Credit Quality Signaling through Government Ownership: The Case of Credit Rating Decisions for Hospital Municipal Bonds

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ABSTRACT

In an asymmetrically informed conduit municipal bond market, credit rating agencies help alleviate the lemons problems; however, if the ownership of the borrower can serve as a certifier signaling the quality of the corporate or non-profit borrowers, bond issuers may choose not to obtain bond ratings. For example, investors may view the ownership by a statutory public body (e.g., federal, state or local agency) as a validating signal about repayment capability due to the perception of a government guarantee. Using a panel data of U.S. hospitals' municipal bond issuance from 1996 to 2010 we find empirical support that bond issuers may use their government ownership as a quality certification to strategically avoid the cost of bond rating. We also find evidence that new municipal bond issues with credit enhancement and cheaper underwriting fees and from conduit issuers with larger asset size, lower leverage, better liquidity and newer equipment are more likely to obtain ratings. However, we do not find evidence for the use of callable feature, sinking fund and tax-exempt qualification as a determinant of rating choice.

Keywords: Municipal bond rating, credit rating agency, certification, government ownership
JEL Codes: G3, H7, D8

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An unrated [municipal] bond isn't necessarily more risky… The issuer of the bond pays for the rating. But some bonds aren't rated because the value of the deal doesn't warrant the cost of a rating... Also, some smaller issuers may be unwilling to wait for a rating.

--- Wall Street Journal, October 12, 2012

I. INTRODUCTION

Municipal bonds, or "munis" for short, are securities issued by states, cities, counties and other governmental entities to raise money to build roads, schools and other public projects. In the U.S., more than half of all newly issued municipal bonds in the past five years are not rated (see Table I). Bond issuers may choose not to obtain credit ratings due to high cost and time constraint for obtaining ratings, or new issues are of low credit quality because rating agencies discourage below-investment-grade borrowers from obtaining ratings; however, market practitioners have observed many investment-grade quality bond issues being offered without a credit rating (see the quote at the beginning of this article).[1]

[Insert Table I Here]

Within in this general municipal bond market, there is a special kind of muni bond known as "conduit bond" issued by a governmental entity to finance a project of a third party, either a for-profit corporation or a non-profit organization. According to news releases from Thomson Reuters and Income Securities Advisors,[2] the conduit bond market in the U.S. have grown much faster than the general municipal bond market over the last five years: over $84 billion of conduit bonds were issued in 2010. Although conduit bonds account for about 20% of

[1] Allen, Sanders, and Dudney (2009) find that the municipal bond issuers that forgo credit ratings do not necessarily have a higher cost of borrowing.

[2] Thomson Reuters is a multinational media and information firm based in New York, and Income Securities Advisors is a Florida-based independent investment advisory and research firm specializing in income securities including bonds, convertibles, preferreds and hybrids.

all municipal bonds, and they account for roughly 70% of all defaults in the municipal bond market in recent years (Popper 2011).

Given the fact that regional and local banks often purchase nonrated tax-exempt municipal conduit bonds for their investment portfolios, and these commercial banks are required by law to purchase only investment-grade securities for their own account, it is indeed paradoxical why these issuers chose not to obtain credit ratings when issuing new conduit bonds. What is more interesting, however, is the extra interest costs incurred due to non-rating are trivial. One possible answer is that these nonrated bonds must be of investment-grade quality but there are not many potential investors to justify the rating cost (both monetary and time constraints). In this paper, we propose an alternative hypothesis that issuers owned by the state or local government purposely avoid obtaining credit ratings due to the quality certification role of government ownership. To test this hypothesis, we examine the determinants of credit rating choices by hospital municipal bond issuers.

An extensive theoretical literature investigates the information revelation role of credit rating agencies. In these analyses, asymmetric information exists between corporate borrowers and the investing public. Credit rating agencies are paid to reveal information about the borrowers to alleviate agency costs associated with information asymmetry between debt issuers and investors, and therefore facilitate price discovery and allow market prices to reflect the true credit quality of bond issues.[3] Relative to the corporate bond market, the tax-exempt municipal bond market has a much higher level of information asymmetry.[4] If bond rating agencies serve to attenuate the lemons problem in the credit market, they should be more

[3] See Millon and Thakor (1985) for a model justifying the existence of financial rating agencies and Booth and Smith (1986) for a model of underwriters (investment banks) as certifiers.

[4] Hsueh and Liu (1993) argue that these bond issuers are smaller in size and segmented in regional and local municipal markets. Their financial reporting practice is not standardized as the corporate borrowers.

valuable to municipal conduit borrowers than to corporate borrowers, *ceteris paribus*.[5] What we are essentially arguing in this paper is that given the importance of credit rating agencies, if government ownership can serve as a quality certification, or a substitute for the information revelation function, borrowers can avoid the cost of obtaining credit ratings. The reason is that government ownership provides an implicit guarantee of either quality or bailout in case of financial difficulties. Borisova and Megginson (2011) suggest that government ownership reduces the cost of debt because bondholders perceive that the government-owned company will not default on its payments. In banking literature, Brown and Dinc (2009) find that no bank with more than 50% government ownership faces financial distress in their seven-year period.

Based on the above arguments we therefore conduct an empirical analysis to study the interrelation between government ownership and credit rating choice. Our findings provide insights of the relative importance of the quality certification role of government ownership compared to the information revelation role of credit rating agencies. The results can be considered to explain the paradox why these issuers chose not to obtain credit ratings when issuing new municipal conduit bonds.

In contrast to most other studies, which in most cases rely on panel data from all industries and sectors, we are able to examine a specific municipal bond market with detailed financial accounting data of hospitals. Our study expands upon existing work on two respects. First, we demonstrate that government ownership reduces the cost of credit rating by signaling the quality of the borrowers. Second, by focusing on a single narrowly defined industry rather than examining a cross-section of industries and sectors, we avoid the problem of attributing observed differences in credit rating choices to industry differences.

[5] In the lemons problem in Akerlof (1970), only sellers of high-quality would have the incentive to reveal their true quality if the buyers were not informed.

The remainder of the paper is organized as follows. Section II reviews the relevant prior research on the information revelation role of credit rating agencies and the quality certification role of government ownership. Section III presents the sample data, measurement choice, and empirical method. Section IV evaluates the results. Section V conducts additional robustness checks for credit risk. Section VI addresses the causality concern. Section VII concludes.

II. RELATED LITERATURE

The paper is related to two main threads of work. First, it is related to a growing literature which focuses on the bond issuer's decision to obtain credit ratings. Second, it is also related to a rather small number of studies on the effects of hospital ownership on performance. Unfortunately the results are inconclusive to answer the question whether hospital ownership matters for their financial outcomes (See Shen, Eggleston, Lau and Schmid 2007 for a comprehensive survey on this regard).[6] The following literature review will focus on the studies of the determinants of municipal bond issuers' decisions to seek credit ratings and the role of government ownership in helping mitigate the information asymmetry problem in the credit market. Understanding how ownership status or public/private control affects the bond issuers' rating decision in the credit market is important for many policy issues. Much of the policy discussion throughout the world in relation to the privatization of state-owned enterprises in general and the public-to-private conversion in the health care sector in particular concentrates on the costs and benefits involved. The benefit of government ownership reducing the cost of financing remains as an interesting possibility.

The publication of Akerlof (1970) and Viscusi (1978) highlight the importance of the information revelation role of credit rating agencies to mitigate the lemons problem. Buyers do not directly observe borrowers' quality in an asymmetrically informed market. By obtaining

[6] We can attribute the relation between the hospital muni bond issuer's decision to obtain credit ratings and its financial performance to a self-selection problem as we have discussed in the previous section.

credit ratings, high-quality borrowers can reduce the cost of debt issuance and benefit the most in quality revelation; as a result, they will be the first to seek credit ratings. On the other hand, low-quality borrowers do not have incentive to obtain credit ratings because they will be worse by revealing their quality type.[7]

In the past twenty years, issuers, investors, and government regulators have increased their reliance on the opinions of credit rating agencies for corporate financing, investment decisions, and risk management.[8] According to Jewell and Livingston (1998), these parties have long considered bond ratings an important part of the credit-certification process in the issuance of public corporate debt. Although conflicting views exist on the importance of bond ratings, evidence provided by Reiter and Zeibart (1991), Ederington, Yawed and Roberts (1987) and Liu and Thakor (1984) shows that ratings bring information to the marketplace beyond that are conveyed by publicly available financial information alone. In contrast to equity issuance where investment bankers set the initial price for a stock, three major creditor rating agencies (Standard & Poor's, Moody's, and Fitch) certify the credit quality of a bond issue.

The municipal bond market is inherently different than the corporate bond market.[9] The issuer is a state or local government rather than a corporation, and the bond issues typically fund public projects. Although municipal bonds are issued by a state or local government, their beneficiaries are not necessarily owned by the state or local government. In our sample, both public hospitals with government ownership and private hospitals without government ownership are the beneficiaries of municipal bond issuance; therefore, the research question of this paper is whether government ownership of the beneficiaries can serve as a certification for the municipal bond issues, making credit ratings not the only source of borrowers' credit

[7] Kashyap and Kovrijnykh (2013) develop a theoretical model to analyze optimal compensation schemes among issuers, rating agencies, and investors, and suggest that it will be better for investors rather than issuers to pay for the ratings because rating errors are smaller in this case.
[8] See White (2010) for the policy and regulatory perspectives of credit rating agencies.
[9] For the history and background of U.S. municipal bond market, see Hildreth and Zorn (2005).

quality information in the market. In our case of U.S. hospitals, certification is a function that a certifier (the government) puts her reputation on the line when shifting the hospital ownership from private to public in the first place, and investors view that as a validating signal about the hospitals repayment capability due to the perception of a government guarantee.

