An Empirical Analysis of Municipal Bond Ratings for General Purpose Governments in New York State

Katherine List, George Palumbo, & Mark P. Zaporowski

INTRODUCTION

Creditworthiness, as reflected in bond ratings, is of great interest to municipalities since it directly affects the cost and ability to borrow money. Municipalities experiencing fiscal or financial stress are especially concerned about how these developments will impact their future bond ratings. It is well known that municipal analysts monitor a community’s economic health since this has an important impact on creditworthiness. What is less well known however, are the underlying factors that influence the bond rating process. As a dominant force in the municipal credit rating market, Moody’s Investors Service has been criticized for employing a process that lacks transparency, is not easily understood by professionals or the general public and yields lower ratings, and therefore higher borrowing costs for instruments with less risk of default than corporate bond equivalents. The purpose of this paper is to develop an econometric model of the rating process that identifies the economic, demographic, fiscal, governmental and financial factors that influence the perception of the probability of a municipality’s default. The model will allow municipal governments to gauge the impact of an observable set of factors on their credit ratings. It will also provide some basis for

anticipating changes in bond ratings that can affect the prices of bonds held in a variety of portfolios.

**Credit Rating Methodology**

In 2002, there were nearly 42,000 general obligation bond issues with credit ratings from Moody’s. Issuers apply for a rating by sending the rating agency an official statement with financial projections and audits. The issuer then either meets with or has a telephone interview with the agency to answer questions prepared by the agency’s lead analyst. Following the interview, a rating committee reviews the tentative rating that the lead analyst provides. The actual issuance of a rating requires that a contract be signed and that fees be paid to the agency by the municipality. This has led to considerable criticism about the validity of a rating process that is perceived by some to be little more than a fee for service relationship. In addition to initial ratings, the Moody’s website indicates that approximately ten percent of their ratings are adjusted to reflect fundamental changes in credit risk each year. It also maintains the Moody's Watchlist that indicates issues that are under review for possible upgrades or downgrades. The following discussion outlines the many factors that influence the perceived riskiness of a municipal bond.

**Economic & Demographic Factors**

Regional economic factors affecting credit analysis include: population trends, employment, income, industry composition, and property values. Per capita income is a key indicator of economic health in a region but can sometimes be misleading due to distortions from large non-working or low wage groups. The socioeconomic variables used in municipal analyses are assumed to reflect the resource base and service demands of the community.

Smith (1979) describes the importance of population trends in the economic analysis of a region since it governs the community’s capacity to produce and consume. Expanding populations may affect the composition of the labor force and the need for facilities and services. The migration
of unskilled workers, who might become dependent on public aid, can increase the fiscal strain on a government. The diversity of a community’s educational attainment, working status and income can also be used to measure potential economic contributions or needs for aid. Both ends of the age spectrum often require support from society because they consume but generally are not involved in wage paying production.

The level and trend in the personal income received by the inhabitants is an important indicator of a region’s economic health. Since wage and salary income is the dominant source of personal income, the level of employment in a community is linked directly to its economic well being. Additionally, high levels of unemployment can lead to a lower tax base as well as higher levels of government expenditures. Thus, a region is more susceptible to a credit default as the unemployment rate increases or as personal income falls.

Smith (1979) further suggests that the more diversified the industrial mix, the less vulnerable a community is to the adverse trends that may affect individual industries. If employment in a community is dominated by one or two industries, the region’s prospects will be inextricably linked to the prospects for those industries. It is not just the level of employment, or the earnings generated in that employment, but the stability of the employment and earnings stream that determines the economic stability of a region.

**Fiscal Factors**

The fiscal health of a municipality is related directly to the revenue it receives and the dollars it expends to provide services. The fiscal capacity of a community is in part, determined by the size of the bases that can be taxed. Local governments in the U.S. rely most heavily on property values, the level of sales, and wages or income as their principal tax bases. Both directly and indirectly, the level of earnings in a community affects the size of these bases and the tax revenues they can generate. Fees and charges, which can be collected for the provision of such services as water and sewerage treatment, housing, health care, utilities, and
transportation facilities, are an additional source of revenue for most local governments. As with tax collections, some of these revenue sources can be exported to consumers outside of the jurisdiction collecting the fees, but some part of the revenue generation depends upon the level of earnings and income within the local government area.

