114.

he finds that underlying credit risk was the most substantial determinant of the decision to purchase insurance. In a related paper, Kenneth A. Kriz[34] uses logistic regression to analyze state bond issuers' decisions to get insurance using similar variables. He finds no relationship between the decision to get insurance and the credit rating of the issue. This difference in results could be because Kriz used a sample of state bonds, whereas Denison used local bonds. State bond underlying ratings are widely available, so the decision to insure is much more likely to be driven by variables that are less well known by bond purchasers. Another paper using a much larger sample than either Kriz's or Denison's found a quadratic relationship between credit rating and bond insurance. [35] One other paper during this period was contributed by Jun Peng.[36] He uses a similar methodology to Hsueh and Chandy and finds that bond insurance provides information that is valuable to the market.

After this round of research, the academic study of bond insurance again entered a quiet period. Part of this less active period was likely a result of the upheaval in the insured municipal bond market caused by the financial crisis, as documented in this paper's introduction. This point was brought home in two papers. The first, by Robert S. Kravchuk and Christine R. Martell,[37] analyzes the effects of the financial crisis on the market for variable-rate debt. Variable-rate debt had grown tremendously in popularity during the run-up to the crisis. Kravchuk and Martell find that downgrades for insurers of variable-rate debt have significant effects on interest costs, but downgrades of private liquidity providers produce an even bigger effect on reoffering yields. In the second paper, Todd L. Ely[38] analyzes the cost of obtaining bond insurance. He finds that bond insurance premiums increased dramatically in the postcrisis period, especially for credits with lower underlying credit rating. He also finds evidence that the practice of "creaming," where bond insurance is available only for higher-quality credits, increased in the postcrisis period.

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34. Kenneth A. Kriz, "Do Municipal Bond Underwriting Choices Have Implications for Other Financial Certification Decisions?," *Municipal Finance Journal* 21, no. 3 (Fall 2000): 1–24.
35. Vikram Nanda and Rajdeep Singh, "Bond Insurance: What Is Special about Munis?," *Journal of Finance* 59, no. 5 (October 2004): 2253–79.
36. Jun Peng, "Do Investors Look beyond Insured Triple-A Rating? An Analysis of Standard & Poor's Underlying Ratings," *Public Budgeting & Finance* 22, no. 3 (Fall 2002): 115–31.
37. Robert S. Kravchuk and Christine R. Martell, "Bond Insurance and Liquidity Provision: Impacts in the Municipal Variable Rate Debt Market, 2008–09," *Public Finance Review* 38, no. 3 (May 2010): 378–401.
38. Todd L. Ely, "No Guaranties: The Decline of Municipal Bond Insurance," *Public Budgeting & Finance* 32, no. 1 (Spring 2012): 105–27.

To date, we have found only one study that has directly addressed the issue of the interest-cost effect of bond insurance since the early days of the financial crisis. Van Son Lai and Xueying Zhang[39] analyze reoffering yields of 42,540 bonds from 10 states from 2001 to 2010. Their sample included fixed-rate, investment-grade, tax-exempt general obligation bonds with par amounts of more than $5 million, and callable bonds were excluded. The primary methodology used in their study was linear regression of reoffering yields on issue characteristics and market characteristics, with a dummy variable for the provision of bond insurance; this dummy variable interacted with a financial crisis indicator variable. Secondarily, they analyze time-series yield measures over the period of the financial crisis, relating them to various predictor variables. Lai and Zhang find that, although bond insurance provided a significant yield reduction in the pre–financial crisis period, the yield effect after 2008 is not statistically significant. Furthermore, they find that the time-varying yield differences are mainly driven by the market interest rate and relative bond supply.

Between the 1970s and 2010, one or more municipal bond insurers received an AAA rating from at least one rating agency. Consequently, previous literature on the cost-effectiveness of private municipal bond insurance relied on data from market conditions that no longer exist. New empirical research is needed to assess the effect of municipal bond insurance in an environment under which these firms carry ratings no higher than AA from the major rating agencies. Our research begins to fill this gap in the literature. We take as an initial hypothesis the "no effect" null hypothesis: namely, that bond insurance exhibits no statistically significant effect in reducing interest costs for issuers, once other variables that determine borrowing costs are controlled.