There have been papers on firm's reputational capital arguing that credit rating agencies provide a certification function in addition to their information revelation function (Beatty and Ritter 1986, Booth and Smith 1986, DeAngelo 1981, and Mayers and Smith 1982), and Hsueh and Liu (1993) conclude that the certification function is relatively more important than the revelation function in determining the value of credit rating.[10] Most of these studies treat the bond ratings as an exogenous factor and examined the impact of bond ratings on the cost of borrowing (such as Ingram, Brooks and Copeland 1983). Liu and Thakor (1984, 1988), Liu and Seyyed (1991) and Reiter and Ziebart (1991) show that credit ratings have an independent effect on prices; that is they provide information to investors that is in addition to economic characteristics, financial conditions, and other publicly available information. Because the information asymmetry problem is much more severe in the municipal bond market, investors are likely to rely heavily on ratings in the municipal bond market. This paper takes a different view, arguing that obtaining ratings is an endogenous decision that bond issuers choose to obtain ratings based on their financial conditions and bond characteristics. This is similar to other works studying the determinants of bond ratings (Ziebell and Rivers 1992, Gonis, Paul and Tucker 2012, Cantor and Packer 1997, and Cleverly and Nutt 1984).

Another difference between the municipal bond market and the corporate bond market is the regulatory environment. All state laws require disclosure of the terms and conditions of the new offerings, and the issuers are not directly regulated by the SEC, and not required to

[10] Cook, Schellhorn and Spellman (2003) use the event study to estimate the lender certification premium and provide evidence that a lender's endorsement serves as certification that creates value to the borrower.

report financial statements conforming to the GAAP accounting standards or obtain an audit.[11] Table I shows that about 60% of all U.S. municipal bond issues in the past five years (2008-2012) and 30% hospital municipal bond in our sample chose not to obtain a credit rating.[12] Given the greater potential for information asymmetries in the municipal market, independent ratings should be more valuable to investors in this market, yet compared to corporate bonds, a much smaller percentage of municipal bonds are rated. If ratings are more valuable in the municipal market, are issuers acting rationally when they opt to forgo ratings on new issues? The answer to this question is related to the fact that obtaining a bond rating is not costless, and rational borrowers always weigh the costs against the potential benefits when deciding whether to obtain a rating, but still the cost of obtaining a rating is lower relative to the potential interest savings would suggest that issuers should reduce investor default uncertainty by obtaining a rating because interest cost on bond issues is the largest expense incurred by municipalities. While ratings can reduce investor uncertainty and do not cost that much, obtaining a rating may not be in the best interest of the issuer. Allen, Sanders and Dudney (2009) suggest two reasons: First, the rating may increase interest costs (yields) if the rating provides new information that the default risk is higher than the risk perceived by investors. Second, the rating may increase issuance costs (gross spread) if the rating provides no additional information and thus no cost saving to the issuer. This is particularly the case with issues of

[11] In the corporate bond market, issuers are regulated by the SEC and their' financial statements are widely available on company websites and SEC EDGAR, and virtually all new corporate bond issues are rated (Bongaerts, Cremers and Goetzmann 2012).

[12] This significant degree of difference in decisions not to obtain credit ratings (ie, 60% vs. 30%) suggests that relative to other municipal bonds, hospital muni bonds are more likely to have credit ratings at issuance. This could be due to the "demand uncertainty" for the services provided by the hospitals as explained in Sorensen (1979). Hospital muni bonds can be inherently more risky than many other types of muni bonds. For issuers facing less uncertainty in demand, for example, having natural monopolies like utilities and public schools, the probability of obtaining credit rating will be generally low (Chappatta 2013).

small amount that can be marketed to local investors. Local investors are more likely familiar with the issuer and easily evaluate the credit quality of the issuer.[13]

Given the theory that ratings are more valuable in the municipal market, it seems paradoxical that some issuers opt to forgo ratings on new muni bond issues. We argue in this paper that issuers owned by the state or local government purposely avoid obtaining credit ratings due to the quality certification role of government ownership. Prior studies in corporate finance (Borisova and Megginson 2011) and banking (Brown and Dinc 2011) have provided empirical evidence that government ownership could provide an implicit guarantee to bondholders that the company or bank will not default on its payments. How does this implicit "guarantee" work to reduce the cost of financing a business? In corporate finance theory, Leland and Pyle (1977) note that information asymmetry between a 100% owner and a prospective buyer of a company could be mitigated by the owner retaining some stake in the company, signaling a belief in its quality and future prospects. In the context of privatization, Perotti (1995) characterizes residual state shareholdings as a sign of commitment that the government will not interfere with the firm after its divestment. Furthermore, Borisova and Megginson (2011) argue that a larger retained government stake can make bond investors more confident in the firm's sustainable performance and less concerned with monitoring a state-owned enterprise.

Municipal conduit bonds also differ from corporate bonds in that they are generally tax-exempt. Tax-exempt securities usually face severe restrictions on how the proceeds can be used in order to prevent tax arbitrage.[14] There are some taxable municipal bonds but they are a small proportion of the total municipal issues market (5% in our sample in terms of the number of

[13] Butler (2008) finds that local investment banks have substantial advantages and charge lower underwriting fees and sell bonds at lower yields, and suggests that local underwriters are better able to assess soft information and place difficult bond issues.

[14] Tax arbitrage is to use some portion of the proceeds to acquire higher yielding investments.

new issues), for purposes of this study, they are not inherently different from their more common tax-exempt counterparts. Conduit bonds can be taxable for several reasons. Bonds that are used to finance loans to nongovernment entities must be taxable, and a state's unfunded pension liabilities can be financed with taxable municipal bonds.[15] However, the taxable status of municipal bonds is not the focus of this paper, we will control for the type of bonds in the following statistical analysis.

III. DATA AND METHODOLOGY

To test the hypothesis that conduit bond issuers owned by the state or local government purposely avoid obtaining credit ratings due to the quality certification role of government ownership, we examine the determinants of credit rating decisions by hospital municipal bond issuers. Our primary data source is the Thomson Reuters SDC Platinum's Public Finance database that contains detailed bond characteristic and ratings information on new municipal bond issues from all U.S. issuers. For all hospitals located in a county, we calculate the total number of new municipal bond issues in our sample. These counts of new issues are plotted in Figure 1 with different colors corresponding to different ranges of the numbers of municipal bonds.

[Insert Figure 1 Here]

To study the determinants of rating decisions, we need to control for bond issuers' financial and operational characteristics. We obtain hospital issuers' annual financial statements from the Medicare Cost Report and merge it with the data set of new bond issues. Medicare-certified hospitals are required to submit an annual cost report to a Medicare Administrative Contractor (MAC). The cost report contains provider information such as facility characteristics, utilization data, cost and charges by cost center, Medicare settlement data, and financial statement data.

[15] See Atwood (2003) for more details on this regard.

The Center for Medicare & Medicaid Services (CMS) maintains the cost report data in the Healthcare Provider Cost Reporting Information System (HCRIS). We obtain all hospitals' balance sheet and income statement data from the Worksheet G, G-2 and G-3 archived on the HCRIS web site. The time series of the merged data set ranges from 1996 to 2010.

Our dependent variable is a binary choice decision by the issuer: whether to obtain a credit rating when issuing a new bond. It is noted that the three major rating agencies (Standard & Poor's, Moody's, and Fitch) do not necessarily rate all municipal bonds or the same issues. Allen and Dudney (2008) find that from 1986 to 2002 Moody's rated significantly more issues than Standard & Poor's, and disagreement among rating agencies is common.[16] To overcome this problem of "selective" rating problem, we construct a dummy variable that is set to one if the hospital issuer obtained a credit rating from any of the three major credit rating agencies and zero otherwise.

Following prior studies, we also construct a set of bond-level and issuer-level variables by matching the bond issues to the issuers' financial statements to control for issuer and bond characteristics. The control variables of the issuers include hospital asset size, financial leverage, profit margin, short-term liquidity, asset age, and whether the hospital is owned by the state or local government. The control variables for bond characteristics include issuance amount, maturity, credit enhancement, callable option, revenue or general obligation type, and whether a bond has a sinking fund set aside. Municipal conduit bonds can be taxable or tax-exempt, and taxable conduit bonds are a small proportion of the total municipal issues market. For the purpose of this study, we create a dummy variable with the value 1 their tax-exempt qualification; however as you will see in the results section, they are not inherently different

[16] There is a large literature on why multiple ratings exist and its effect on borrowing costs. For example, Cantor and Packer (1997) reveal that the observed rating differences reflect different rating scales rather than selection bias. Bongaerts, Cremers, and Goetzmann (2012) find evidence that an issuer may request additional ratings that might qualify the bond issue for an investment-grade classification. Thompson and Vaz (1990) suggest the information production function of a second rating.

from their less common taxable counterparts in terms of influencing rating decision. In addition, we need to control for the cost and quality of issuance. Cost is measured by the *gross spread*, which is the cash compensation to the underwriter as a percentage of the issue amount.[17] Quality is measured by the offering *yield to maturity* on each issue, which reflects the price that the underwriter can obtain for the issuer, and is associated with the reputation of the underwriters; therefore, we are controlling for the reputation effects in our analysis. Fang (2005) finds that more reputable underwriters obtain lower yields (YTM) and higher fees (gross spreads); however, Daniel and Vijayakumar (2007) show that municipal bond issues lead-managed by prestigious underwriters actually can lower borrowing costs and gross spreads at the same time. Grossman, Goldman, Nesbitt, and Mobilia (1993) find that the selection of underwriters by negotiation rather than by competitive bidding resulted in higher cost of borrowing as measured by YTM. To some extent, both yield to maturity and callable option reflect the cost of borrowing as argued by Grossman, Goldman, Nesbitt, and Mobilia (1993) that the Federal tax act of 1996 raised the cost of hospital debt by encouraging bond issues to contain call features.

The formal definitions and summary statistics of these variables are reported in Table II.

[Insert Table II Here]

On average, 73% of new hospital municipal bond issues obtained at least one credit rating from the three major rating agencies with a standard deviation of 44%. This is higher than the 36% rating choice of all issues as illustrated in Table I, suggesting that hospital municipal bonds might have better quality comparing to other issues. There is a lot of heterogeneity in hospital characteristics with, on the one hand, the average asset age is 14.8 years and the average

[17] In a typical "firm commitment" issuance, investment banks purchase directly from the issuer all the securities that are to be sold to investors. The underwriter buys the bonds at a price that is lower than the offer price. The offer price minus the price at which the bonds are bought from the issuer is referred to as the gross spread.

government ownership is 46% and, on the other hand, the standard deviation is 23.3 years and 49% respectively. As we discussed earlier, taxable muni bonds are a small proportion of the total municipal issues market with only 5% market share (number of issues).

