[Reprinted from the Proceedings of the Sixty-Fifth Annual Conference on Taxation sponsored by the National Tax Association, 1972.]

CREDIT RATINGS, BOND DEFAULTS AND MUNICIPAL BORROWING COSTS: A NEW ENGLAND STUDY *

DANIEL RUBINFELD
Assistant Professor
Department of Economics
Research Associate
Institute of Public Policy Studies
University of Michigan
Ann Arbor, Michigan

The relationship between published credit ratings and municipal borrowing costs has received a good deal of attention in recent years. The objective of this paper is to analyze the existing process used by the rating agencies (with emphasis on Moody's), to determine the extent to which yields on new general obligation issues are affected by credit ratings, and to examine the process by which bond defaults occur. The empirical body of data to be analyzed contains a sample of general obligation bond issues for communities in New England. The New England region was chosen because it was felt that a careful analysis of credit ratings could not be done unless one had a good understanding of the economic, legal, and political environment facing localities in a particular geographical area. Because of the choice of sample, no conclusions can be reached concerning ratings and the quality of debt of large metropolitan areas. Section I will examine the rating process of Moody's rating agency, while the second section will place the analysis of the rating process in the context of the municipal market. Its primary goal is to provide a test of the extent to which credit ratings, independent of the market's own evaluation, actually influence municipal yields. Section III will be concerned with the process by which bond defaults occur, with emphasis being placed on the default history of Fall River, Massachusetts. Conclusions

* This paper is based on portions of my Ph.D. dissertation, "An Econometric Analysis of Credit Ratings and the Market for General Obligation Municipal Bonds," submitted to M.I.T., June, 1972. I am grateful to my thesis committee which included Franklin Fisher (chairman), Martin Feldstein, and Jerome Rothenberg, for their helpful comments and suggestions. Jackson Phillips of Moody's Investors Service and Robert King of the Securities Industries Association assisted in gathering much of the data used in the study. Financial support was received by the National Science Foundation and computer work was accomplished on the XSTAT software package of Dynamics Associates, Cambridge, Massachusetts.

about the rating process, bond defaults, and municipal borrowing costs will appear in the fourth section.

I. *The Credit Rating Process*

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 or researchers to a ranking of communities by probability of default. The fundamental issue appears to be the probability of default and not the performance of bonds in the secondary market.[1] According to Moody's,[2]

> our ratings represent the considered judgment of a group of experienced security analysts about the probable future performance of bonds over the long-term. To us, long-term means: as far ahead as the practical imagination will permit, and in any case long enough to span a business recession of some severity and length . . .
>
> Bonds, of course, are payable in the future. Hence, an issue's investment worth is gauged by the anticipated ability of its issues to meet all debt service commitments on schedule, particularly during periods of depressed economic circumstances.

Thus, Moody's seeming interest in the "marketability" of bonds appears to be based on a concern for the default potential of the issue.[3]

The primary purpose of this section is to provide a statistical analysis of the methods by which credit ratings are actually determined. The objective is to determine those quantitative characteristics of the communities upon which Moody's places major emphasis in its rating process.[4] One approach to this problem involves the use of multiple discriminant analysis to derive a statistical scoring system that duplicates Moody's ratings. Such a procedure has the disadvantage of necessitating the evaluation of several distinct classification functions

[1] A technical default occurs when payments of interest or principal are delayed. Most defaults have been of short duration, and only a small number actually involved repudiation of interest and principal outstanding. See (4) and (5) for details. Few, if any defaults on local general obligation issues have occurred since World War II.

[2] Moody's Investors Service, Inc., "Gauging Bond Quality," pp. 4-5.

[3] It is certainly true that new offering yields will be a function of existing market conditions as well as the characteristics of the community being rated. However, rating based on how previous issues have fared in the market could lead to a vicious circle in which the probability of default bears little or no relationship to new offering yields.