Another element of a community’s fiscal capacity is the aid it receives in the form of intergovernmental transfers. These transfers can be categorical or general, formula or project, matching or lump-sum. Their purpose can be to share revenue or to stimulate governmental activity. Whatever the reason for the grants, the recipient community’s ability to provide public services is affected and may result in diminished local contributions to pay for those services. State governments that mandate expenditure programs that the local governments must pay often pick-up part of the financing responsibility for these services. When recipient governments become overly dependent on intergovernmental revenue, they can have their creditworthiness compromised in two ways. The first is through the downgrading of the credit rating of the transferring government. It is difficult for a recipient government to be perceived as sounder than the government which provides 35 to 40 percent of the recipient government’s revenues. Secondly, if the aid flows are ad hoc in nature or are appropriated on an emergency basis, then they could be perceived as more easily interrupted than aid that is built into a formula and is viewed as ongoing. In addition, states can affect a local government’s revenue raising capacity through tax and debt limits.

DEBT & FINANCIAL FACTORS

In determining credit worthiness, it is imperative that an analyst determine whether or not the potential debt issue is manageable for the municipality based on its population, income, employment levels and property values. A few of the important debt variables for consideration in creditworthiness include: total direct debt, net direct debt and debt per capita. Total direct debt is defined as the sum of any short-term notes and is usually comprised of any general obligation debt outstanding. Net direct
debt is calculated by subtracting sinking funds, reserve funds and all debt that the municipality isn’t responsible for, out of the total direct debt. Much, though not all of this debt data was compiled by the Government Division of the U.S. Bureau of the Census in 2002.

Financial information for governmental units is often less comparable, reliable and available than corporate information because it is often not prepared in accordance with generally accepted accounting principles (GAAP).

**CRITICISM OF THE RATING PROCESS**

In the wake of the sub-prime housing market crisis that has had crippling effects on numerous financial institutions throughout the world, it is evident that a need exists to improve the transparency of the rating process for credit rating agencies such as Moody’s and Standard and Poor’s. These agencies have come under fire for assigning top (Aaa) ratings to collateralized mortgage obligations (CMO’s) that in a very short period of time were downgraded to junk status. These ratings, historically reserved for the least speculative of all securities, were in effect even as general purpose governments that had remarkably low historic default rates on general obligation bonds were carrying the lowest investment grade of Baa3. In an attempt to reduce borrowing costs, or even have access to the debt market, full-faith and credit instruments were issued with credit enhancements obtained through third party insurance companies. The combination of defaults on insured instruments and investment losses from the decline in the value of derivative securities held in their portfolios, led to reduced credit ratings for both the monocline insurers and the ratings of the issues that they insured.

Issuers of tax exempt bonds have raised the question of the reliability of the ratings process. American municipalities have been placed in jeopardy since as many as two-thirds of their underlying general obligation bond issues have been enhanced by the Aaa ratings of the insurance companies. Municipal government officials are wary of the impact that the massive write-offs by financial institutions and the undercapitalization of
insurers have had on their own ability to bring investment grade issues to market. As of this writing, no monoline municipal bond insurer retained its Aaa credit rating from Moody’s.

The transparency, or lack thereof, of the ratings of the most secure and least complicated type of government debt issuance, the general obligation bond, is examined below. If one can establish a link between those factors said to be determinants of the creditworthiness of a municipality and the resultant credit rating, it lays to rest the idea of bias in the rating process. Additionally, it provides an expectation set for governments that desire to purchase a credit rating for a new issue, and thus, through parity, for all of its outstanding unenhanced debt issues. Finally, for those that desire to follow the creditworthiness of general obligation bonds in the secondary market with an eye to anticipate changes in the underlying creditworthiness of issuing governments, a predictive model could provide guidance to future upgrades or downgrades.

Analysis of the credit rating process for bonds issued by state and local governments dates back to Carleton and Lerner (1969) and Bahl (1971). Rubinfeld (1973), Liu and Thakor (1984), Capeci (1991) and more recently Johnson and Kriz (2005) have demonstrated an independent effect of Moody’s credit ratings on debt yields and borrowing costs. Thus, even when economic, demographic and financial factors are included as independent variables, markets identify an independent effect from differential credit ratings. This independent effect alone justifies a separate analysis of the determinants of credit ratings.

