Credit Ratings and the Market for General Obligation Municipal Bonds

Daniel L Rubinfeld, Berkeley Law

Available at: https://works.bepress.com/daniel_rubinfeld/57/
CREDIT RATINGS AND THE MARKET FOR GENERAL OBLIGATION MUNICIPAL BONDS

by

DANIEL RUBINFELD

Reprinted from
NATIONAL TAX JOURNAL
March, 1973, Vol. XXVI, No. 1
CREDIT RATINGS AND THE MARKET FOR GENERAL OBLIGATION MUNICIPAL BONDS

DANIEL RUBINFELD*

ABSTRACT

A model of the general obligation municipal bond market provides for an analysis of the credit rating process and for a test of the assumption that credit ratings affect municipal borrowing costs. It is found that published credit ratings do have an effect on municipal yields which is independent of the market's evaluation of the financial status of the rated communities. For this reason, the potential discriminatory behavior of rating agencies is worthy of considerable attention.

Introduction

In late 1967 and 1968 the Subcommittee on Economic Progress of the Joint Economic Committee in Congress held hearings on the credit rating of municipal bonds. These hearings appear to have been spurred by protest following Moody's July 1965 decision to lower New York City's credit rating from A to Baa, the lowest of the four investment grade categories, and by criticism within the investment banking field itself. (Parenthetically, in December, 1972 Moody's raised New York City back to A.) The assumption upon which New York City's complaints and the ensuing Joint Economic Committee hearings were based was that credit ratings play an important part in determining the costs of borrowing for municipalities. This paper undertakes an econometric test of the assumption that credit ratings do affect yields on general obligation municipal bonds, and in the process provides an analysis of the credit rating process itself.

Section I includes a review of some of the relevant literature on the relationship between credit ratings and market yields. The second section describes a three equation model of the municipal market necessary to the econometric tests which follow. In section III the credit rating process is analyzed, while the test of whether or not ratings affect yields appears in section IV. Conclusions and suggestions for further research appear in the concluding section.

I. Review of the Literature

Numerous studies of yield spreads are available in the existing literature. White's rating system implies a close relationship between ratings and market performance. In Robinson found that when market influences such as maturity are taken into consideration, there was an inverse relationship between yields and credit ratings. In a later econometric study, Charlotte Phelps estimated a linear relationship between parameters including the credit rating and the net interest cost to the borrower. From her coefficients she obtained estimates of the relevant interest cost differentials. However, none of the above studies (along with others not mentioned here) attempt to deal with the causal question of whether ratings actually affect market yields.

The issue of causality is, of course, an important one. Any study of the impact of credit ratings becomes very difficult because it is known that ratings are not accepted without some criticism and additional research. Thus, yield differentials may be due in part to the influence of published ratings and in part to the effect of the market's separate analysis of the creditworthiness of the issuer. The "market rating" as Jant-

*Assistant Professor, Department of Economics, Research Associate, Institute of Public Policy Studies, The University of Michigan.

†The author wishes to thank Franklin M. Fisher, Jerome Rothenberg, Myron Scholes, and Martin Feldstein for their helpful comments. Jackson Phillips of Moody's Investors Service and Robert King of the Securities Industries Association provided assistance in gathering much of the data used in the study. Work was completed while under an NSF dissertation fellowship. Computer work was accomplished on the XSTAT software package of Dynamics Associates, Cambridge, Massachusetts.

1[15].
2[10].
3[8].
scher4 calls it, is likely to be very highly correlated with the published rating. The problem becomes increasingly difficult when one focuses on the dynamic nature of the bond market. A rating change in the form of a published letter change by Moody's or Standard & Poor's can be in part a response of the rating agency to past conditions in the market, or it can serve to spur a change in the market leading to either short run or long run yield changes.

One suitable way to view this question is to see the published ratings as carriers of information. If published ratings were completely correlated with the market ratings, then one could not say that published rating changes affect market yields. Rather, the rating agencies would be mirroring the responses that the market would make, even if rating agencies did not exist. A more realistic picture of the market is that rating agencies in part mirror the views of the market, but that rating agencies also act independently of the market. When a published rating change occurs, the market is likely to respond in the short run purely because it is willing to take into account the information provided to it by the rating agencies. Many investors may, in fact, be willing to take a credit rating as a final measure of bond quality and not concern themselves with changes in the underlying financial characteristics of the community.