The standard measure of firm size in this article and in most of the relevant literature is the total assets, which is reported in the balance sheet of a hospital' financial statements. To avoid problems of skewed distribution of firm size and potential outliers that may bias the regression results, we use a natural logarithm transformation of the total assets to normalize its distribution:

$$AssetSize_i = \log(Total\ Assets_i) \tag{1}$$

Financial leverage is the degree to which a firm (or shareholders) is utilizing borrowed money, mainly in the form of debt financing. Leverage magnifies increases in earnings during periods of rising operating income due to the tax benefits of debt, but adds significant risks for stockholders and creditors because of added interest obligations. Because companies that are highly leveraged may be providing better return to investments and having higher probability of bankruptcy at the same time, leverage has been commonly used in the corporate literature as a measure of a firm's risk-taking behavior. For example in the public finance literature, Yan and Denison (2009) show that non-profit organizations, particular arts institutions, issue more debt and have higher leverage ratios. For hospital *i*, we define the financial leverage as its debt-to-asset ratio:

$$Leverage_i = \frac{Debt_i}{Total\ Asset_i} \tag{2}$$

For this sample of hospitals, the mean leverage is 52% with a standard deviation of 19%.

The current ratio (*liquidity*) is a financial ratio that measures whether or not a firm has enough resources to pay its debts over the next year. It compares a firm's current assets to its

current liabilities, and it is an indication of a firm's market liquidity and ability to meet creditor's demands.

$$Liquidity_i = Current\ Ratio_i = \frac{Current\ Asset_i}{Current\ Liabilities_i} \tag{3}$$

To reduce their new issue borrowing cost, conduit borrowers often obtain credit enhancement through additional collateral, insurance, or a third party guarantee. According to CDFA[18], more than 60% of tax-exempt bonds issued in the U.S. have some form of credit enhancement. The most common types of credit enhancement are bond insurance and letters of credit. Less common types include lines of credit, mortgage insurance, and private guarantees. The use of credit enhancement generally results in the rating of the insured bonds being the higher and the reduction of borrowing cost is generally larger than the cost of bond insurance.[19] Prince and Ramanan (1994) find a positive correlation of debt insurance, credit rating, and hospital operating performance. By examining the market for private guarantees for municipal debt from 1987 to 1989, Quigley and Rubinfeld (1991) estimate the insurance effect on bond yields to be substantial (14 to 28 basis points). Similar effects of using letters of credit in the corporate tax-exempt bond market can be found in Stover (1996).

The rest of the variables are self-explanatory, and precise definitions of each variable appear in Table II. We report the Pearson's correlations in Table III. An examination of the correlation matrix indicates that correlations between independent variables are generally smaller than 0.5 except one case of the maturity and yield to maturity (0.99) due to the fact of commonly observed upward-sloping yield curve. The low correlation among the covariates helps prevent the problem of multicollinearity that causes high standard errors and low

[18] The Council of Development Finance Agencies (CDFA) is a Columbus, Ohio-based national group that lobbies on behalf of state and local development finance agencies that provide job creation and economic development programs through the use of tax-exempt and public-private partnership financing schemes.

[19] See Kidwell, Sorensen and Wachowicz (1987) on the net benefits of debt insurance and Angelides (2002) on the use of bond insurance as a form of credit enhancement in California's municipal bond market.

significance levels when both variables are included in the same regression. Further diagnostics indicate no obvious evidence of serious multicollinearity among the covariates.

[Insert Table III Here]

Figure 2 plots the time-series characteristics of these bond issuers: the percentage of hospitals being non-profit, the natural log of total assets, the financial leverage, the age of hospital assets in years, and the percentage of government-owned hospitals. It is noted that the proportion of non-profit hospitals has been increasing over the years, whereas the proportion of hospitals owned by the federal and state government has being declining during the same time period. However, this trend stopped in 2009, the first year after the onset of the recent recession.

[Insert Figure 2 Here]

Figure 3 and 4 plot the time-series characteristics of bonds: issue amount, maturity in years, gross spread, percentage of tax-exempt bond, yield-to-maturity, the percentages of bonds being callable bond and revenue bond, and the percentages of total issues with credit enhancement and sinking fund. The total amount of hospital bond issues has been steadily rising, probably as a result of the booming economy from the late 1990's up until the late 2000's.

[Insert Figure 3 and 4 Here]

In the first set of regression analysis, we estimate the quality certification effect of the government ownership on firms' decision to obtain credit ratings for new bond issues by fitting firm-level (*i*) logistic regression equations that take the form and control various firm and bond characteristics:

$$Rating = \beta_0 + \beta_1 Size + \beta_2 Leverage + \beta_3 Profit + \beta_4 Liquidity + \beta_5 Amount + \beta_6 Maturity + \beta_7 GrossSpread + \beta_8 TaxExempt + \beta_9 GovernmentOwn + \beta_{10} CreditEnhancement \quad (4)$$

In the second regression analysis, we add six more control variables: asset age, yield to maturity, callable option, whether the new issue is a revenue bond and whether it has sinking fund set aside.

$$Rating = \beta_0 + \beta_1 Size + \beta_2 Leverage + \beta_3 Profit + \beta_4 Liquidity + \beta_5 Age + \beta_6 Amount + \beta_7 Maturity + \beta_8 GrossSpread + \beta_9 TaxExempt + \beta_{10} GovernmentOwn + \beta_{11} CreditEnhancement + \beta_{12} YTM + \beta_{13} Callable + \beta_{14} RevenueBond + \beta_{15} SinkingFund \quad (5)$$

However, there might be differences in different years that are not captured by the control variables in all three specifications and that affect the rating decision and the firm/bond characteristics simultaneously. This may lead to biased and inconsistent parameter estimates; for example, Reiter, Wheeler and Smith (2008) and Stewart and Smith (2011) indicate that U.S. non-profit hospitals increased their reliance on debt financing (increasing leverage) to meet their capital financing needs during the 2000-2001 and 2008-2009 economic crises. Therefore, we add year fixed-effects to the models, and examine the sensitivity of these regression estimates to the inclusion and exclusion of the year fixed-effects. For robustness checks, we also conduct estimation using logit as well as OLS regressions.

IV. RESULTS

Under the hypothesis of government ownership as quality certification, bond issuers owned by the state or local government can avoid obtaining credit ratings because investors view the government ownership as a validating signal about the hospitals repayment capability due to the perception of a government guarantee. We begin by looking at the relation between the government ownership and borrowers' decision to obtain credit ratings by following the prior work to control for individual issuer and bond issue characteristics. Table IV reports coefficient estimates for the covariates of interest and other control variables, by which we account for firm size, financial leverage, profitability, liquidity, asset age, insurance amount, maturity, gross

spread, tax-exempt qualification, government ownership, credit enhancement, yield to maturity, callable option, revenue bond type and sinking fund provision.

[Insert Table IV Here]

In specifications (1) and (2) of Table IV, we report results from pooled regressions of the rating decision on the government ownership by controlling for basic firm and bond characteristics that are closely related to the borrower's decision whether to obtain a credit rating, with and without year fixed-effects. We find negative effects of government ownership on issuers' decision to obtain a credit rating. In addition, larger issuers as measured by the natural log of total assets and those with lower financial leverage (asset to equity) and better liquidity (current ratio) are more likely to obtain credit ratings for their new issues, which is consistent with the findings in the previous studies. Apparently this type of firm is not prone to experience binding financial constraints when making investment decisions, and their new issues tend to be investment-grade; as a result, they are more likely to choose to obtain credit ratings. The results also suggest that firms issuing bonds with credit enhancement are more likely to acquire credit ratings.

It is obvious that estimates of specifications (1) to (2) might be plagued by omitted variable bias. To avoid that bias, we add more controls to specifications (3) and (4), namely, asset age, yield to maturity, and three dummy variables that is set to one if a bond is callable, revenue bond, and comes with sinking fund respectively. The results show that firms with newer assets (smaller asset age) and lower underwriter fees (smaller gross spread) are also more likely to obtain credit ratings, whereas the coefficient estimates of government ownership remain significantly positive in all specifications.

Taking this result at face value, a natural interpretation is that the government ownership of a municipal bond issuer might have fostered a positive perception of debt

capacity and repayment capability; hence reduced the need of obtaining credit rating because the government ownership has serve the role of quality certification. More interestingly, the coefficient estimates of taxable status become significance in specifications (2) and (4) with year fixed-effects, suggesting some evidence that a taxable bond might also signal the issuer's debt-repayment capability.

The robustness checks using probit and OLS regressions provide similar coefficient estimates for the covariates of interest and most control variables. The results are reported in Table V and VI respectably. Because of space limitations it is necessary to forego discussing how these factors determine the firm's credit rating decisions in a similar fashion that is revealed in Table IV.

[Insert Table V and VI Here]

V. CREDIT RISK

This paper studies the relationship between a hospital's ownership and its decision to obtain bond ratings when issuing new municipal bonds. However, it could be simply the case that hospitals owned by federal, state or local governments and their agencies have greater credit risk; therefore, public hospitals are less likely to seek and obtain bond ratings than their non-public counterparts. To explicitly control for this potential bias, we calculate the credit risk for each hospital/bond in each year and add them to the regression models.

Accounting-based Credit Risk

In the financial accounting literature, the Z-score is often used to measure a firm's credit risk, the risk of financial distress or bankruptcy. According to Altman (2013), the Z-score for non-publicly traded firms is a linear combination of five financial accounting ratios weighted by coefficients:

$$Z = 0.717\frac{WorkingCapital}{TotalAssets} + 0.847\frac{RetainedEarnings}{TotalAssets} + 3.107\frac{EBIT}{TotalAssets} + 0.420\frac{Equity}{Liabilties} + 0.998\frac{Sales}{TotalAssets} \quad (6)$$

where *WorkingCapital* is the difference between current assets and current liabilities, and *EBIT* is the earnings before interests and taxes. Besides this so-called *Revised* Z-Score or Z'-Score, Altman (2013) also defines a *Further Revised* Z-Score or Z"-Score for non-manufacturing firms:

$$Z = 6.56\frac{WorkingCapital}{TotalAssets} + 3.26\frac{RetainedEarnings}{TotalAssets} + 6.72\frac{EBIT}{TotalAssets} + 1.05\frac{Equity}{Liabilties} \quad (7)$$

It should be noted here that the *Equity* in the above equation is the market value of equity and we are using the book value of equity to proxy for it because most of the hospitals in the sample are not publicly traded. Section A of Table VII reports the distribution of the Z-Scores (from this point on we will call them Z-Score 1 and Z-Score 2 respectively). Based on the cut-off points suggested in Altman (2013), only 10% of the hospitals in our sample are considered financially safe in the case of Z-Score 1, and less than half of the hospitals in our sample are financially safe in the case of Z-Score 2.