[4] Moody's does, of course, base its decisions upon 'subjective' factors such as management ability and the economic diversity of the area. There is no reason in principle, however, that most or all of this so-called subjective factors could not be quantified.

for each of the rating categories, Aaa, Aa, A, Baa, etc. This presents a practical difficulty for the researcher desiring to focus on the importance of the individual independent variables in credit classification. On the other hand, arbitrary selection of a dummy variable taking one value for each rating category is not suitable because the selection process forces (arbitrarily) an ordering on the ratings and on the gaps between rating categories.[5] For these reasons, the regression estimator to be outlined below has been devised.[6]

The credit rating process is seen here as one which attempts 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. Assume that the true relationship between a continuous variable Y representing credit worthiness and a vector of community attributes X is linear. However, the rating agency selects four distinct regions of choice to get its Aaa, Aa, A and Baa ratings.[7] 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.

The model to be considered is:

$$R = \sum_{i=1}^{K} b_i X_i$$

$R = 0$ if the rating is Baa, r_2 if the rating is A, r_3 if the rating is Aa, and 1 if the rating is Aaa.

There are N communities in the sample, N_1 receiving ratings of Baa, N_2 receiving ratings of A, N_3 receiving Aa, and N_4 receiving the highest Aaa rating.

The X's represent the community attributes, while the b_i's are the unknown regression parameters.

Ordinary least squares estimates of r_2, r_3, and the b_i's were determined using the technique described in (13). The sample under

[5] Such a procedure has been used by Bahl (1) and others.

[6] Derivation of the estimator and a discussion of its usefulness appear in Rubinfeld (13). The econometric results which follow are similar in many ways to the results which would have been obtained if an arbitrarily indexed dummy variable has been regressed on the vector of community attributes to be described.

[7] Lower ratings than Baa are possible, but none of the communities in the sample received such ratings.

study included 128 localities in New England during the 1970 period. The list of variables utilized contained all objective measurements of community attributes examined by Moody's which were accessible to the author.[8] Among these variables are the following: [9]

DAAA = dummy variable equal to 1 if the rating is Aaa and 0 otherwise

DAA = dummy variable equal to 1 if the rating is Aa and 0 otherwise

DA = dummy variable equal to 1 if the rating is A and 0 otherwise

AV = actual valuation of the property tax base (1970) in millions of dollars

FV = full valuation of the property tax base (1970) in millions of dollars

TAX = actual tax rate (1969)

PAYF = five-year debt-payout ratio

PAYT = ten-year debt-payout ratio

DEF = current account surplus (1969)

POP = population (1970)

NONW = percent of population non-white (1970)

GROWS = percent rate of growth of population from 1960 to 1970

GROWF = percent rate of growth of population from 1950 to 1960

COL = percent of taxes uncollected in the previous year (1969)

DST = dummy variable equal to 0 if the community is in Massachusetts, and equal to 1 otherwise

MFI = median family income (1960) in thousands of dollars

DON = overlapping debt (1970) in millions of dollars

DDN = direct net debt (1970) in millions of dollars

DDN/FV = ratio of direct debt to full valuation

DDN/AV = ratio of direct debt to assessed valuation

DDN/POP = direct debt per capita

The regression results are as follows: [10] (standard errors appear in parentheses)

[8] It is important to realize that the analysis in this section is a positive one. No attempt has been made to select variables such as indices of industrial base or economic diversity which might be chosen on normative grounds.

[9] See the appendix for a description of the data and its sources.