Their response to a rating increase may be sufficient to lower bond yields for a period of months at least. Underwriters are likely to be more quality conscious and are most probably responsible for the existing quality differentials within rating classes. If underwriters, upon careful analysis, decide that the rating increase was not consistent with conditions in the community, then it is conceivable that the market may readjust its position in either direction.

This is certainly a plausible outcome, given the kind of detailed research carried out by the major underwriters. On the other hand, one must keep in mind that to a large extent the underwriters' demand for new issues is a derived demand, dependent upon the underlying investors' demand. If investors are naive about published ratings, then underwriters must respond accordingly. It is clear, in any case, that a complete answer to the question of the effect of rating changes on yields must involve a study of yields over time. Such complete evidence will not be provided in the analysis completed in this paper, but information of this type is available in the study by Jantscher.6

Jantscher's study involves the pooling of time series and cross-section data on yields of communities that have undergone rating changes. He is aware of the problem that a rating change may be in part a response to previous conditions in the community and in part may have a separate effect on new issue yields. By comparing borrowing costs of communities undergoing rating changes at a given point in time to those remaining unchanged, Jantscher concludes that communities' borrowing costs are strongly affected by published rating changes. However, Jantscher also concluded that borrowing costs for communities with the same rating differ in a manner which is systematically related to whether a community is to undergo a rating increase or decrease. In other words, the market yield to some extent reflects underlying conditions in advance of any published rating change.

Jantscher's study is a valuable contribution to the literature, but several difficulties remain. Jantscher's study (and the present one) does not explicitly consider an alternative hypothesis. If rating agencies are, in fact, acting as information services for the municipal market, then one might suppose that rating agencies look at yields in previous periods very closely. When the yield of an issue gets near the tail of the distribution of all yields within the rating class, then the published rating is changed accordingly. If this hypothesis is true, then the conclusions concerning the effect of a rating change on the borrowing costs of a community may be misleading. In this case, rating changes have no effect on the market themselves. Rather, they respond to valuations of quality differences already made by the market. Rating agencies claim that such

4[6] Jantscher's study improves substantially upon most of the previous literature because Jantscher is acutely aware of the causality issue.

6[6].

6[6], p. 15.
an hypothesis is not consistent with their behavior, although it is difficult to believe that rating analysts would not be responsive to conditions in which market yields for a community's issues were way out of line with market yields for most issues within a rating class.

Because Jantscher does not analyze the way in which rating agencies actually rate communities he is not in a position to attempt to completely separate out the effects of published rating changes from market ratings. Such an attempt is made in section V of this paper.

II. A Model of the Municipal Market

This section presents a model of the market for municipal bonds which will make possible a test of the effect of published credit ratings on offering yields of general obligation municipal issues. Briefly, the municipal market works in the following manner. When the intention of communities to borrow is announced, bids from underwriters are submitted. Commercial banks and private underwriting companies handle almost all of the bids. The empirical work to be described is concerned only with competitive bids in which the underwriter bidding the lowest net interest cost to the community is selected to handle the new issue.7 Almost all new issues are allocated by a competitive bidding process of this type. Once the underwriter has been selected, the underwriter must set the spread on the issue in question and reoffer it to the market. The offering and spread processes are not independent, since the underwriter's bidding strategy depends upon considerations of spread, coupon structure, etc. as well as the general factors which determine the price at which new issues can be reoffered. The general structure of the model is described below, with the definition of the variables in the model following.

(1) Offering Equation

\[ \text{INT} = f_1(\text{BID, AMT, MAT, INX, RANG, INP, CALL, X, RATING}) \]

7Net interest cost is simply a weighted average of interest coupons, where the weights are based upon the maturities of the individual bonds within a serial issue. Discounting is not used in the calculation of net interest cost.