[Insert Table VII Here]

The Pearson's correlation between these two measures of Z-Score is 0.95 and their correlations with other variables are shown in Section B of Table VII. It is not surprising to see their strong correlations with financial leverage (-0.46), liquidity (0.81) and profit margin (0.16) because they are part of the factors in calculating the Z-Scores in equations (6) and (7).

After obtaining the Z-Scores we add them to our regression models and report the coefficient estimates in Table VIII. The results in Columns (1) and (2) show that lower bankruptcy risk (higher Z-Score 1) is associated with higher likelihood of hospitals acquiring bond ratings. This is consistent with prior findings that bond issuers use credit rating agencies to convey information about the true quality of their new issues (Hsueh and Kidwell 1988), even with credit enhancement or bond insurance (Peng 2002), to further alleviate the information asymmetry problem in the conduit bond market. In addition to that, hospitals owned by various governments and their agencies are less likely to seek and obtain bond

ratings. Similarly results are reported in Columns (3) and (4) which include Z-Score 2 as part of the control variables.

[Insert Table VIII Here]

Yield-implied Credit Risk

Alternatively, we can estimate the credit risk of each non-profit hospital bond by analyzing its yield spread in a theoretical default model that takes the tax consequences of tax-exempt conduit bond defaults into the consideration. Following the methods in Yawitz, Maloney and Ederington (1985) and Wu (1991), we define a simple state-contingent model that derives the after-tax return *Y* from investing one dollar in a risky municipal bond:

$$Y = 1 + r_M \qquad \text{with probability } P_M \tag{8}$$

$$Y = \alpha\tau \qquad \text{with probability } 1 - P_M \tag{9}$$

where r_M is the municipal bond yield, τ is the income tax, and a is the fraction of tax reduction due to bond defaults, and its value is between 0 and 1. Now consider a risk-free and tax-free bond with a rate of return i, and a risk-free and taxable bond (e.g., Treasury) with a rate of return r_G. Then, the after-tax return on the risk-free bond is $i = r_G(1 - \tau)$. We can derive the equilibrium relationship between the yields on Treasury and municipal bonds as follows:

$$r_G = \frac{i}{1 - r_M} \tag{10}$$

$$r_M = \frac{i}{P_M} + \frac{1 - P_M}{P_M}(1 - \alpha\tau) \tag{11}$$

After combining equations (10) and (11), we obtain:

$$r_M = \frac{(1 - P_M)(1 - \alpha\tau)}{P_M} + \frac{1 - \tau}{P_M} r_G \tag{12}$$

We can use the observed rates of returns to fit the following empirical model to estimate the probability of payment P_M:

$$r_M = \beta_0 + \beta_1 r_G + \varepsilon \tag{13}$$

where

$$\beta_0 = \frac{(1 - P_M)(1 - \alpha\tau)}{P_M} \tag{14}$$

$$\beta_1 = \frac{1 - \tau}{P_M} \tag{15}$$

Although there is a linear relationship between the returns of risky municipal bonds (r_M) and the risk-free Treasury bonds (r_G), both β_0 and β_1 are not linear functions of the probability of payment (P_M). We need to apply a grid search type of numerical method to estimate the probability of payment (P_M) and calculate the default probability (P) of a conduit bond:

$$P = 1 - P_M \tag{16}$$

Once we obtain the default probability (P) for all conduit bonds of a hospital, we aggregate them to a hospital-level measure of credit risk. We then re-estimate our regression models with this new control variable and find similar results consistent with our previous findings.[20]

VI. CAUSALITY

The economic interpretation of the previous results provides some explanation as to why hospitals obtain bond ratings; however, it deserves caution because the results do not provide "true" causal evidence. They could be driven by endogeneity concerns. Specifically, there might be significant omitted variable(s) correlated with both the hospital ownership and rating decision driving our results spuriously. To specifically address the endogeneity concern and provide Rubin causality evidence issue, we need to employ a quasi-experimental study that assigns intervention (treatment) and control (non-treatment) status to government ownership,

[20] We omit the tables due to space constraints.

and examines the outcomes (changes of rating decisions) before and after conducting the intervention or treatment.

We consider the conversion from public (federal, state or local) to private (for-profit or non-profit) ownership of a hospital as an exogenous shock. According to Desai, Lukas and Young (2000), converting public hospitals to private ownership has been recognized as an effective way to gain their strategic and managerial flexibility and offer potential gains in operating efficiency.[21] Needleman, Chollet and Lamphere (1997) report that public hospitals were struggling to survive during the 1970s and 1980s, and more than three hundreds public hospitals were converted to private ownership status between 1980 and 1993. In this quasi-experimental study, we employ a matched-sample difference-in-differences (DiD) regression (see Meyer 1995, and Angrist and Krueger 1999 for detailed explanations of this methodology) to analyze whether the unexpected shock of hospital conversion from public to private ownership have changed the rating decisions for the new municipal bond issues. Accordingly, Hospitals experienced conversions in year *t* are defined as the treatment group, and matched hospitals without conversions in year *t* are defined as the control group. We locate the matched hospital in the control group by identifying the universe of hospitals with the similar asset size and proximate geographic location. From the set of candidate hospitals, we select the one closest in size and distance to the treatment hospital as our match.

The dummy variable *CONVERT* is set to one for converted hospitals and zero otherwise. The dummy variable *POST* is set to one if it is after the conversion event in year *t+1*, and zero otherwise. A third dummy variable *POST*×*CONVERT* is the cross-product of the previous two dummy variables. The coefficient estimates for this DiD analysis are shown in Table IX. The

[21] The motives and consequences of public project privatization has been studied extensively in the economic literature. For example, Levy and Pauzner (2014) suggest that privatization can alleviate the information asymmetry problem between the government with an excessive emphasis on social benefits and the credit market that is investment-return driven.

dependent variable is the rating decision. There are two specifications: (1) uses OLS regression and (2) uses logistic regression.

$$RatingDecision_{i,t} = \beta_0 + \beta_1 POST_{i,t} + \beta_2 CONVERT_{i,t} + \beta_3 POST_{i,t} \times CONVERT_{i,t} + \varepsilon_{i,t} \quad (17)$$

[Insert Table IX Here]

The coefficient estimates of the interaction term (*POST*×*CONVERT*), which represents the hospitals experienced conversion from public to private ownership and the time is after the conversion event, are positive, suggesting that after the hospital lost its government ownership, the value of credit ratings to the new bond issues increases, and hence the hospital is more likely to obtain credit ratings despite the high cost of rating.

It should be noted that this specific quasi-experimental design can only provide causal evidence in the sense of Rubin (1974, 1978), i.e., hospitals are more likely to obtain credit ratings after the exogenous shock of conversion from public to private ownership. However, it has no explanation power for exactly what is the underlying economic channel that has caused this change. It could be that the new owners of the converted hospitals have enforced better corporate governance or the new management is more in favor of market mechanism; as a result, they are more likely to depend on the financial market to reduce the information asymmetry problem between bond issuers and investors.

VII. DISCUSSION AND CONCLUSION

Despite a large body of theoretical and empirical papers on how credit rating agencies alleviate the information asymmetry problem for bond issuers by revealing their quality type, prior literature of examining the determinants of issuers' endogenous decision to obtain credit ratings is scarce, and relatively little research has been done into the potential role of quality certification by institutional ownership in the municipal conduit bond market. Given the theory

that credit ratings are more valuable in the municipal market because bond issuers in the municipal bond market face more of an asymmetric information problem than their counterparts in the corporate bond market, it seems paradoxical that some issuers opt to forgo ratings on new conduit bond issues. In this paper, we propose a hypothesis of government ownership as a quality certification, which conjectures that conduit issuers avoid obtaining credit ratings to reduce issuance costs by signaling their quality type with their government ownership status. Essentially government ownership status serves as a substitute for the information revelation function of credit rating agencies. We use the data of hospital conduit bond credit ratings and issuer-bond characteristics from the Thomson Reuters SDC Platinum's Public Finance database and The Center for Medicare & Medicaid Services (CMS)'s Medicare Cost Report to empirically evaluate this hypothesis.

In contrast to most other studies, which in most cases rely on panel data from all industries and sectors, we are able to examine a specific municipal bond market with detailed financial accounting data of hospitals. By focusing on a single narrowly defined industry rather than examining a cross-section of industries and sectors, we avoid the problem of attributing observed differences in credit rating decisions to industry difference.

Our study expands upon existing work on three respects. First, we demonstrate that government ownership reduces the cost of credit rating by signaling the quality of the borrowers. This is consistent with government ownership playing a quality certification role that reduces the needs of information revelation role played by credit rating agencies. Second, we find evidence that new bond issues without credit enhancement and cheaper underwriting fees are more likely to obtain credit ratings, suggesting the certainty of obtaining an investment-grade rating. Third, issuers with smaller asset size, higher leverage, worse liquidity and older equipment are more likely to avoid seeking credit ratings. However, we do not find robust

evidence for the use of callable option, sinking fund and tax-exempt qualification as a determinant of credit rating choice. Thus, even though callable bonds are on average clearly riskier than non-callable bonds and bonds with sinking fund are safer than those without, there appears to be little quality information contained in these additional features, relative to the information already contained in other determinants of rating decisions.

The relation between hospital ownership and borrowers' credit rating decisions that we document in this paper can help guide federal, state or local governments that are considering public-to-private conversion or undertaking privatization of state-owned enterprises in the early stages, in regards to the costs and benefits involved.

It is worth noting that the findings presented in this study are limited by the sampling bias that characterizes studies using a rather small group of municipal conduit bond issuers, who could be "self-selected" into making non-rating choices. It remains unclear whether the same findings would be maintained in a sample of issuers in other service sectors. Although selection bias is a concern in almost all empirical work of credit rating decisions, the severity of the problem is unknown. In an attempt to test whether observed rating differences reflect different rating scales or simply result from sample selection bias, Cantor and Packer (1997) do not find strong evidence of selection bias in the credit rating market, and interestingly, in a study of the determinants of the choice of credit rating agencies, Moon and Stotsky (1993) find self-selection to be important in Moody's ratings while not in those of S&P.[22] Nonetheless, we advise readers to exercise caution when interpreting such results.