THE NATURE OF MUNICIPAL SECURITIES

Municipal bonds are financial instruments that state and local governments rely on to provide such services as electric power, housing, transportation, education, hospitals, economic development and pollution control. A unique characteristic of municipal bonds is that the interest income they provide their holder is exempt from Federal income taxes. Those who face high marginal income tax rates are the most common investors in municipal bonds. High income individuals, mutual funds, and property
and casualty insurance companies comprise the groups best able to take advantage of the tax exempt status of these securities. The data from the Federal Reserve shown in Table 1 (Temel, 2001) illustrates the percentage of municipal bonds held by each category of investor for the years 1980, 1989 and 1999.

The percentages of highest ownership shifted from primarily commercial banks in 1980 to households and mutual funds in 1999. Temel (2001) suggests that this was due to changes in federal tax laws. Beginning in 1982, commercial banks were allowed to deduct only a fraction of the interest paid on debt incurred to purchase or carry tax-exempt securities. The Tax Reform Act of 1986 (TRA) effectively eliminated this interest expense deduction. The TRA also caused a decline in the willingness of property and casualty insurance companies to hold municipal securities since it imposed an Alternative Minimum Tax (AMT) on corporations. The impact of the AMT on corporate behavior involved a change in the method of calculating book income, which required corporations to include tax exempt interest in reported profits (Kelty, 1987). This resulted in a twenty percent corporate minimum tax on municipal bond interest. Since taxable and tax-exempt bonds exhibit significant differences in their yields, commercial banks realized they could receive higher after-tax returns from other taxable investments (Eng, 1992).

<table>
<thead>
<tr>
<th>Category</th>
<th>1980</th>
<th>1989</th>
<th>1999</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households</td>
<td>26.2</td>
<td>48.2</td>
<td>35.0</td>
</tr>
<tr>
<td>Mutual fund totals</td>
<td>1.6</td>
<td>15.9</td>
<td>33.7</td>
</tr>
<tr>
<td>Bank personal trusts</td>
<td>6.5</td>
<td>6.4</td>
<td>5.8</td>
</tr>
<tr>
<td>Commercial Banks</td>
<td>37.3</td>
<td>11.8</td>
<td>7.2</td>
</tr>
<tr>
<td>Property &amp; casualty insurance companies</td>
<td>20.2</td>
<td>11.9</td>
<td>13.7</td>
</tr>
<tr>
<td>Other</td>
<td>8.3</td>
<td>5.8</td>
<td>4.6</td>
</tr>
</tbody>
</table>
The increase in municipal bond holdings by mutual funds may account for the dramatic increase in third party enhancements for bonds that were supported by the full faith and credit of the issuing governments. A municipal bond fund that labeled itself as investing only in triple A rated securities could differentiate itself from funds that held bonds of higher inherent creditworthiness without the enhancements. The movement of municipals into this type of retail market could explain the desire of single A rated governments to buy insurance that would enable them to sell bonds at prices not significantly different from the average of single A rated instruments (Palumbo & Sacks, 1986).

Despite the much publicized defaults of New York City in 1975 and Orange County California twenty years later, there have been remarkably few defaults of general obligation bonds since the 1930’s. Indeed, Moody’s set the historic probability of a default of any investment grade municipal bond at .0651% in 2006; while claiming there have been no material payment defaults on general obligation bonds rated by Moody’s since 1970.

**The Bond Rating Model**

Moody’s history of bond rating dates back to 1919. Since Moody’s has dominated the tax-exempt bond rating market, its credit ratings will be analyzed in this paper. The ratings assigned by Moody’s to bond issues in this analysis range from highest quality (Aaa) with the lowest probability of default to the lowest quality (Ba) with the highest probability of default. The ratings that qualify a bond as investment grade are: Aaa, Aa, A, Baa and very few Ba, with gradations within each class of 1, 2 or 3. This rating scheme yields a total of twelve rating categories. Insured bonds include enhancements and guarantees from third parties that raise the credit rating and complicate the process of identifying the underlying credit rating of the issuing government. Consequently, this paper examines only the underlying credit ratings of general obligation bonds before insurance enhancements. Equation (1) relates the various economic, fiscal and financial variables to the underlying rating that Moody’s issued ($Y_i$) for a cross section of municipal bonds,
An Empirical Analysis of Municipal Bond Ratings

\[Y_i = \beta_0 + \beta_1MVH_i + \beta_2CUR_i + \beta_3PC_i + \beta_4CEPW_i + \beta_5DTRR_i + \beta_6DC_i + \beta_7DT_i + u_i\]  