(2) Underwriting Spread Equation

\[ \text{SPREAD} = f_2(\text{BID, AMT, MAT, INX, INP, CALL, RANG, TOTAL, RATING}) \]

(3) Credit Rating Behavioral Equation

\[ \text{RATING} = f_3(X) \]

Variables in the Model

\[ \text{INT} = \text{net interest cost of the new issue in basis points} \]

\[ \text{BID} = \text{number of bids in the offering process} \]

\[ \text{MAT} = \text{average maturity of the offering} \]

\[ \text{AMT} = \text{total amount of the issue in dollars} \]

\[ \text{INX} = \text{Bond Buyer weekly index of 20 Municipals on the day of offering or on the nearest date prior to offering} \]

\[ \text{INP} = \text{Bond Buyer weekly index one week prior to INX} \]

\[ \text{DDEL} = \text{average of INX and INP} \]

\[ \text{CALL} = \text{dummy variable equal to 1 if the issue was not callable and equal to 0 if callable (or if no information was available)} \]

\[ \text{RANG} = \text{range of the issue, equal to the number of years before all bonds within the offering will become due} \]

\[ \text{PROD} = \text{product of INX and log (MAT)} \]

\[ \text{TOTAL} = \text{total value of all outstanding issues of a community at the time of issue} \]

\[ \text{X} = \text{vector of community attributes (to be detailed in section III)} \]

\[ \text{RATING} = \text{a variable or group of dummy variables to represent the published rating by Moody's attached to the new issue} \]

The equation describing the determination of underwriting spreads is based on the
work of Reuben Kessel. Kessel's work is concerned primarily with the relationship between bids on competitive issues and the municipal market. In the process, Kessel estimates two equations, one determining underwriting spreads, and the other determining reoffering yields. These two equations serve to completely determine the offering behavior of the market. Kessel's study bears out the fact that rating changes can have effects on municipal yields, through both the offering process and the underwriting process. Because it is not central to the question at issue, the underwriting spread equation has not been estimated econometrically in this study.

The offering equation is worthy of careful consideration. The dependent variable is the net interest cost of the issue. One would expect that as the number of bids increase, the underwriting spread falls, and that reoffering yields also fall. This, of course, has implications for the offering process. One would expect that offering yields would be lower as the number of bids increase, and this is borne out by Kessel's work. Kessel also finds that call provisions add to the underwriting costs for general obligation bonds. It is likely for this reason alone that, other things equal, new offerings with call options will sell at higher prices and lower yields than offerings without call options. On a separate tack, given scale economies in the handling of new issue sales, one would expect, ceteris paribus, that larger issues could be sold at lower yields.

The level of interest rates was chosen as a simple measure of the market conditions facing the underwriters at the time of the bidding process. However, underwriters are more directly concerned with what the level of interest rates will be when the issue is reoffered than the rate at the time of bidding. Allowance for possible expectational effects was made by inclusion in the model of the variable DDEL, the average of the previous two weeks Bond Buyers indices.

The range of the issue and the maturity can have effects on net interest costs because issues with differing maturities sell at different yields in the market. The specific form that was chosen for the variables in the model was as follows. The range variable was included directly to take explicit account of the effect of maturity on yield. The sign of its coefficient was expected to be positive. A second variable PROD was included, PROD being the product of the level of interest rates and the logarithm of the average maturity of the issue. The logarithm of maturity is included because one would expect (in part on the basis of Kessel's and Jantscher's studies) that as maturities increase, yields increase, but the rate of increase declines with increasing maturity. The product of the two variables is included to take into account the fact that the rate of change of offering yields with respect to changes in maturities is also a function of the level of interest rates. The particular form chosen serves to reduce the differences between interest rates of issues with different maturities as interest rates rise.

Finally, the vector of community attributes X, and the rating variable are included in the offering equation. It is clear that underwriters look at the ratings when determining their bids for new issues. The specific choice of rating variable will be explained in section IV. The vector of community attributes is included in the equation because underwriters do examine the financial status of communities before they enter into the bidding process, and we wish to separate out the effect of the published rating from the effect of direct examination by the market of the vector of community attributes.

### III. Analysis of the Credit Rating Process

This section includes a statistical analysis of the methods by which credit ratings are determined. The primary goal is not to find a statistical procedure which will reproduce Moody's or Standard & Poor's ratings with some accuracy, but rather to determine those characteristics of the community which are important indicators of the ratings attached to the community. A study by Carleton and
Lerner\textsuperscript{10} and a followup study by Horton\textsuperscript{11} both use discriminant analysis techniques to develop a statistical scoring system that duplicates Moody's ratings. Their problem as posed is a straightforward classification problem, so that the application of multivariate discriminant analysis is logical.