[22] Carpenter (1992) concludes that after correcting for selection, hospital characteristics are not longer good predictors of the cost of capital (hospital bond yield).

REFERENCE

Angelides, Philip, 2002, Bond Insurance as a Form of Credit Enhancement in California's Municipal Bond Market, California Debt and Investment Advisory Commission (CDIAC), Sacramento, CA.

Akerlof, George, 1970, The Market for "Lemons": Quality Uncertainty and the Market Mechanism, *Quarterly Journal of Economics* 84, 488–500.

Allen, Arthur and Dunna Dudney, 2008, The Impact of Rating Agency Reputation or Local Government Bond Yields, *Journal of Financial Services Research* 33, 57–76.

Allen, Arthur, George Sanders, and Donna Dudney, 2009, Should More Local Governments Purchase a Bond Rating?, *Review of Quantitative Finance and Accounting* 32, 421–438.

Altman, Edward, 2013, Predicting Financial Distress of Companies: Revisiting the Z-Score and ZETA Models, *Handbook Of Research Methods And Applications In Empirical Finance*, eds. Adrian Bell , Chris Brooks, and Marcel Prokopczuk, Edward Elgar Publishing, Cheltenham, UK.

Atwood, T.J., 2003, Implicit Taxes: Evidence from Taxable, AMT, and Tax-Exempt State and Local Government Bond Yields, *Journal of the American Taxation Association* 25, 1–20.

Beatty, Randolph and Jay Ritter, 1986, Investment Banking, Reputation, and the Underpricing of Initial Public Offerings?, *Journal of Financial Economics* 15, 213–232.

Bongaerts, Dion, K. J. Martijn Cremers, and William Goetzmann, 2012, Tiebreaker: Certification and Multiple Credit Ratings, *Journal of Finance* 67, 113–152.

Booth, James and Richard Smith, 1986, Capital Raising, Underwriting and The Certification Hypothesis, *Journal of Financial Economics* 15, 261–281.

Borisova, Ginka and William Megginson, 2011, Does Government Ownership Affect the Cost of Debt? Evidence from Privatization, *Review of Financial Studies* 24, 2693–2737.

Brown, Craig and I. Sedar Dinc, 2011, Too Many to Fail? Evidence of Regulatory Forbearance When the Banking Sector Is Weak, *Review of Financial Studies* 24, 1378–1405.

Butler, Alexander, 2008, Distance Still Matters: Evidence from Municipal Bond Underwriting, *Review of Financial Studies* 21, 763–784.

Cantor, Richard and Frank Packer, 1997, Differences of Opinion and Selection Bias in the Credit Rating Industry, *Journal of Banking and Finance* 21, 1395–1417.

Carpenter, Caryl, 1992, Determinants of Hospital Tax-Exempt Debt Yields: Corrections for Selection and Simultaneous Equation Bias, *Health Services Research* 27, 695–713.

Chappatta, Brian, 2013, States Refusing Expanded Medicaid Fuel Worst Losses, Bloomberg, Sep 12, 2013.

Cleverly, William and Paul Nutt, 1984, The Decision Process Used for Hospital Bond Rating and its Implications, *Health Services Research* 19, 615–637.

Cook, Douglas, Carolin Schellhorn, and Lewis Spellman, 2003, Lender Certification Premium, *Journal of Banking and Finance* 27, 1561–1579.

Daniels, Kenneth and Jayaraman Vijayakumar, 2007, Does Underwriter Reputation Matter in the Municipal Bond Market?, *Journal of Economics and Business* 59, 500–519.

DeAngelo, Linda, 1981, Auditor Independence, 'Low Balling', and Disclosure Regulation, *Journal of Accounting and Economics* 3, 113–127.

Desai, Kamal, Carol VanDeusen Lukas, and Gary Young, 2000, Public Hospitals: Privatization and Uncompensated Care, *Health Affairs* 19, 167–172.

Ederington, Louis, 1986, Why Split Ratings Occur, *Financial Management* 15, 37–47.

Fang, Lily, 2005, Investment Bank Reputation and the Price and Quality of Underwriting Services, *Journal of Finance* 60, 2729–2761.

Gonis, Eleimon, Salima Paul, and Jon Tucker, 2012, Rating or No Rating? That is the Question: An Empirical Examination of UK Companies, *European Journal of Finance* 18, 709–735.

Granger, C., 1969, Investigating Causal Relations by Econometric Models and Cross-spectral Methods, Econometrica 37, 424–438.

Grossman, Michael, Fred Goldman, Susan Nesbitt, and Pamela Mobilia, 1993, Determinants of Interest Rates on Tax-exempt Hospital Bonds, *Journal of Health Economics* 12, 385–410.

Hildreth, W. Bartley and C. Kurt Zorn, 2005, The Evolution of the State and Local Government Municipal Debt Market over the Past Quarter Century, *Public Budgeting & Finance* 25, 127–153.

Hsueh, L. Paul and David Kidwell, 1988, Bond Ratings: Are Two Better than One?, *Financial Management* 17, 46–53.

Hsueh, L. Paul and Y. Angela Liu, 1993, Should All Tax-exempt Borrowers With Investment-grade Quality Acquire Credit Ratings?, *Journal of Business Finance & Accounting* 20, 291–306.

Ingram, Robert, Leroy Brooks, and Ronald Copeland, 1983, The Information Content of Municipal Bond Rating Changes: A Note, *Journal of Finance* 38, 997–1003.

Jewell, Jeff and Miles Livingston, 1998, Split Ratings, Bond Yields, and Underwriter Spreads, *Journal of Financial Research* 21, 185–204.

Jin, Ginger Zhe, Andrew Kato, and John List, 2010, That's News To Me! Information Revelation In Professional Certification Markets, *Economic Inquiry* 48, 104–122.

Kashyap, Anil and Natalia Kovrijnykh, 2013, Who Should Pay for Credit Ratings and How?, NBER Working Paper No. 18923.

Kidwell, David, Eric Sorensen, and John Wachowicz, 1987, Estimating the Signaling Benefits of Debt Insurance: The Case of Municipal Bonds, *Journal of Financial and Quantitative Analysis* 22, 299–313.

Leland Hayne and David Pyle, 1977, Informational Asymmetries, Financial Structure, and Financial Intermediation, *Journal of Finance* 32, 371–387.

Levy, Nadav and Ady Pauzner, 2014, Government's Credit-Rating Concerns and the Evaluation of Public Projects, *Journal of Public Economics* 115, 117–130.

Liu, Pu and Fazel Seyyed, 1991, The Impact of Socioeconomic Variables and Credit Ratings on Municipal Bond Risk Premia, *Journal of Business Finance & Accounting* 18, 735–746.

Liu, Pu and Anjan Thakor, 1984, Interest Yields, Credit Ratings, and Economic Characteristics of State Bonds: An Empirical Analysis, *Journal of Money, Credit, and Banking* 16, 344–351.

Lizzeri, Alessandro, 1999, Information Revelation and Certification Intermediaries, *RAND Journal of Economics* 30, 214–231.

Nathaniel Popper, 2011, 'Conduit' Muni Bond Defaults Draw Scrutiny, *Los Angeles Times*, June 14th.

Mayers, David and Clifford Smith, 1990, On the Corporate Demand for Insurance: Evidence from the Reinsurance Market, *Journal of Business* 63, 19–40.

Millon, Marcia and Anjan Thakor, 1985, Moral Hazard and Information Sharing: A Model of Financial Information Gathering Agencies, *Journal of Finance* 40, 1403–1422.

Moon, Choon-Geol, and Janet Stotsky, 1993, Testing the Differences Between the Determinants of Moody's and Standard & Poor's Ratings: An Application of Smooth Simulated Maximum Likelihood Estimation, *Journal of Applied Econometrics* 8, 51–69.

Needleman, Jack, Deborah Chollet, and JoAnn Lamphere, 1997, Hospital Conversion Trends, *Health Affairs* 16, 187–195.

Peng, Jun, 2002, Do Investors Look Beyond Insured Triple-A Rating? An Analysis of Standard & Poor's Underlying Ratings, *Public Budgeting & Finance* 22, 115–131.

Perotti, Enrico, 1995, Credible Privatization, *American Economic Review* 85, 847–859.

Prince, Thomas and Ramachandran Ramanan, 1994, Bond Ratings, Debt insurance, and Hospital Operating Performance, *Health Care Management Review* 19, 64–73.

Quigley, John and Daniel Rubinfeld, 1991, Private Guarantees for Municipal Bonds: Evidence from the Aftermarket, *National Tax Journal* 44, 29–39.

Reiter, Kristin, John Wheeler, and Dean Smith, 2008, Liquidity Constraints on Hospital Investment When Credit Markets are Tight, *Journal of Health Care Finance* 35, 24–33.

Reiter, Sara and David Zeibart, 1991, Bond Yields, Ratings, and Financial Information: Evidence from Public Utility Issuers, *Financial Review* 26, 45–73.

Rodney, G. Thompson and Peter Vaz, 1990, Dual Bond Ratings: A Test of the Certification Function of Rating Agencies, *Financial Review* 25, 457–471.

Rubin, D., 1974, Estimating Causal Effects of Treatments in Randomized and Non-Randomized Studies, Journal of Educational Psychology 66, 688–701.

Rubin, D., 1978, Bayesian Inference for Causal Effects, The Role of Randomization. Annals of Statistics 6, 34–58.

Shen, Yu-Chu, Karen Eggleston, Joseph Lau, and Christopher Schmid, 2007, Hospital Ownership and Financial Performance: What Explains the Different Findings in the Empirical Literature?, *Inquiry* 44, 41–68.

Sorensen, Eric, 1979, Negotiated Municipal Underwritings: Implications for Efficiency, *Journal of Money, Credit, and Banking* 11, 366–370.

Stewart, Louis and Pamela Smith, 2011, An Examination of Contemporary Financing Practices and the Global Financial Crisis on Nonprofit Multi-Hospital Health Systems, *Journal of Health Care Finance* 37, 1–24.

Stover, Roger, 1996, Third-Party Certification in New Issues of Corporate Tax-Exempt Bonds: Standby Letter of Credit and Bond Rating Interaction, *Financial Management* 25, 62–70.