DATA

To test the hypothesis developed in the last section of the paper, we performed a linear regression analysis of the all-in true interest cost (TIC) for a sample of municipal bond issues from the state of California issued during the period of January 1, 2012, to July 15, 2016. To reduce the study population to a manageable size and reduce effects from bonds with different sources of repayment, we restricted the sampling frame to new-money,[40] long-term (defined as issues

39. Van Son Lai and Xueying Zhang, "On the Value of Municipal Bond Insurance: An Empirical Analysis," *Financial Markets, Institutions & Instruments* 22, no. 4 (November 2013): 209–28.
40. A new-money bond is one in which previous borrowings are not being rolled over. It is conceptually equivalent to a mortgage on a new home sale, as opposed to a refinancing.

having a final maturity of 20 years or greater), general obligation bond issues. Initially, we created a sample of 231 bond issues for analysis; however, some issues had missing information, and our final sample size in the estimated models is 217 issues.

Table 1 shows the variables that we collected for the analysis, along with the source of the information. The all-in TIC was calculated from information contained in the cash flow estimates (for principal and interest payments) and the sources and uses of funds (issuance cost information) contained in the official statements for each issue. Several of the independent variables are standard ones used in the literature and need no further explanation. However, we included some additional variables based on the characteristics of the sample. The sample contained several bond issues with a substantial portion of capital appreciation bonds (variable "CAB"), which are bonds that do not pay regular interest payments but rather accrete interest until maturity. These bonds are sold at a deep discount, and concerns have been raised about their influence on borrowing costs for governments.[41] There are three types of issuers in the sample dataset—K–12 school districts, community college districts, and municipal governments—that are represented by dummy variables. In terms of market and economic conditions, aside from the typical variables for the level of interest rates, interest rate volatility, and visible supply, we follow Lai and Zhang[42] by including variables for the condition of the equity market (Wilshire_5000) and macroeconomic conditions (unemployment [unem]). Furthermore, based on the recommendations of an anonymous reviewer, we include variables capturing the financial condition of issuers (gfrevada and expada, as explained in table 1).[43] These variables

"Previous literature on the cost-effectiveness of private municipal bond insurance relied on data from market conditions that no longer exist."

41. James P. Estes and Astrid Sheil, "Future Shock: The Long-Term Consequences to States and Municipalities of Capital Appreciation Bonds," *Academy of Business Research Journal* 1 (2015): 119–34.
42. Lai and Zhang, "On the Value of Municipal Bond Insurance."
43. We acknowledge that no other studies in this literature have included these types of variables in their analysis.

TABLE 1. VARIABLES INCLUDED IN THE ANALYSIS

Variable	Definition	Data source
	Dependent variable–interest cost	
All_In_TIC	All-in true interest cost (including issuance cost)	calculated from bond official statements
	Issue characteristics	
par	par value of bond issue	CDIAC database; official statements
ytm360	years to final maturity, calculated on 30/360-day basis	CDIAC database; official statements
CAB	capital appreciation bonds as percentage of issue par value	CDIAC internal data
Issuer=K–12 School District	K–12 school district issuer	CDIAC database; official statements
Issuer=Community College	community college issuer	CDIAC database; official statements
Issuer=Municipality	municipal issuer	CDIAC database; official statements
callable	bond has optional redemption provision (1=yes, 0=no)	CDIAC database; official statements
insured	variable of interest: insured bond issue (1=yes, 0=no)	CDIAC database; official statements
compsale	competitive bid bond sale (1=competitive, 0=negotiated)	CDIAC database; official statements
	Market and economic conditions	
Visible_Supply	municipal bond visible supply (thousands)	Bond Buyer Market Statistics Archive
Bond_Buyer_20	bond buyer 20-bond index value during week of issue	Bond Buyer Market Statistics Archive
Std_Dev_BBI20	8-week standard deviation of bond buyer 20-bond index	calculated from Bond Buyer Market Statistics Archive
Wilshire_5000	Wilshire 5000 total market index	Federal Reserve Bank of St. Louis Economic Database
unem	unemployment rate for the county where the issuer is located during the month of issuance	US Bureau of Labor Statistics
Pci	per capita income for the county where the issuer is located during the year of issuance	US Bureau of Economic Analysis
	Issuer creditworthiness–underlying ratings	
bestrate	best credit rating among Moody's, S&P, Fitch	CDIAC database; official statements
numrate	number of credit ratings	CDIAC database; official statements
splitspmood	split rating between Moody's and S&P	CDIAC database; official statements
	Issuer creditworthiness–financial variables (school districts only)	
gfrevada	general fund revenues per student	California Department of Education Annual Financial Database†
expada	total expenditures per student	California Department of Education Annual Financial Database

† The California Department of Education Annual Financial Database is available at http://www.cde.ca.gov/ds/fd/fd/.