In the general classical case, the problem of classification between four rating categories (Aaa, Aa, A, and Baa are the four highest Moody ratings) involves the evaluation of six distinct classification functions. This presents a practical difficulty for the researcher desiring to focus on the importance of the individual independent variables in credit classification. Arbitrary selection of a dummy variable taking four values, one for each rating category, is not suitable because the selection process forces an ordering on the ratings and on the 'distance' between rating categories. For these reasons, the regression model to be outlined below has been devised.\textsuperscript{12}

The rating process (for general obligation issues) is one that involves examination of a set of attributes or characteristics of communities. Analysis of these attributes leads the researcher to a ranking (ordinality is implicit) of communities. The choice of a single scalar index to represent creditworthiness is, of course, a restrictive choice, but will be taken as given here. The choice of the number of rating categories to represent the index involves further restrictions. In any case, the credit rating process ought to provide a single continuous index (or a step function to approximate it), defined over the vector of community attributes, which varies monotonically with the probability of default of a locality's outstanding debt.\textsuperscript{13}

Assume that the true relationship between a continuous variable $Y$ representing creditworthiness and a vector of community attributes $X$ is linear. However, the rating agency (Moody's in this study) selects four distinct regions of choice to get its Aaa, Aa, A and Baa ratings.\textsuperscript{14} One can estimate the credit rating equation using a single regression, if one estimates not only the coefficients of the independent variables, but also the parameters of the discrete version of the dependent variable. A normalization of the rating index is necessary, since any affine transformation of the regression model would leave all important statistical results unchanged. To assume that such an index was given would be to assume that gaps between rating categories were known, a priori.

The model to be considered is:

$$R = X\beta + \varepsilon$$

where $R$ is the creditworthiness index.

\[
R_i = \begin{cases} 
0 & \text{if rating is Baa} \\
\alpha_2 & \text{if rating is A} \\
\alpha_3 & \text{if rating is Aa} \\
1 & \text{if rating is Aaa} 
\end{cases}
\]

$N_1$ occurrences

$N_2$ occurrences

$N_3$ occurrences

$N_4$ occurrences

\textsuperscript{10}[10].

\textsuperscript{11}[5].

\textsuperscript{12}The details of the technique as well as a discussion of its usefulness appear in [11]. The econometric results which follow are similar in many ways (but different in some) to the results which would have been obtained if an arbitrarily indexed dummy variable had been regressed on the vector of attributes, as was done by Bash [1] and others.

\textsuperscript{13}The issue of what ratings are for and how they ought to be done will not be studied here. The only concern within the context of the model is how rating agencies actually behave. For a discussion of how ratings ought to be done and surrounding issues, see [11], [3], and [12].

\textsuperscript{14}Additional rating categories do exist, but none of the sample communities had a rating below Baa.
N is the number of communities in the sample. Ordinary least squares estimates of $a_0, a_3$ and $\beta$ were determined using the technique described in [11]. A sample of 128 communities (cities and towns) in the New England region and their Moody's ratings was studied during the 1970 period. The list of variables utilized is as follows:

**TABLE 1**

<table>
<thead>
<tr>
<th>Dep. Variable</th>
<th>DAA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indep. Variables</td>
<td></td>
</tr>
<tr>
<td>CONSTANT</td>
<td>53**</td>
</tr>
<tr>
<td>(09)</td>
<td></td>
</tr>
<tr>
<td>ADDN/AAV</td>
<td>-35*</td>
</tr>
<tr>
<td>(23)</td>
<td></td>
</tr>
<tr>
<td>AFV</td>
<td>0.0024*</td>
</tr>
<tr>
<td>($000,000)</td>
<td>(0.0016)</td>
</tr>
<tr>
<td>ADON</td>
<td>-0.028**</td>
</tr>
<tr>
<td>($000,000)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>AMFI</td>
<td>0.027**</td>
</tr>
<tr>
<td>($000)</td>
<td>(0.11)</td>
</tr>
<tr>
<td>AGROWS</td>
<td>-0.016**</td>
</tr>
<tr>
<td>(0.005)</td>
<td></td>
</tr>
<tr>
<td>ACOL</td>
<td>-0.049*</td>
</tr>
<tr>
<td>(0.033)</td>
<td></td>
</tr>
<tr>
<td>DST</td>
<td>-0.097**</td>
</tr>
<tr>
<td>(0.027)</td>
<td></td>
</tr>
<tr>
<td>DAA</td>
<td>-0.64**</td>
</tr>
<tr>
<td>(0.04)</td>
<td></td>
</tr>
<tr>
<td>DA</td>
<td>-0.55**</td>
</tr>
<tr>
<td>(0.04)</td>
<td></td>
</tr>
</tbody>
</table>