Viscusi, W. Kip, 1978, A Note on "Lemons" Markets with Quality Certification, *Bell Journal of Economics* 9, 277–279.

White, Lawrence, 2010, The Credit Rating Agencies, *Journal of Economic Perspectives* 24, 211–226.

Wu, Chunchi, 1991, A Certainty Equivalent Approach to Municipal Bond Default Risk Estimation, *Journal of Financial Research* 14, 241–247.

Yan, Wenli and Dwight Denison, 2009, Revenue Structure and Nonprofit Borrowing, *Public Finance Review* 37, 47–67.

Yawitz, Jess, Kevin Maloney, and Louis Ederington, 1985, Taxes, Default Risk, and Yield Spreads, *Journal of Finance* 40, 1127–1140.

Ziebell, Mary and Mary Rivers, 1992, The Decision To Rate or Not Rate: The Case of Municipal Bonds, *Journal of Economics and Business* 44, 301–316.

Figure 1. Total number of new municipal bond issues in counties

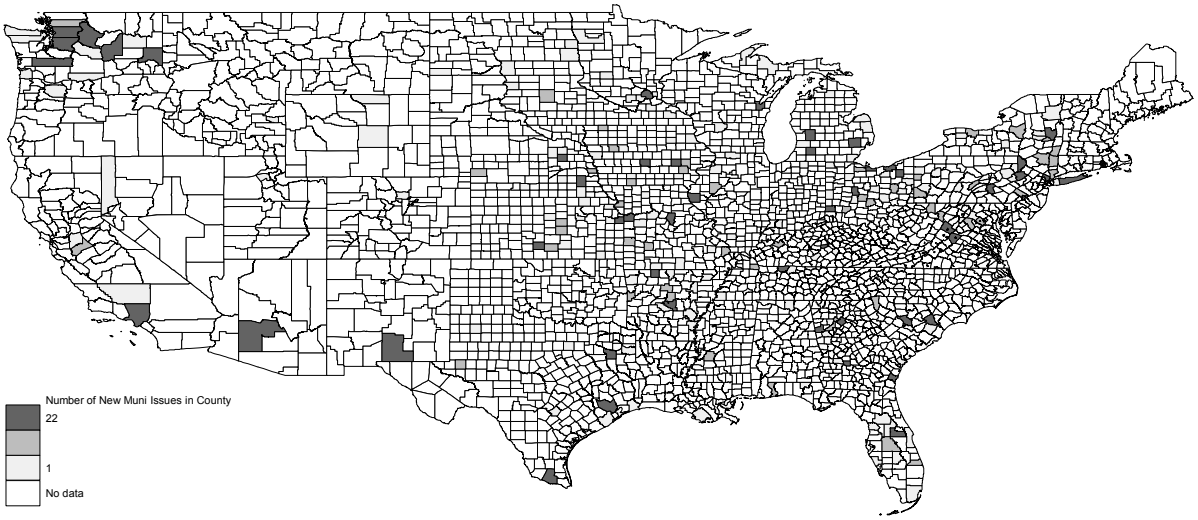

Figure 2. Time-series plot of bond issuer (hospitals) characteristics

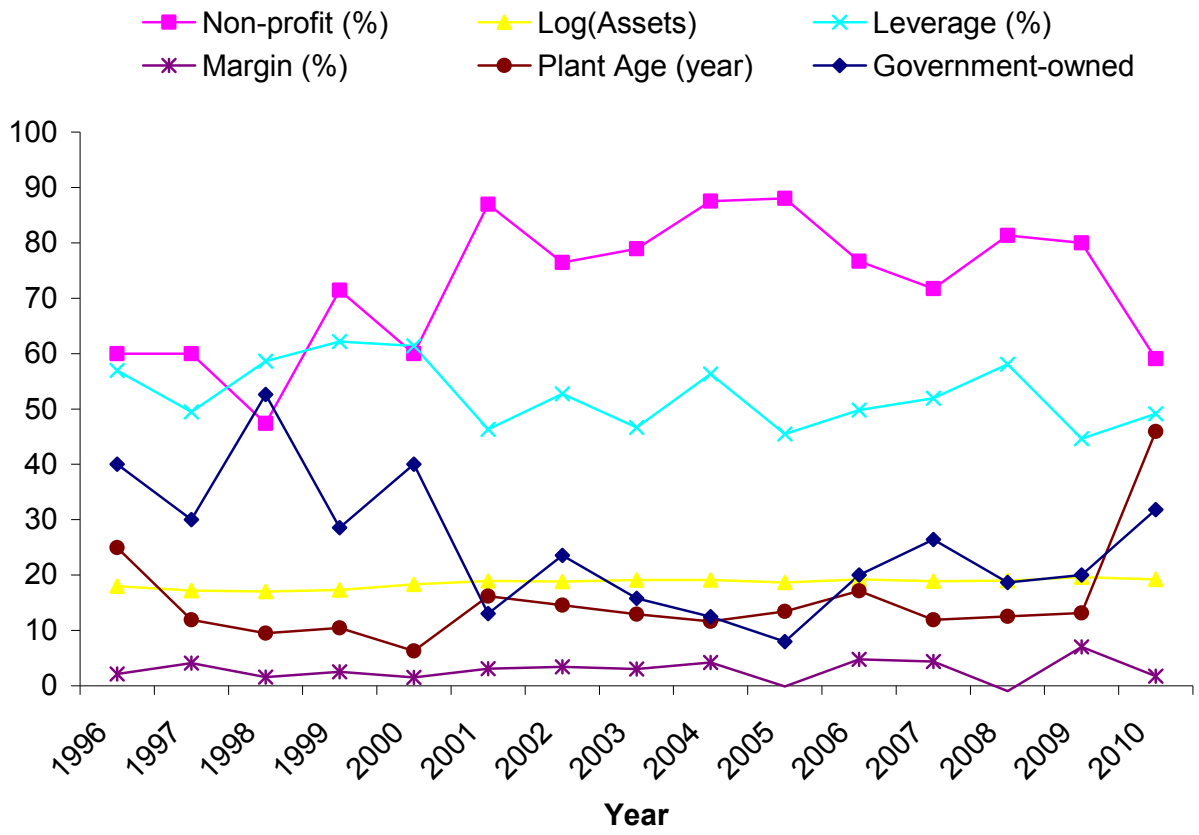

Figure 3. Time-series plot of bond characteristics (issue amount, maturity, gross spread, tax-exempt bond, and yield-to-maturity)

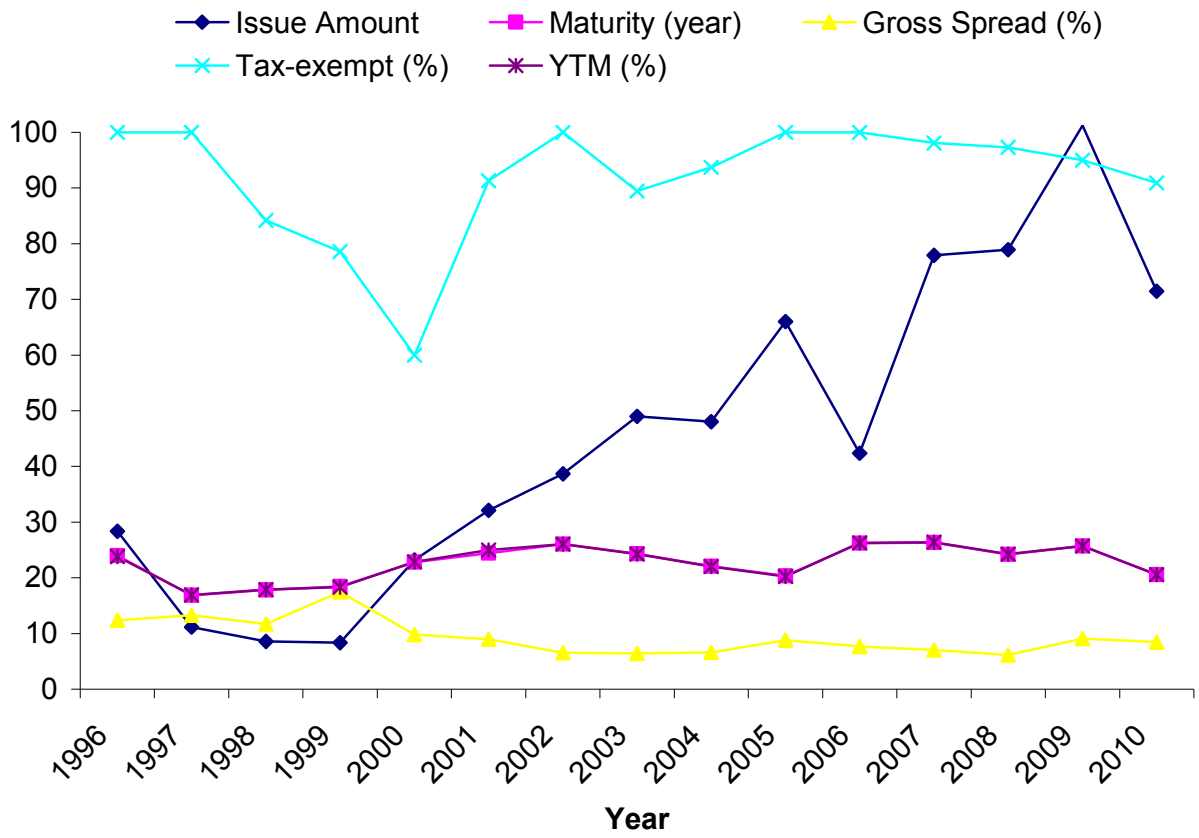

Figure 4. Time-series plot of bond characteristics (credit enhancement, callable bond, revenue bond, and sinking fund)