[10] The form of the equation is peculiar to the regression technique used. The results can be interpreted in a manner similar to the interpretation of a regression in which the dummy variable consists of the known rating index and independent variables are the community attributes.

$$
\begin{aligned}
\text{DAAA} = \underset{(.09)}{.53^{**}} - \underset{(123)}{.35^{*}(\text{DDN/AV})} + \underset{(.00016)}{.00024^{*}(\text{FV})} \\
- \underset{(.0005)}{.0028^{**}(\text{DON})} + \underset{(.011)}{.027^{*}(\text{MFI})} - \underset{(.0005)}{.0016^{**}(\text{GROWS})} \\
- \underset{(.0033)}{.0049^{*}(\text{COL})} - \underset{(.027)}{.097^{**}(\text{DST})} - \underset{(.04)}{.64^{**}(\text{DAA})} \\
- \underset{(.04)}{.55^{**}(\text{DA})}
\end{aligned}
$$

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

Examination of the regression results provides some interesting insights into the nature of the bond rating process. The estimated rating index of 0, .55, .64, 1 is reassuring because the estimation process did not guarantee that the ordering of the rating categories would correspond to the ordering of the rating index.[11] Some comments should be made at this point about those community attributes which appear to influence the rating process. These comments rely implicitly on a conceptual model of the bond rating process and on information about the pattern of bond defaults.[12]

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 debt-to-assessed value variable is the actual assessed value, not the estimated full market value of the community. A variable representing the debt-to-full market value ratio was statistically insignificant in the same regression.[13] It appears, therefore, the Moody's continues to focus too much attention on actual assessed value, despite the now public information concerning the biases which result from best assessment practices.

The next two coefficients, attached to the assessed full value and aggregate overally net debt variables, were both significant. There is

[11] The gaps in the rating index should not be taken literally as a measure of the gaps between rating classes. The index is quite useful in providing for the determination of a proper measure of the success of the classification process. For details, see Rubinfeld (14).

[12] Conceptual models of the rating process are provided by Bahl (1), Hempel (4), and others. Descriptions of the pattern of bond defaults appear in Hempel (4) and Hillhouse (5). Section III of this paper provides some additional evidence on the economic and political factors which appear to cause bond defaults.

[13] Because of multicollinearity problems it was impossible to distinguish in a satisfactory fashion between debt measures as well as aggregate valuation measures when they appeared separately in the regression equation. However, this problem does not apply when the corresponding ratios of debt to assessed valuation are compared (the correlation between the two is 0.5).

some question as to whether any aggregate measures of this sort should determine credit ratings. After all, it should be the relationship *between* debt service charges (as represented by aggregate debt) and overall cash inflows (as represented by assessed full value) which determines the likelihood of default. 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 positive coefficient attached to the median family income variable is not surprising when one considers that higher family income can be indicative of the ability of the community to vote tax increases to cover sudden revenue gaps faced by the local jurisdiction. What should be more important is, of course, the future income pattern of residents and their future demands for public services (which might well increase substantially as income rises). In addition, the distribution of income is likely to be a much better indicator of public sector demand than any single statistic based on that distribution.

The only dynamic quantitative variable appearing in the regression results in the rate of growth of population. Whether cities and towns undergoing high rates of growth should be rated lower, ceteris paribus, than communities growing at a slower rate, is a difficult question. High rates of growth are associated with added demands for public services and for a larger public capital stock, as well as a larger economic base. In any case it appears that rating agencies are more reluctant to give high ratings to cities and towns undergoing growth 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. An additional variable, the current account surplus, was statistically insignificant, a reasonable result given the problems associated with this particular accounting item.[14]

The dummy variable appearing in the regression results was included to allow for possible rating variations across states in the New England region. The negative coefficient implies that, other things equal, a community in Massachusetts is more likely to have a higher rating than one in Connecticut, Rhode Island, or Maine. Given that all of the states have undergone quite similar default histories, the significance of the DST coefficient points to possible differences in

[14] See the appendix for details.

economic development which are relevant to the potential for default (such differences are not clearly discernible), or to differences in the rating behavior among analysts on the staff of the rating agency.

One of the facts behind the importance of the two previously discussed aggregate indicators, debt and tax base, may be that rating agencies tend to discriminate between communities of varying population sizes. It is clear that many smaller communities which are unrated by Moody's and Standard & Poor's suffer in the bond market, but it is not clear whether smaller communities receive lower ratings solely on the basis of their size. One might expect smaller communities to be less stable economically than larger communities in cases in which their tax bases are heavily dependent upon one or two large industries located in the area.