**= significant at the 5% level. 
**= significant at the 10% level.

The regression results are as listed in Table 1 (with standard errors in parentheses). The estimates of the rating index are $a_0 = .55$ and $a_3 = .64$, yielding a final credit index of 0, .55, .64, 1. The estimated indices were tested to be statistically different from one another. The specific values of the index should not be taken literally as a relative measure of the "gaps" between rating classes due to the limited number of observations in the Aaa and Baa categories. The fact that the ordinal index has turned out as expected is in itself reassuring. A better use for the estimated rating index is to provide the basis for a classification procedure by which bonds may be categorized, given observations for the vector of independent variables representing community characteristics. One can choose cut-off points between rating classes so as to minimize the expected cost of misclassification. Chart I describes the results of the classification process in which equal priors,
CHART 1
REGRESSION PROCEDURE

<table>
<thead>
<tr>
<th>Actual Rating</th>
<th>Aaa</th>
<th>Aa</th>
<th>A</th>
<th>Baa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaa</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predicted Aa</td>
<td>6</td>
<td>31</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Predicted A</td>
<td>13</td>
<td>51</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Predicted Baa</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>44</td>
<td>69</td>
<td>6</td>
</tr>
</tbody>
</table>

% of Observations Along Diagonal — 67

equal costs of misclassification, and equal standard deviations were assumed.\(^{17}\) As a test of the success of the entire regression and classification procedure, multiple discriminant analysis was utilized to classify the observations in the sample.\(^{18}\) The results appear in Chart 2. The regression procedure utilized here works amazingly well. Only one additional error of classification was made by the regression technique than was made by multiple discriminant analysis. In addition, no misclassification error of more than one category was made, while two such errors were made by multiple discriminant analysis.

Before returning to the estimation of the offering equation, some comments should be made concerning the nature of the regression results. The coefficient of the debt-to-actual assessed value variable is negative. This result is as one might expect because a higher level of debt relative to tax base is a possible signal of future debt payment difficulties. However, the measure of the tax base appearing in the variable is the actual assessed value, not the estimated full market value of the property tax base in the community. A variable representing the debt-to-full market value ratio was statistically insignificant in the same regression. Thus, it appears that Moody’s focuses too much attention on actual assessed value, despite the new public information concerning the biases which result from assessment practices.

The next two coefficients, attached to the assessed full value and aggregate overall net debt variables, were both significant. There is some question as to whether any aggregate measures of this sort should determine

CHART 2
MULTIPLE DISCRIMINANT ANALYSIS

<table>
<thead>
<tr>
<th>Actual Rating</th>
<th>Aaa</th>
<th>Aa</th>
<th>A</th>
<th>Baa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaa</td>
<td>5</td>
<td>8</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Predicted Aa</td>
<td>4</td>
<td>26</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Predicted A</td>
<td>10</td>
<td>53</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Predicted Baa</td>
<td>2</td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>44</td>
<td>69</td>
<td>6</td>
</tr>
</tbody>
</table>

% of Observations Along Diagonal — 68

credit ratings. After all, it is the relationship between debt service charges and overall cash inflows which relates to the likelihood of default.\(^{19}\) In any case, both coefficients had the expected signs, implying that additional debt, other things equal, can lead to a lower credit rating, while a larger tax base can lead to a higher rating.

The coefficient of the median family income variable is positive. Such a result is reasonable given that median family income can be taken as indicative of potential inflows of cash which offset outstanding debt. The rate of growth of population is the only dynamic variable included in this regression. High rates of growth are associated with added demands for public services (and a larger capital stock in particular), along with a larger tax base. It appears that rating agencies are more

\(^{17}\)The cut-off points were .279, .598, and .819 respectively. Similar overall results were obtained when standard deviations were estimated from the sample. A comparison of these results with those obtained by Carleton and Lerner \(^\text{[2]}\) might be valuable. Their technique (minimum information) is roughly comparable to the procedure used here (size and coverage of samples are different). Our classification rule predicts approximately two-thirds of the actual ratings, with the remaining one-third off by one rating class. Unlike Carleton and Lerner, we predicted the extreme ratings of Aaa and Baa less often than they actually appeared in the sample.