TABLE 2. CODING OF UNDERLYING CREDIT RATING VARIABLE (BESTRATE)

Value	Rating
0	Aa2/AA
1	Aa3/AA–
2	A1/A+
3	A2/A
4	A3/A–
5	Baa1/BBB+

are included only for school districts because the mixing of financial variables for different types of issuers produces denominator problems—the denominator for school districts is the number of students (as measured by average daily attendance in the California Department of Education database), while municipal government financial variables are typically per capita.

We include the underlying credit rating using an ordinal variable representing the highest credit rating among the three major credit rating agencies. Our credit rating variable, *bestrate*, takes the values shown in table 2.[44] There were no bonds with underlying ratings less than Baa1/BBB+ in the sample. To this variable, we add two that capture the number of credit ratings and a difference in the assessment of creditworthiness by Moody's and Standard and Poor's.

Descriptive statistics for the continuous variables in the sample are shown in table 3. The average all-in TIC is 4.3 percent, with a range of 2.6 percent to 6.7 percent. We found no obvious outliers on the TIC variable in the sample. Par values averaged $27.8 million, although there were a sizable number of large issues, with 5 percent of the sample having a par value of more than $100 million. For that reason, we use the natural logarithm of par value in our estimation. Yield to final maturity averages just under 28 years, with a minimum of 20 years and a maximum of 40. The ratio of CAB par value to total par value at issuance is 14 percent, although large CAB ratios occur in relatively few issues. More than 65 percent of the sample issues do not contain CABs. Unemployment rates show a wide range of values even though our sample did not coincide with an entire business cycle.

Table 4 shows a cross-tabulation of bond insurance and best underlying credit rating for the 217 issues for which complete information is available. There

44. We also include an estimation using a series of dichotomous indicator variables for each category, as described in the Methodology and Results section below.

TABLE 3. DESCRIPTIVE STATISTICS FOR CONTINUOUS VARIABLES, N = 231

Variable	Mean	Standard deviation	Minimum	Maximum
All_In_TIC	0.043	0.008	0.026	0.067
par	27,800,000	35,600,000	828,471	250,000,000
ytm360	27.698	3.773	19.944	39.558
cab	0.142	0.284	0.000	1.000
Visible_Supply	9,119,120	2,884,781	2,690,915	17,500,000
Bond_Buyer_20	0.039	0.004	0.029	0.050
Std_Dev_BBI20	0.00096	0.00054	0.00026	0.00359
Wilshire_5000	79.602	13.093	52.220	96.790
unem	9.80	3.78	3.40	28.90
pci	47,926.25	15,936.87	28,570.00	109,076.00
gfrevada	7,540.97	2,056.06	5,794.49	26,792.58
expada	8,936.12	1,683.58	6,355.38	19,787.06

TABLE 4. CROSS-TABULATION OF HIGHEST UNDERLYING CREDIT RATING (BESTRATE) AND BOND INSURANCE (INSURED), N = 217

	bestrate				
	0 Aa2/AA	1 Aa3/AA–	2 A1/A+	3 A2/A	5 Baa1/BBB+
Not insured (value 0 for "insured" variable)	51	33	3	1	0
Insured (value 1 for "insured" variable)	13	8	82	25	1

are no bond issues with a best credit rating of 4 = A3/A– left in the sample after observations with missing values are removed. As one might reasonably expect, insured issues have lower underlying credit ratings: the median credit rating for insured issues is A1/A+ while the uninsured median credit rating is Aa2/AA. Somewhat surprisingly, 13 insured issues have highest underlying credit ratings of Aa2/AA.

METHODOLOGY AND RESULTS

As a first approximation of an estimate of the effect of bond insurance, we can compare the average TIC for issues without insurance and the average TIC for

TABLE 5. ALL-IN TRUE INTEREST COST FOR INSURED AND UNINSURED ISSUES, N = 231

	Mean all-in TIC	Standard deviation
Not insured (value 0 for "insured" variable)	0.0413	0.0081
Insured (value 1 for "insured" variable)	0.0447	0.0074

those that are insured. Table 5 shows these results. The mean all-in TIC is approximately 33 basis points higher for insured issues than for uninsured issues. Taking into account the slightly lower standard deviation of insured issues' TIC, the difference in means is statistically significant ($p < 0.001$). However, before concluding much from this analysis, we note that issues with insurance are systematically different from uninsured issues, as demonstrated in table 4. Therefore, we must control for differences between issues through a linear regression model.