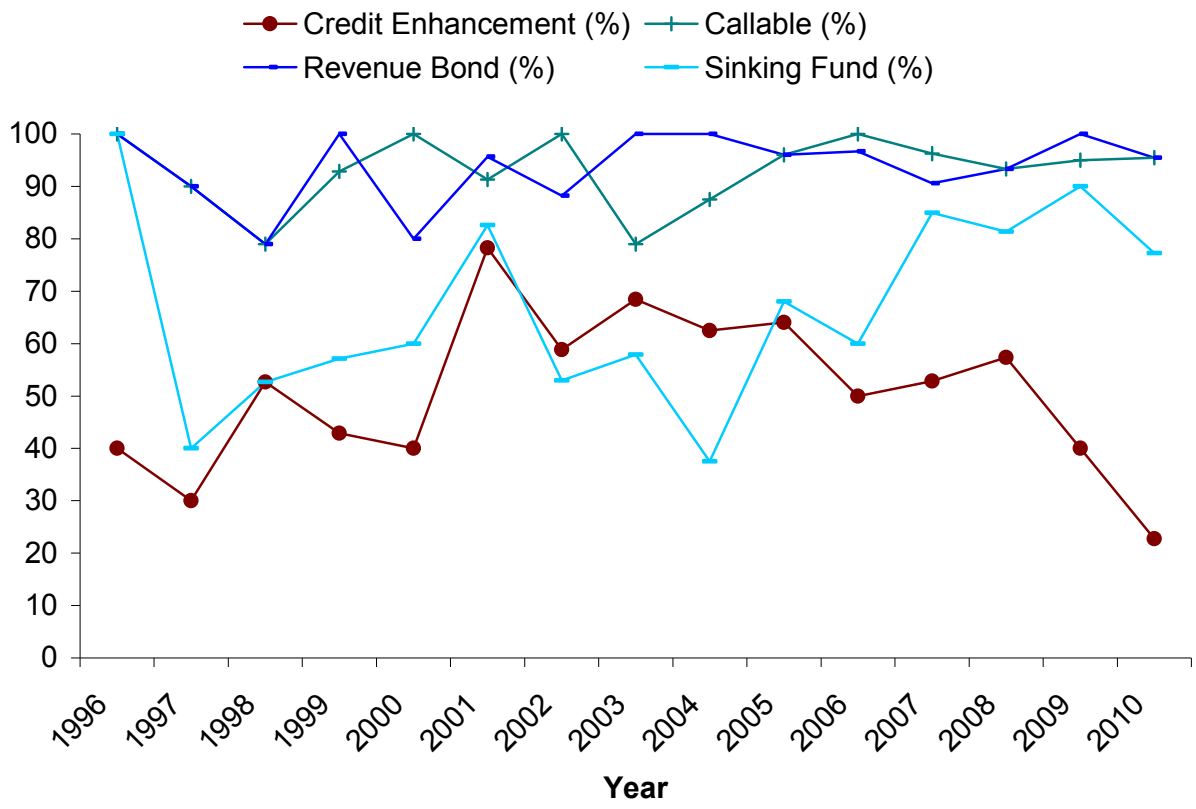

Table I. Numbers of rated and unrated municipal bonds issued in the U.S. from 2008 to 2012

Thomson Reuters SDC Platinum provides credit ratings of all newly issued municipal bonds from Fitch, Moody's and Standard & Poor's. A new issue is considered rated if it obtains a credit rating from any of the three rating agencies at the time of bond issuance.

Year	Total Issues	Rated Issues	Rated Issues in Percentage	Unrated Issues	Unrated Issues in Percentage
2008	14,244	5,829	41%	8,415	59%
2009	15,043	5,542	37%	9,501	63%
2010	16,849	5,074	30%	11,775	70%
2011	13,485	5,006	37%	8,479	63%
2012	15,987	5,456	34%	10,531	66%
All	75,608	26,907	36%	48,701	64%

Table II. Variable definitions and summary statistics

Variable	Type	Definition	Mean	Standard Deviation
Rating Decision	Dummy	1 if credit rating is obtained when issuing, 0 otherwise	0.73	0.44
log(Total Assets)	Scale	Natural log of total assets on the balance sheet	18.5	1.41
Leverage	Scale	Total debt divided by total assets	0.52	0.19
Profit Margin	Scale	Net income divided by gross revenue on the income statement	2.75%	8.77%
Liquidity	Scale	Current assets divided by current liabilities	2.99	2.97
Asset Age	Scale	The age of the fixed assets (year)	14.8	23.3
Issuance Amount	Scale	Total new bond issuance ($ million)	42.2	53.9
Maturity	Scale	Maturity of the new issue	22.1	8.45
Gross Spread	Scale	Underwrite fees (%)	8.86	5.81
Tax-exempt Bond	Dummy	1 if the bond is qualified as tax-exempt, 0 otherwise	0.95	0.23
Government-owned	Dummy	1 if the issuance is for a public hospital, 0 otherwise	0.26	0.44
Credit Enhancement	Dummy	1 if the bond has a credit enhancement, 0 otherwise	0.46	0.49
Yield to Maturity	Scale	Year to maturity of the new issue	23.5	13.4
Callable Bond	Dummy	1 if the bond is callable, 0 otherwise	0.81	0.39
Revenue Bond	Dummy	1 if the new issue is revenue bond, 0 otherwise	0.89	0.31
Sinking Fund	Dummy	1 if the bond has a sinking fund set aside, 0 otherwise	0.53	0.49

Table III. Correlation matrix

	Rating Decision	log(Total Assets)	Leverage	Profit Margin	Liquidity	Asset Age	Issuance Amount	Maturity	Gross Spread	Tax-exempt Bond	Government-owned	Credit Enhancement	Yield to Maturity	Callable Bond	Revenue Bond
log(Total Assets)	0.519														
Leverage	-0.182	-0.237													
Profit Margin	0.138	0.168	-0.162												
Liquidity	0.099	0.120	-0.419	0.111											
Asset Age	0.023	0.036	-0.177	0.000	-0.051										
Issuance Amount	0.287	0.435	-0.031	0.005	0.019	0.103									
Maturity	0.185	0.359	-0.047	0.206	0.021	0.097	0.387								
Gross Spread	-0.605	-0.573	0.087	-0.068	-0.084	0.022	-0.356	-0.228							
Tax-exempt Bond	-0.038	0.092	0.014	-0.009	0.030	0.047	0.162	0.261	-0.050						
Governmental-owned	-0.161	-0.214	-0.018	-0.075	0.139	-0.086	-0.211	-0.140	0.118	-0.140					
Credit Enhancement	0.460	0.172	-0.075	0.018	0.041	0.061	0.021	0.008	-0.443	-0.046	-0.052				
Yield to Maturity	0.188	0.363	-0.056	0.207	0.025	0.096	0.384	0.997	-0.228	0.245	-0.142	0.010			
Callable Bond	-0.028	-0.029	0.018	0.047	0.043	0.015	0.047	0.221	0.017	0.334	-0.015	-0.026	0.209		
Revenue Bond	0.012	0.131	-0.050	-0.017	-0.090	0.024	0.105	0.100	0.058	-0.009	-0.420	-0.099	0.095	0.023	
Sinking Fund	0.071	0.093	0.054	0.068	-0.025	0.051	0.266	0.317	-0.035	0.208	-0.028	-0.055	0.313	0.398	-0.035

Table IV. Determinants of rating decisions using logistic regression

The dependent variable is rating decision with 1 for receiving credit rating one of the three credit rating agencies and 0 for no rating. The independent variables include log total assets, financial leverage (debt to asset), profit margin (net income to revenue), liquidity (current ratio), asset age, bond issuance amount, maturity, gross spread, tax-exempt status, governmental hospital flag, credit enhancement flag, yield to maturity, callable flag, revenue bond flag, and sinking fund flag. Year fixed-effects are included in specifications (2) and (4). All specifications use logistic regression, and z-statistics are shown in the parentheses with ***, ** and * indicating its statistical significant level of 1%, 5% and 10% respectively.

Dependent Variable: Rating Decision	(1)	(2)	(3)	(4)
log(Total Assets)	1.104*** (3.797)	1.237*** (3.363)	1.267*** (4.097)	1.697*** (3.631)
Leverage	-1.693 (-1.013)	-3.311 (-1.477)	-3.188* (-1.730)	-4.759** (-2.066)
Profit Margin	4.188 (1.082)	-0.202 (-0.0472)	3.044 (0.728)	-0.705 (-0.171)
Liquidity	0.602** (2.303)	0.798** (2.119)	0.584** (2.066)	0.851** (2.069)
Asset Age			-0.0275** (-2.307)	-0.110** (-2.268)
Issuance Amount	0.0121* (1.793)	0.0120 (1.450)	0.0124* (1.843)	0.0127 (1.418)
Maturity	-0.0263 (-0.656)	0.0826 (1.436)	1.062 (1.492)	0.546 (0.480)
Gross Spread	-0.143** (-2.427)	-0.225*** (-2.582)	-0.138** (-2.280)	-0.207** (-2.236)
Tax-exempt Bond	-1.823 (-1.379)	-5.891** (-2.092)	-2.002 (-1.408)	-7.622** (-2.322)
Government-owned	-1.407** (-2.107)	-0.976* (-1.731)	-1.723** (-2.215)	-1.653* (-1.645)
Credit Enhancement	5.624*** (4.353)	6.169*** (4.212)	6.184*** (4.174)	7.048*** (4.147)
Yield to Maturity			-1.082 (-1.533)	-0.435 (-0.381)
Callable Bond			0.660 (0.499)	1.455 (0.796)
Revenue Bond			-1.287 (-0.998)	-1.283 (-0.857)
Sinking Fund			0.283 (0.389)	-0.914 (-0.839)
Year Fixed-Effects	No	Yes	No	Yes
N	353	353	353	353
Pseudo R-square	0.682	0.759	0.701	0.781
LR Chi-square Test	215.08***	228.12***	220.92***	234.53***

Table V. Determinants of rating decisions using probit regression

The dependent variable is rating decision with 1 for receiving credit rating one of the three credit rating agencies and 0 for no rating. The independent variables include log total assets, financial leverage (debt to asset), profit margin (net income to revenue), liquidity (current ratio), asset age, bond issuance amount, maturity, gross spread, tax-exempt status, governmental hospital flag, credit enhancement flag, yield to maturity, callable flag, revenue bond flag, and sinking fund flag. Year fixed-effects are included in specifications (2) and (4). All specifications use probit regression, and z-statistics are shown in the parentheses with ***, ** and * indicating its statistical significant level of 1%, 5% and 10% respectively.