In order to isolate the effect of population on credit ratings, several regressions were run. The results appear in Table 1.[15] When aggregate population was used as an independent variable in place of assessed values, its coefficient was positive and significant. The same quantitative result was reached when aggregate debt was also dropped from the regression and when the natural logarithm of population was used to eliminate the disproportionate effect on ratings of the larger cities in the sample. The division of the continuous population variable into four categories by size enables one to focus on the issue of whether the short-run financial difficulties facing larger cities leads to lower ratings. DP_1, the omitted dummy variable, takes on the value 1 for all communities having a 1970 population less than 15,000 and the value 0 otherwise. DP_2 takes on the value 1 for communities between 15,000 and 50,000 in size, while the corresponding ranges for DP_3 and DP_4 are 50,000-85,000 and 85,000 and over, respectively. Regression results make it clear that a higher population does lead, ceteris paribus, to a higher rating, even for the population group containing cities with a population over 85,000. This result is limited, of course, by the fact that the sample being studied contains only one city above 200,000 in population.

Before this section of the chapter is concluded, some mention should be made with respect to those variables which did not appear in the regression results discussed previously. One might have expected, for example, that high payout ratios would be correlated with lower ratings due to the short-run budget pressure associated with the large volume of bonds to be redeemed. However, both the five and ten year payout ratios were statistically insignificant in all regressions. A second variable which did not appear was the percentage

[15] All of the results are not reproduced here because of space limitations. None of the results are very sensitive to the choice of rating index used as the dependent variable.

TABLE 1. — Regression Results — Behavioral Equation

Dependent Variable Independent Variables	DAAA	DAAA
CONSTANT	.45 ** (.11)	.50 ** (.10)
DDN/AV	− .36 * (.24)	− .46 ** (.24)
DON ($000,000)	− .0033 ** (.0014)	.0016 ** (.0006)
MFI ($000)	.041 ** (.012)	.036 ** (.011)
GROWS	− .0016 ** (.0005)	− .0015 ** (.0005)
COL	− .0050 * (.0035)	− .0054 * (.0035)
DST	− .057 ** (.027)	− .058 ** (.028)
POP (000)	.0014 ** (.0006)	— —
DP_2	— —	.026 (.036)
DP_3	— —	.075 * (.050)
DP_4	— —	.121 ** (.057)
DAA	− .64 ** (.04)	− .66 ** (.04)
DA	− .58 ** (.04)	− .59 ** (.04)

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

of the population which was non-white. Given the small number of non-whites in the New England region was a whole, the insignificance of variable is not surprising.

II. *Credit Ratings and Municipal Borrowing Costs*

The inverse relationship between published credit ratings and municipal borrowing costs has often been taken for granted in the literature.[16] This, is in part due to the fact that the average yield

[16] A summary of some of these studies is provided by Bahl (1) and Rubinfeld (14).

on Aaa rated bonds is lower than the yield on Aa's, which in turn is lower than the yield on A rated general obligation bonds, etc. In actual fact, the evidence that published ratings do affect municipal borrowing costs is quite limited. The difficulty arises because published ratings are not accepted without some criticism and additional research by underwriters and others directly involved in the municipal market. 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 Jantscher calls it[17], 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 rating, 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 (or raise) 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 reaffirm its initial position.

It is clear that a complete answer to the question of the effect of rating changes on yields must involve a study of yields over time. Information of this type is provided in the study by Jantscher.[18] However, because Jantscher does not analyze the manner in which

[17] Jantscher (6) improves substantially upon most of the earlier literature because he is acutely aware of the causality issue.
[18] Jantscher (6).

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 outlined below,[19] with emphasis being placed solely upon the offering process.