\(^{18}\)The technique utilized here is a special case of multiple discriminant analysis, and can involve fewer misclassification errors only because of small sample size.

\(^{19}\)This issue is described in more detail in \([11]\) and \([12]\).
reluctant to give high ratings to cities undergoing growth, despite the fact that such growth may be healthy for the community, than they are to communities whose industrial and residential patterns have been fixed for a substantial period of time.

The variable representing the percentage of taxes uncollected in the previous year is included as a measure of the ability of the governing body to manage short-term financial affairs. Clearly if property tax revenues are difficult to collect, it might be harder for the government to deal with sudden increases in cash outflows. The sign of the tax collections coefficient was negative as would be expected. The final attribute variable is a dummy variable which was included to allow for possible differences in credit ratings due solely to the state in which the community is located. The significant negative coefficient implies that, ceteris paribus, a community in Massachusetts is likely to have a higher credit rating than one in Connecticut, Rhode Island, or Maine. Given that all of the states have undergone similar economic development, and have similar default experiences, the significance of the DST coefficient may point to differences in rating behavior among analysts on Moody's staff.

IV. Credit Ratings and Municipal Borrowing Costs

Before proceeding with the estimation of the offering equation, a decision must be made about the inclusion of a rating variable or variables. One could represent rating by a sequence of dummy variables as Kessel, Jantscher, and others do. However, given the nature of the credit rating behavioral equation, it is reasonable to assume that underwriters are aware at least of the relative differences between rating classes. Under this assumption, the rating categories can be represented by a single variable CARD, defined as follows:

\[
\text{CARD} = \begin{cases} 
1 & \text{if the rating is Aaa,} \ 
.638 \text{ if the rating is Aa,} \ 
.558 & \text{if the rating is A,} \ 
0 & \text{if the rating is Baa.}
\end{cases}
\]

The inclusion of CARD does not imply that underwriters can know the underlying rating of each issue, but that they can gain information about the means of the rating categories, and that this mean information is taken into consideration by the bidding process. The vector of community attributes is included in the equation because underwriters do examine the financial status of communities before they enter into the bidding process. With the inclusion of the vector X in the model, the coefficient of the rating variable provides a test of whether or not published ratings have an effect on new offering yields which is independent of market ratings. A published rating change would result in a change in the CARD observation, but no change in the vector X. A negative and significant coefficient on the CARD variable would allow one to reject the hypothesis that published ratings do not have an independent effect on the market. Note that significance tests on the individual variables in the X vector are not important with respect to the above test. The X vector is included solely to allow one to determine that part of the effect of credit ratings which is uncorrelated with the "market rating."

The estimation of the offering equation is based upon the same sample of 128 communities described previously. Before examining the regression results it would be useful to glance at the sample spread in basis points between all rating classes as provided by Table 2. Note that the spread in basis points between Aaa and Baa rating classes is 80, and that there is considerable variation of yields within rating classes. If a community has its rating changed from Aaa to Baa, with its rating falling at the mean of each category before and after the change, then one would expect net interest cost to increase by 80 basis points.

The measure of the independent effect of the rating agencies on this spread is provided by Table 3. The coefficients of all market variables are significant with signs consistent with one's a priori notions about the market. The CARD coefficient is significant at the 5% level using a one-tailed test. The coefficient allows one to conclude

20 See the appendix for data description and sources.

21 A one-tailed test seems more reasonable than a two-tailed test given that one could not accept a positive coefficient without substantially revising the entire market model.
TABLE 2

NET INTEREST COST BY RATING CLASS
(in basis points)