Our regression estimation approach is consistent with earlier studies in modeling the TIC of the bond issues as a function of variables capturing issue characteristics (***IC***), market and economic conditions (***MC, EC***), and issuer creditworthiness (***CR***)—captured by the underlying credit rating of the issue. In vector notation, our model is

$$\text{TIC} = \alpha + \boldsymbol{\beta_1 IC} + \boldsymbol{\beta_2 MC} + \boldsymbol{\beta_3 EC} + \boldsymbol{\beta_4 CR} + \varepsilon. \quad (1)$$

We estimate our model using standard least-squares linear regression. The insurance variable is included as one of the issue characteristics variables. Our estimation will result in a coefficient for bond insurance that represents the independent effect of bond insurance on interest costs at issuance, controlling for other confounding variables. Using the language of Thakor[45] and others, this coefficient represents the signaling effect of bond insurance.

Table 6 presents the results of our estimation of equation (1). The model was estimated using robust standard errors because initial regression analyses indicated the presence of heteroscedasticity. The signs of the control variables are as expected. The goodness of fit measures are in the same range as those found in previous studies.

We ran three versions of the model. The "base" model in column (1) includes all variables in table 1 with the exception of the financial variables, which are available only for school district issuers. In response to the concerns

45. Thakor, "Exploration of Competitive Signalling Equilibria with 'Third Party' Information Production."

TABLE 6. RESULTS FROM LEAST-SQUARES ESTIMATION OF EQUATION (1)

Independent variable/ model	(1)	(2)	(3)
Constant	0.0164**	0.0179**	0.0162**
	(0.0072)	(0.0077)	(0.0080)
insured	**0.0001**	**−0.0003**	**−0.0002**
	(0.0007)	**(0.0009)**	**(0.0009)**
lnpar	−0.0013***	−0.0014***	−0.0014***
	(0.0003)	(0.0003)	(0.0003)
callable	0.0001	−0.0001	0.0003
	(0.0009)	(0.0009)	(0.0011)
ytm360	0.0004***	0.0005***	0.0005***
	(0.0001)	(0.0001)	(0.0001)
issuertype			
Issuer = Community College	0.0007	0.0005	
	(0.0012)	(0.0013)	
Issuer = Municipal Government	−0.0015	−0.0018	
	(0.0012)	(0.0015)	
cab	0.0116***	0.0116***	0.0110***
	(0.0013)	(0.0013)	(0.0014)
bestrate	0.0012***		
	(0.0004)		
Highest Rating = Aa3/AA−		0.0003	−0.0001
		(0.0009)	(0.0009)
Highest Rating = A1/A+		0.0025**	0.0015
		(0.0011)	(0.0012)
Highest Rating = A2/A		0.0035***	0.0016
		(0.0013)	(0.0015)
Highest Rating = Baa3/ BBB+		0.0076***	0.0079***
		(0.0016)	(0.0017)
numrate	0.0008	0.0007	0.0004
	(0.0009)	(0.0010)	(0.0011)
splitspmood	0.0011	0.0011	0.0008
	(0.0009)	(0.0009)	(0.0011)
compsale	−0.0011	−0.0009	−0.0006
	(0.0012)	(0.0012)	(0.0014)
Visible_Supply	0.0000	0.0000	2.26e−10**
	(0.0000)	(0.0000)	(0.0000)
Std__Dev__BBI	−0.0026	−0.0459	−0.3700
	(0.5840)	(0.6200)	(0.6330)

(*continued*)

TABLE 6. RESULTS FROM LEAST-SQUARES ESTIMATION OF EQUATION (1) (*CONTINUED*)

Independent variable/ model	(1)	(2)	(3)
Bond_Buyer_20_Index	0.905***	0.910***	0.909***
	(0.0928)	(0.0911)	(0.0905)
Wilshire_5000_TMI	−7.75e−05***	−7.67e−05***	−6.93e−05**
	(0.0000)	(0.0000)	(0.0000)
pci	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)
unem	0.0001	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)
gfrevada			0.0000
			(0.0000)
expada			0.0000
			(0.0000)
Observations	217	217	198
R-squared	0.744	0.745	0.729

*** indicates $p < .001$; ** indicates $p < .01$.

of anonymous reviewers about the specification of a control variable, in model (2) we estimate the model with indicator variables for credit ratings. In model (3), we include financial indicator variables for school districts. There are 198 school districts in the sample, reflected in the lower number of observations.