The empirical work to be described is based upon the process by which the lowest competitive bid of all underwriting bids submitted determines the new offering yields. The net interest cost to the community on a new issue is a function of market conditions at the time of issue, characteristics of the individual issue, attributes of the community in question and the published credit rating placed on the new issue.[20] An offering equation of the following form was estimated:

$$\begin{aligned} INT = {} & c_1 + c_2(BID) + c_3(\log(AMT)) + c_4(CALL) \\ & + c_5(INX*\log(MAT)) + c_6(INX) \\ & + c_7((INX + INP)/2) + c_8(X) + c_9(RANG) \\ & + c_{10}(RAT) \end{aligned}$$

where the variables are defined as follows:

INT = net interest cost of the new issue in basis points

BID = number of bids in the offering process

AMT = total amount of the issue in dollars

INX = Bond Buyer weekly index of 20 Municipals on the day of offering or on the nearest date prior to offering

INP = Bond Buyer weekly index one week prior to INX

CALL = dummy variable equal to 1 if the issue was not callable and equal to 0 if callable (or if no information was available)

RANG = range of the issue, equal to the number of years before all bonds within the offering will become due

X = vector of community attributes (listed in the previous section)

RAT = rating dummy variable, equal to 1 if the rating is Aaa, .638 if the rating is Aa, .558 if the rating is A, and 0 if the rating is Baa.

One would expect that as the number of bids increases, the underwriting spread would fall and that reoffering yields would also fall. This has direct implications for the offering process, where one expects an inverse relationship between the number of bids and offering

[19] For greater detail on the model of the municipal market, see Rubinfeld (14).

[20] Net interest cost is a simple weighted average of the interest coupons upon bonds in the issue, where the weights are determined on the basis of the maturities of the individual bonds. Discounting is not used in the calculation of the net interest cost.

yields. Because of the reduced costs of handling large issues one would expect that large issues could be sold at lower yields than smaller issues. Call options add to the underwriting costs for general obligation issues, so that one would expect new offerings with call options to sell at higher prices and lower yields than offerings without such options.

The inclusion of the average level of interest rates for the two weeks prior to the offering period and the level in the week prior to offer involved an attempt to allow for expectations on the part of underwriters as to what the level of interest rates would be at the time that the new issue was offered. The product of the level of interest rates and the logarithm of the average maturity of the issue was included because one would expect that as maturities increase, yields would increase accordingly, but that the rate of increase would decline with increasing maturity. The product accounts for the fact that the rate of change of yields with respect to changes in maturities is also a function of the interest rate level in such a manner that as interest rates rise, differences in net interest costs with different maturities are reduced. The range variable accounts for a portion of the effect of maturity on the net interest cost of the new issues.

Finally, the vector of community attributes X, and the rating variable RAT are included in the offering equation. 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. 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 RAT, rather than a series of dummy variables. 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 the market rating. A negative and significant coefficient on the RAT variable would allow one to reject the hypothesis that credit ratings do not have an independent effect on the market.

The offering equation has been estimated using the sample of 128 communities described previously.[21] The regression results are displayed in Table 2. Notice that the coefficients of all of the market variables are significant with signs which are consistent with the implications of the previous discussion. The RAT coefficient is significant at the 5% allowing one to conclude 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 34 basis

[21] See the appendix for details concerning the data and its sources.

points.[22] It is clear therefore, that rating agencies are important as an independent operator in the municipal market. On the other hand, one must be careful not to exaggerate the importance of published ratings. On the basis of the results here, one can estimate the change in borrowing cost resulting from a published change in rating, but one cannot estimate the extent to which such a change in borrowing cost will remain over time.