<table>
<thead>
<tr>
<th>Rating</th>
<th>No. of Obs.</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaa</td>
<td>9</td>
<td>512.4</td>
<td>80.6</td>
<td>424.0</td>
<td>624.0</td>
</tr>
<tr>
<td>Aa</td>
<td>44</td>
<td>533.0</td>
<td>85.0</td>
<td>559.0</td>
<td>673.8</td>
</tr>
<tr>
<td>A</td>
<td>69</td>
<td>567.4</td>
<td>81.7</td>
<td>582.6</td>
<td>715.1</td>
</tr>
<tr>
<td>Baa</td>
<td>6</td>
<td>392.3</td>
<td>73.1</td>
<td>495.0</td>
<td>658.0</td>
</tr>
</tbody>
</table>

TABLE 3

REGRESSION RESULTS — DETERMINATION OF NET-INTEREST COST-INT

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td>-85.33*</td>
<td>48.72</td>
</tr>
<tr>
<td>CARD</td>
<td>-33.83**</td>
<td>20.95</td>
</tr>
<tr>
<td>BID</td>
<td>-6.07**</td>
<td>1.68</td>
</tr>
<tr>
<td>LOG(AMT)</td>
<td>-12.65**</td>
<td>4.11</td>
</tr>
<tr>
<td>CALL</td>
<td>-23.51**</td>
<td>8.59</td>
</tr>
<tr>
<td>PROD</td>
<td>0.06#*</td>
<td>0.036</td>
</tr>
<tr>
<td>DDEL</td>
<td>-1.12**</td>
<td>0.34</td>
</tr>
<tr>
<td>RANG</td>
<td>5.60**</td>
<td>1.42</td>
</tr>
<tr>
<td>INX</td>
<td>2.05**</td>
<td>0.34</td>
</tr>
<tr>
<td>ADDN/AAV</td>
<td>-52.32</td>
<td>53.29</td>
</tr>
<tr>
<td>AFV</td>
<td>-2.10 × 10^-5</td>
<td>1.36 × 10^-5</td>
</tr>
<tr>
<td>ADON</td>
<td>1.58 × 10^-4</td>
<td>1.28 × 10^-4</td>
</tr>
<tr>
<td>AMFI</td>
<td>-0.0053**</td>
<td>0.0026</td>
</tr>
<tr>
<td>AGROWS</td>
<td>0.21*</td>
<td>0.12</td>
</tr>
<tr>
<td>ACOL</td>
<td>-0.26</td>
<td>0.75</td>
</tr>
<tr>
<td>DFF</td>
<td>1.62</td>
<td>6.85</td>
</tr>
<tr>
<td>R^2</td>
<td>.88**</td>
<td></td>
</tr>
</tbody>
</table>

** Significant at 5% level.
* Significant at 10% level.

that if a rating change from Aaa to Baa were to occur, then even if the underlying conditions of the community did not alter, the borrowing cost would rise by 54 basis points.\(^{22}\) The effect of smaller rating changes on borrowing costs can also be determined. Thus, it is clear that rating agencies are important as an independent operator in the municipal market. In the short run, rating changes can alter municipal borrowing costs. Evidence about long run adjustment must be provided by further studies in the area.

V. Conclusions

A model has been described in which a test of the effect of published credit ratings on municipal borrowing costs can be provided. It was determined that credit ratings do have a small but significant effect on the underwriters' spread between offering and reoffering yields. More importantly, published ratings do have an effect on market yields which is independent of the market's evaluation of the community's financial situation. However, at most 34 of the 80 basis points between Aaa and Baa yields can be explained by the credit rating itself. The remainder of the spread is due in part to varying market conditions at the time of offer and to the market valuation of the communities.

One can conclude that the credit rating process is worthy of study because rating changes are likely to affect borrowing costs. As described briefly here and in more detail in [12] rating changes which do occur appear to discriminate against certain classes of communities in a predictable way. Much of the recent discussion about the improvement of the rating system is clearly worthwhile on this basis. On the other hand, one must be careful not to overstate the importance of published ratings. On the basis of uncovariables, the market affects yields). In both cases, the general conclusions reached were substantially the same.

\(^{22}\) One might suspect that the result just obtained was sensitive to the specific form of the offering equation posited. In order to gain information about the sensitivity of the equation (with respect to the rating variable in particular), we tested alternative hypotheses concerning the effect of credit ratings on yields. The first involved using a series of dummy variables to represent the rating categories, while the second involved use of the residuals from the credit rating behavior equation in the offering equation (the test here was whether or not rating "errors"
the model presented, one can estimate the change in borrowing cost resulting from a published rating change, but one cannot estimate the extent to which such a change in borrowing cost will remain over time. Such an estimate could only be obtained from a time series study in which an offering equation as well as a credit rating behavioral equation were estimated. A study of this type might also allow for alternative hypotheses of the causal link between credit ratings and yields to be explicitly considered.