Dependent Variable: Rating Decision	(1)	(2)	(3)	(4)
log(Total Assets)	0.594*** (3.649)	0.599*** (2.846)	0.696*** (3.963)	0.862*** (3.383)
Leverage	-0.813 (-0.879)	-2.019 (-1.532)	-1.490 (-1.519)	-3.261** (-2.306)
Profit Margin	1.176 (0.623)	-0.213 (-0.103)	0.385 (0.206)	-0.897 (-0.414)
Liquidity	0.346** (2.374)	0.353* (1.691)	0.370** (2.395)	0.367 (1.617)
Asset Age			-0.0103* (-1.766)	-0.0546** (-2.074)
Issuance Amount	0.00575* (1.699)	0.00493 (1.181)	0.00587* (1.717)	0.00492 (1.070)
Maturity	-0.0187 (-0.838)	0.0462 (1.421)	0.375 (1.248)	0.298 (0.458)
Gross Spread	-0.0607** (-2.062)	-0.114*** (-2.634)	-0.0488 (-1.599)	-0.0951* (-1.925)
Tax-exempt Bond	-0.414 (-0.500)	-2.786** (-2.462)	-0.316 (-0.375)	-3.061** (-2.259)
Government-owned	-0.642* (-1.844)	-0.580* (-1.727)	-0.906** (-2.247)	-1.098* (-1.942)
Credit Enhancement	2.453*** (4.914)	3.320*** (4.449)	2.543*** (5.070)	3.732*** (4.273)
Yield to Maturity			-0.394 (-1.317)	-0.248 (-0.380)
Callable Bond			0.217 (0.281)	0.619 (0.612)
Revenue Bond			-1.021 (-1.499)	-1.303 (-1.365)
Sinking Fund			0.292 (0.795)	-0.0836 (-0.150)
Year Fixed-Effects	No	Yes	No	Yes
N	353	353	353	353
Pseudo R-square	0.631	0.729	0.651	0.758
LR Chi-square Test	170.64***	185.62***	175.97***	192.73***

Table VI. Determinants of rating decisions using OLS regression

The dependent variable is rating decision with 1 for receiving credit rating one of the three credit rating agencies and 0 for no rating. The independent variables include log total assets, financial leverage (debt to asset), profit margin (net income to revenue), liquidity (current ratio), asset age, bond issuance amount, maturity, gross spread, tax-exempt status, governmental hospital flag, credit enhancement flag, yield to maturity, callable flag, revenue bond flag, and sinking fund flag. Year fixed-effects are included in specifications (2) and (4). All specifications use OLS regression, and z-statistics are shown in the parentheses with ***, ** and * indicating its statistical significant level of 1%, 5% and 10% respectively.

Dependent Variable: Rating Decision	(1)	(2)	(3)	(4)
log(Total Assets)	0.0653*** (3.770)	0.0623*** (3.561)	0.0679*** (3.810)	0.0618*** (3.442)
Leverage	-0.159 (-1.529)	-0.109 (-1.053)	-0.184* (-1.683)	-0.173 (-1.600)
Profit Margin	0.252 (1.243)	0.278 (1.366)	0.212 (1.030)	0.223 (1.084)
Liquidity	-0.000398 (-0.0603)	0.00145 (0.223)	-0.000975 (-0.144)	-0.000516 (-0.0781)
Asset Age			-0.000395 (-0.588)	-0.00137* (-1.926)
Issuance Amount	0.000548 (1.477)	0.000345 (0.912)	0.000478 (1.239)	0.000355 (0.915)
Maturity	-0.000468 (-0.179)	0.00182 (0.679)	0.000544 (0.0174)	-0.00106 (-0.0333)
Gross Spread	-0.0194*** (-4.624)	-0.0200*** (-4.616)	-0.0189*** (-4.381)	-0.0188*** (-4.247)
Tax-exempt Bond	-0.0700 (-0.776)	-0.120 (-1.320)	-0.0830 (-0.856)	-0.136 (-1.410)
Government-owned	-0.0694* (-1.699)	-0.0744* (-1.738)	-0.0883* (-1.864)	-0.0943** (-2.029)
Credit Enhancement	0.231*** (5.750)	0.241*** (6.010)	0.233*** (5.714)	0.256*** (6.244)
Yield to Maturity			-0.00147 (-0.0470)	0.00317 (0.0997)
Callable Bond			-0.00239 (-0.0271)	0.00486 (0.0556)
Revenue Bond			-0.0597 (-0.740)	-0.0484 (-0.606)
Sinking Fund			0.0503 (1.131)	0.0488 (1.087)
Year Fixed-Effects	No	Yes	No	Yes
N	353	353	353	353
Pseudo R-square	0.653	0.660	0.634	0.645
F-Test	176.85***	178.64***	171.47***	174.49***

Table VII. Altman's Z-scores

Section A. Distribution of Altman's Z-scores
Z-Score 1 or Z′-Score is estimated from the revised Z-Score model for private firms and Z-Score 2 or Z″-Score is estimated from the further revised Z-score model for non-manufacturing firms (Altman 2013).*

	Mean	Std. Dev.	10th Pctile	25th Pctile	50th Pctile	75th Pctile	90th Pctile
Z-Score 1 (Z′-Score)	1.911	1.889	1.015	1.267	1.558	2.012	2.894
Zones of Discrimination*			|←—— Distress —→|		←———— Gray ————→|		← Safe →|

* Distress zone: Z′<1.23, Grey zone: 1.23<Z′<2.9, and Safe zone: Z′>2.9

	Mean	Std. Dev.	10th Pctile	25th Pctile	50th Pctile	75th Pctile	90th Pctile
Z-Score 2 (Z″-Score)	3.156	4.871	0.556	1.581	2.522	3.820	5.179
Zones of Discrimination			|← Distress →|	←———— Gray ————→|		←———— Safe ————→|	

* Distress zone: Z″<1.22, Grey zone: 1.22<Z″<2.9, and Safe zone: Z″>2.9

Section B. Correlation between Altman's Z-scores and other variables

	Z-Score 1	Z-Score 2
Rating Decision	0.1114	0.1256
log(Total Assets)	0.0792	0.1456
Leverage	-0.4587	-0.4730
Profit Margin	0.1571	0.1880
Liquidity	0.8068	0.8354
Asset Age	0.1201	0.0718
Issuance Amount	0.1637	0.1676
Maturity	-0.0529	-0.0151
Gross Spread	-0.0914	-0.1232
Tax-exempt Bond	0.0050	0.0191
Government-owned	0.0399	0.0632
Credit Enhancement	0.0882	0.0989
Yield to Maturity	-0.0526	-0.0144
Callable Bond	0.0635	0.0635
Revenue Bond	-0.0683	-0.0841
Sinking Fund	0.0455	0.0468

Table VIII. Determinants of rating decisions with Altman's Z-Scores

The dependent variable is rating decision with 1 for receiving credit rating one of the three credit rating agencies and 0 for no rating. The independent variables include Z-Scores, log total assets, financial leverage (debt to asset), profit margin (net income to revenue), liquidity (current ratio), asset age, bond issuance amount, maturity, gross spread, tax-exempt status, governmental hospital flag, credit enhancement flag, yield to maturity, callable flag, revenue bond flag, and sinking fund flag. The main variables of interests are Z-Score 1 which is estimated from the revised Z-Score model for private firms and Z-Score 2 which is estimated from the further revised Z-score model for non-manufacturing firms (Altman 2013). All specifications use logistic regression, and z-statistics are shown in the parentheses with ***, ** and * indicating its statistical significant level of 1%, 5% and 10% respectively.

Dependent Variable: Rating Decision	(1)	(2)	(3)	(4)
Z-Score 1	1.384*** (3.632)	1.416*** (3.532)		
Z-Score 2			0.326*** (3.138)	0.423*** (3.491)
log(Total Assets)	1.372*** (4.563)	1.441*** (4.118)	1.169*** (4.158)	1.270*** (3.710)
Asset Age	-0.0351** (-2.355)	-0.0358** (-2.399)	-0.0261** (-2.382)	-0.0304** (-2.350)
Credit Enhancement	6.176*** (4.280)	6.160*** (4.190)	5.666*** (4.113)	6.209*** (4.050)
Gross Spread	-0.120** (-2.323)	-0.112** (-1.996)	-0.141** (-2.634)	-0.109* (-1.846)
Government-owned	-1.232** (-1.965)	-1.379** (-1.970)	-1.631** (-2.624)	-1.569** (-2.211)
Issuance Amount		0.000964 (0.157)		0.00937 (1.409)
Maturity		0.505 (0.651)		0.775 (1.131)
Tax-exempt Bond		0.503 (0.328)		-0.427 (-0.290)
Yield to Maturity		-0.520 (-0.675)		-0.812 (-1.193)
Callable Bond		-0.186 (-0.136)		-0.131 (-0.097)
Revenue Bond		-1.025 (-0.768)		-0.952 (-0.745)
Sinking Fund		0.544 (0.788)		0.780 (1.111)
N	353	353	353	353
Pseudo R-square	0.653	0.660	0.631	0.653
LR Chi-square Test	176.85***	178.64***	170.58***	176.78***

Table IX. Difference-in-difference regressions of public-to-private conversion

We consider the conversion from public (federal, state or local) to private (for-profit or non-profit) ownership of a hospital as an exogenous shock, and employ a matched-sample difference-in-differences (DiD) regression. Hospitals experienced conversions in year *t* are defined as the treatment group, and hospitals without conversions in year *t* are defined as the control group. The dummy variable *CONVERT* is set to one for converted hospitals and zero otherwise. The dummy variable *POST* is set to one if it is after the conversion event in year *t+1*, and zero otherwise. A third dummy variable *POST×CONVERT* is the cross-product of the previous two dummy variables. The dependent variable is the rating decision. We locate the matched hospital by identifying the universe of hospitals with the similar asset size and proximate geographic location. From the set of candidate hospitals, we select the one closest in size and distance to the treatment hospital as our match. The specification (1) uses OLS regression and (2) uses logistic regression. t-test is shown in the parenthesis with ***, ** and * indicating its statistical significant level of 1%, 5% and 10% respectively.

Dependent Variable: Rating Decision	(1)	(2)
POST	0.272 (1.611)	0.260 (1.388)
CONVERT	-0.126 (-1.146)	0.144 (-1.352)
POST ×CONVERT	0.435** (2.442)	0.537*** (2.945)
CONSTANT	-0.0587 (-0.556)	-0.275** (-2.357)
N	62	62
R-square	0.05	0.15
F-test	3.68	3.30