The coefficient for the bond insurance variable, shown in bold in table 6, is not statistically significant in any of our models. This lack of significance suggests that we cannot conclude with scientific levels of certainty that there is any independent signaling effect of bond insurance. The coefficient on the underlying credit rating variable is positive and statistically significant, indicating that the effect of having the credit rating reduced by one notch is an approximately 12-basis-point increase in borrowing costs. This effect is significant: for a bond at the mean par value of $27.8 million, this increase translates into $33,360 in increased borrowing costs per year for each notch that the rating is below Aa2/AA (the highest rating in the sample).

CONCLUSIONS

We studied the effect of bond insurance on interest costs of municipal borrowers. This question remains important, despite the wealth of existing evidence on the topic, because the bond insurance market has undergone extreme structural

change during the period after the financial crisis of 2008–2009 and the associated Great Recession. In contrast to research covering precrisis periods, we have looked at bonds issued when no insurer carried a rating of Aaa/AAA. Two of the remaining bond insurers are currently rated AA by Standard and Poor's, and all carry either no rating or a lower rating from Moody's.

We also use a comprehensive measure of interest costs that takes into account financial costs of issuance. Using a dataset of California bond issues, we find that borrowers realize no statistically significant interest-cost reduction from the use of municipal bond insurance. This finding confirms the results of Hsueh and Liu[46] and the results in the latter period of the Lai and Zhang[47] sample. We further find that, when we control for insurance provision and all other variables, underlying credit ratings have a statistically significant effect on borrowing costs.

These results suggest that, unless it is needed to obtain market access, bond insurance is not a good deal for local governments in a financial sense.[48] This conclusion is especially true if one considers the nonfinancial costs of obtaining bond insurance. While our interest-cost measure takes into account all financial costs of issuance, the economic costs of lost time for staff members in preparing bond insurance applications and providing information to bond insurers is likely to be non-negligible. Furthermore, continuing disclosure requirements may increase for insured issues, creating other opportunity costs. However, if one or more insurers are upgraded, a stronger interest-cost effect might emerge.

Our findings may explain the historically low share of new municipal bonds being insured and the failure of new municipal insurance business models. In a spread-

"Unless it is needed to obtain market access, bond insurance is not a good deal for local governments in a financial sense."

46. Hsueh and Liu, "Effectiveness of Debt Insurance as a Valid Signal of Bond Quality."
47. Lai and Zhang, "On the Value of Municipal Bond Insurance."
48. However, as an anonymous reviewer pointed out, there may be other reasons for using insurance, such as assuring that issues can be sold.

compressed environment, and in the absence of the ability of highly leveraged insurers to achieve AAA ratings, there appears to be insufficient interest rate savings available to justify the costs of insurance.

Future research could extend our analysis to other categories of municipal bonds, such as refundings, revenue issues, and bonds issued in other states. Our initial investigation of non-California bonds revealed numerous instances in which credit enhancements other than private municipal bond insurance were provided. Local government bonds that have state guarantees should be distinguished both from those with no third-party guarantee and from those insured by AGM, BAM, or NPFG.

Furthermore, because our sample mainly consists of issues rated A2/A or higher, we cannot say much about the effects of bond insurance for lower-rated issues. This is another topic for further research. However, given that distribution of insured issues in our sample skews toward A1/A+ rated issues, there is little indication that lower-rated issues are more strongly represented in the population of insured bond issues.

One additional limitation of our results merits discussion. We do not explicitly test or correct for selection bias involving the choice to use bond insurance.[49] In noting this point, we must say that no other paper examining the efficacy of bond insurance has measured or controlled for potential selection bias. Therefore, selection bias may be grounds for future research.

The policy implication of our study is that issuers should be very cautious about using municipal bond insurance, at least in the current market environment. If financial advisors or underwriters recommend the purchase of bond insurance, government finance officers should ask these service providers to explain why they believe the use of insurance would be beneficial for the issue at hand.

49. Thanks to an anonymous reviewer for pointing out this limitation.

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