REFERENCES

APPENDIX
Data Description and Sources

Data used for the credit rating behavioral equation include credit ratings and characteristics of 75 cities and towns in Massachusetts, 35 in Connecticut, 13 in Rhode Island, and 5 in Maine. New Hampshire cities were not included because most 1970 bond issues which were rated by Moody's were sewerage issues which were guaranteed by the state and rated Aaa. Individual Vermont ratings were largely unavailable because of the existence of the Vermont Bond Bank. Most of the financial data were obtained from the Dun & Bradstreet investor reports, through the courtesy of Jackson Phillips, then Director of Research of the Municipal Services Division of Dun & Bradstreet. Most census data used in the study were from the 1970 census although some of the data were not in a complete form at the time of the research. Because the sample was chosen from written reports of Dun & Bradstreet, the sample is clearly not random. In particular, the sample contains very few smaller towns and communities (populations under 10,000 in 1970). The decision to select Moody's ratings as a basis for the study was made primarily because Moody's is still the predominant authority in the rating field. The proportions of ratings appearing in the sample is comparable to proportions for all rated cities and towns within the New England area. Specific comments concerning the nature of the data are listed below.

(1) Gross direct debt includes all long-term debt of a general obligation nature, self-supporting debt (school, sewer, and water bonds), and all unfunded debt (tax anticipation and bond anticipation notes).

(2) Direct net debt equals gross direct debt minus all self-supporting debt and sinking funds (e.g., water, utility, and parking bonds).

(3) Overall net debt includes debt of overlapping districts, e.g., county debt, metropolitan water district debt.

(4) State school construction grants and other capital grants are included in the gross direct debt figures.

(5) 1969 actual tax rates were used rather than 1970 rates because 1969 data were used by the rating agencies.

(6) Median family income data were unavailable for several small towns with 1980 population under 10,000. In those cases, the
median family income of the county in which the community is located was taken as a proxy for the true income. This appears to be a reasonable assumption given that all missing observations were for rural communities.

Data used for the bond market variables described in the text were obtained for the sample of 128 New England cities and towns corresponding to the sample used to estimate the credit rating behavioral equation. Most of the data were obtained through the courtesy of Robert W. King of the Investment Bankers Association in Washington, D.C. The I.B.A. is presently known as the Securities Industry Association. The I.B.A. data files are based primarily on information obtained from the Daily Bond Buyer. For each community in the sample one issue was chosen for study. The choice was made so that the offering data of the issues would correspond closely to the date upon which financial characteristics and credit rating of the community were obtained. When two or more offerings were made within the desired period, one of the offerings was chosen at random for inclusion in the sample. All of the offerings included in the sample consisted of one or more general obligation municipal bond issues where bids were competitive rather than negotiations. A complete list of the issues and related information is available from the author. Specific comments concerning the nature of individual data series are included below.

(1) Net interest cost is a measure of the community's borrowing cost, which was chosen because of its availability.

(2) The weekly Index of 20 Municipals of the Daily Bond Buyer was chosen as a measure of the level of interest rates. The Bond Buyer Index is highly correlated with other indices of interest rates such as the short-term government bond rate and White's yield of 100. Other studies have concluded that regression results are not very sensitive to the choice of interest rate index.

(3) The call provision dummy variable was chosen because it was possible to ascertain additional information such as first call date. As described in the text, the dummy was set equal to one if the issue was not callable. However, information was not available as to whether all observations which were set equal to zero were in fact callable. Thus, interpretation of the effect of call options on net interest cost should be done with great care.

(4) Average maturity of the offering is a simple average of the maturity of all individual bonds within the issue. The range variable is described in the text. Average maturity and range of maturity are rounded to the nearest whole year.

(5) The number of bids is as stated except that 8 bids represent all issues having eight to ten bids, while 9 represents all issues having 11 bids or more. This limitation was due to the nature of the data files of the Investment Bankers Association.