(1)

where:
MVH\(_i\) = median value of housing in municipality \(i\)
CUR\(_i\) = unemployment rate in 2002 for the overlying county in municipality \(i\)
PC\(_i\) = change in population from 1990 to 2000 in municipality \(i\)
CEPW\(_i\) = 2001 earnings per worker for the overlying county in municipality \(i\)
DTRR\(_i\) = the ratio of debt to total revenue in 2002 in municipality \(i\)
DC\(_i\) = 1 if municipality \(i\) is a city and is 0 otherwise
DT\(_i\) = 1 if municipality \(i\) is a town or village and is 0 otherwise.

The error term, \(u_i\) is assumed to be independently and identically distributed with constant variance and the \(\beta_i\)'s are parameters to be estimated.

The coding of the underlying rating issued by Moody’s is shown in Table 2. Smaller values of the dependent variable imply higher creditworthiness and a lower probability of default. A negative value for an estimated coefficient would therefore indicate a direct relationship between the explanatory variable and credit quality while a positive coefficient indicates an inverse relationship between the explanatory variable and credit quality.

The coefficients on the median value of housing (MVH) and 2001 county earnings per worker (CEPW) are expected to be negative since they are indicators of the economic health of a community. *Ceteris paribus*, when people are earning higher wages, they contribute to a more financially stable municipality via an enhanced tax base. A high wage earning municipality should have better creditworthiness and lower probability of default. MVH reflects the median value of housing in an area. It is assumed that there is a direct linkage between housing values, property values, assessed values and property taxes. This measure ignores the property taxes generated from non-residential property, but it is felt that earnings per worker in part, will reflect non-residential property values. The New York State municipalities that increase their tax
base and have higher property tax revenues will be more economically stable and have higher creditworthiness.

The coefficient on the population variable (PC) is also expected to have a negative coefficient since an increasing population implies an expanding tax base that will improve the government’s ability to repay debt, lowers risk, and produce a higher credit rating.

The coefficients on CUR, the 2002 county unemployment rate, and DTRR, the debt to total revenue ratio, are both expected to be positive. Higher unemployment rates imply less people earning wages, lower tax collections and a higher risk of default. DTRR is defined as the ratio of debt to total revenue which is comprised of tax payments, intergovernmental aid, fees and charges, utility revenue (if the municipality operates their own electric or water system), and insurance and pension fund revenue. A higher debt to total revenue ratio indicates a greater commitment to other creditors and an increased probability of default on the level of outstanding debt (Palumbo, Shick and Zaporowski, 2006).

**Table 2.**

<table>
<thead>
<tr>
<th>Value of Y</th>
<th>Underlying Bond Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aaa</td>
</tr>
<tr>
<td>2</td>
<td>Aa1</td>
</tr>
<tr>
<td>3</td>
<td>Aa2</td>
</tr>
<tr>
<td>4</td>
<td>Aa3</td>
</tr>
<tr>
<td>5</td>
<td>A1</td>
</tr>
<tr>
<td>6</td>
<td>A2</td>
</tr>
<tr>
<td>7</td>
<td>A3</td>
</tr>
<tr>
<td>8</td>
<td>Baa1</td>
</tr>
<tr>
<td>9</td>
<td>Baa2</td>
</tr>
<tr>
<td>10</td>
<td>Baa3</td>
</tr>
<tr>
<td>11</td>
<td>Ba1</td>
</tr>
<tr>
<td>12</td>
<td>Ba2</td>
</tr>
</tbody>
</table>
The data used in this paper has been compiled from sources which include: the 2000 Census, the 2002 Census of Governments and Moody’s. The data is restricted to New York State counties, cities, towns and villages, and school districts. Since we were unable to find reliable data on school district population, school district bond issues are omitted from this analysis. This leaves 230 bonds issues to include in the estimation of the parameters in equation (1). A number of potentially useful economic and demographic factors, such as employment concentration and economic base diversity are not included in this analysis due to the fact that they are not available on a consistent basis for cities, towns and county level governments. The two dummy variables, DC and DT, are included in order to compare the relative riskiness of city, and town and village issues to that of counties.

**Empirical Results**

The discrete ordered nature of the dependent variable makes logistic regression the appropriate estimation technique for equation (1). Since estimating the model via logistic regression produced results almost identical to those using Ordinary Least Squares (OLS), we present only the OLS results since they are much easier to interpret.

The estimated coefficients of equation (1) are shown in Table 3. All of the estimated coefficients were of correct sign. The coefficients on DTRR and the dummy variable DT are the only coefficients not statistically different from zero at the 5 percent level of significance. The remaining coefficients are all significantly different from zero at the one percent level of significance or better. The coefficient of determination ($R^2$) indicates that 51.5 percent of the variation in the underlying bond credit rating is explained by the independent variables included in the model.

The estimated coefficient on MVH indicates that *ceteris paribus*, a thousand dollar increase in the median housing value in a community results in a .00599 unit decrease in the dependent variable. This decrease represents an appreciation in the creditworthiness of the bond issue and a lower probability of default.
The coefficient on the variable CUR implies that a one percentage point increase in the unemployment rate of the underlying county results a .424 unit increase in the dependent variable, holding the other explanatory variables constant, indicating an increase in perceived riskiness of the municipality’s debt issue. The coefficient on the population change variable (PC) was negative as expected. *Ceteris paribus*, a community that has experienced a thousand person inflow is met with a .000782 unit decrease in the dependent variable, lowering the probability of default. The coefficient on CEPW is –.000045 which implies that a thousand dollar increase in a municipality’s earnings per worker will reduce the value of the dependent variable by .045 units, lowering the riskiness of the bond issue.

The coefficient on DTRR is .279 but since its standard error is large, we are only able to conclude statistical significance at the 7.7 percent level. *Ceteris paribus*, a one unit increase in DTRR will increase the value of dependent variable, thereby increasing the probability of default.

The coefficient on the city dummy variable, DC, is different from zero at the 1 percent level of significance but the coefficient on the town and
An Empirical Analysis of Municipal Bond Ratings

village dummy, DT, is different from zero at only the 8.2 percent level of significance. Since counties are the omitted category, the relative magnitude of these coefficients indicates that cities are riskier than either counties or towns and villages. A joint test of the significance of the coefficients on the dummy variables resoundingly rejected the null hypothesis that they are jointly zero at the 1 percent level of significance.

**CONCLUSION**

Several variables were identified that reflect a municipality’s economic strength and fiscal health. Since each variable is readily available to the general public, they could be easily monitored and analyzed in the context of the model to predict whether a rating change might occur. In the wake of the recent mortgage-backed security crisis and the associated problems that the credit crisis has caused the monoline municipal insurers, a transparent bond rating process is valuable to both investors and issuers of municipal bonds.

The model presented in this paper explains over half of the variation in ratings of the full faith and credit debt of general purpose governments in New York State. Additionally, strong and appropriate relationships have been identified for a set of economic, demographic, governmental, fiscal and financial factors. All data is non-proprietary and available in the public sector. General purpose governments with higher population growth rates, higher median value housing, and higher earnings per worker are generally perceived to be more creditworthy. Similarly, governments with higher unemployment rates and debt to total revenue ratios had lower credit ratings. While the empirical results generally support the concept of a transparent ratings process, it is interesting to note that city and town governments with the same economic, fiscal and financial characteristics as county governments had lower credit ratings. This last finding could indicate a bias on the part of the rating agencies against these municipalities.

This analysis was limited to general purpose governments in New York State. The existence of towns in the sample precluded an in depth
analysis of the effects of diversity in the economic base and employment concentrations on creditworthiness. Further research expanding the sample beyond New York State, but limiting it to central cities and counties, would enable the analyst to identify these effects as well as the impact of state government policy on local government credit ratings.
REFERENCES