III. *Municipal Bond Defaults*

This section continues with the analysis of credit ratings by focusing on the causes of bond defaults and by providing some evidence as to whether credit rating agencies can actually predict defaults using their present rating system. The 1930's period provides the most recent period of default experience in the New England area. The case of Fall River is worthy of examination here because the experience appears to typify the problems which can result from the sudden exodus of industry from an urban area.[23]

Fall River is an industrial city with approximately 100,000 inhabitants, situated in southeastern Massachusetts. During the period in question it depended quite heavily upon the presence of textile mills in the city for employment and for a tax base. Several factors were responsible for the default that did occur in 1930, among which were the exit of textile mills from the area with the concomitant loss of taxable property, the litigations following the decline of the tax base, and the continuation of a high level of current municipal expenditures during the period of decline.

Total assessed valuation in Fall River rose from $107.1 million in 1915 to $214.1 million in 1926, a phenomenal doubling in only 11 years for a city whose population was relatively stable during the period.[24] The increase in valuation appears to be the result of a boom in demand for textile goods following World War I and a tendency of the local officials to overassess mill property. When the war boom ended, and southern textile mills began to compete sharply with northern mills, the Fall River textile industry entered a period of severe decline. By 1930 total valuations in the community had fallen to $149 million. Blodgett estimates that of the 121 textile

[22] A one-tailed test was used because the nature of the null hypothesis was such that one could not accept a positive coefficient within the context of the complete model of the municipal market. The result described here has been replicated using alternative estimation techniques with quite similar results.

[23] In the complete dissertation the case histories of Fall River and Millville, Massachusetts appear. The causes of default appear to be quite similar in both cases.

[24] (11).

TABLE 2. — Regression Results — Determination of Net-Interest Cost — INT

Variable	Coefficient	Standard Error
CONSTANT	− 85.33 *	48.72
RAT	− 33.83 **	20.95
BID	− 6.07 **	1.68
LOG (AMT)	− 12.65 **	4.41
CALL	− 23.51 **	8.69
INX + log(MAT)	0.065 *	0.036
(INX + INP)/2	1.12 **	.34
RANG	5.60 **	1.42
INX	2.05 **	0.34
DDN/AV	− 52.32	53.29
FV	-2.10×10^{-5} *	1.36×10^{-5}
DON	1.58×10^{-4}	1.28×10^{-4}
MFI	− .0053 **	.0026
GROWS	.216 *	.12
COL	.262	.75
DST	− 1.62	6.83
R^2	.88 **	—

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

factories of varying sizes operating in Fall River during the 1918-20 period, only twenty were present in 1933.[25]

The loss of textile firms was a basic factor in the financial woes of Fall River, but it was not the sole one. As early as 1931 mill owners first began to protest against excessive valuations on their plants, machinery, and equipment. Protests grew from year to year, as evidenced by refusal of payment, demands for adjustment, and court litigation for abatement. As early as 1925 a series of legal suits ended with the court directing settlements of $1,066,100 to 34 factories.

Apparently these early litigation cases did little to alter the behavior of the local assessors, because textile valuations continued to increase. By 1928 normal assessor's abatements totalled $1.9 million, but court executed judgments totalled $7.9 million. These court adjustments

[25] This reference and all future non-referenced data concerning Fall River come directly from the document by William Blodgett (15).

were based on sale information, so that evidence was available to the effect that properties were being assessed at greater than market value. By 1929 abatements increased to $3.4 million while court judgments were reduced to $6.5 million. The corresponding 1930 figures were $1.4 million and $5.4 million respectively. The effect of maintaining an artificially high assessment level was to increase the number of abatements to be paid and then, indirectly, to necessitate increased borrowing to cover current expenditures. In 1925, the city appealed to the state legislature and received permission to issue a $1 million loan to be payable over a 5-year period. The issue was aimed directly at payment of tax abatements to be paid that year. The process of borrowing in anticipation of taxes and in anticipation of future borrowing continued to escalate so that by 1931, $4.63 million in debt of this type was outstanding.[26]

The financial affairs of Fall River reached a nadir when in November, 1930 the city found itself unable to meet $600,000 in tax anticipation notes. The city's credit soon disappeared when bankers who had shown little concern for the state of Fall River's affairs made a sudden turnabout. As a point of fact, the default occurred earlier than it might have otherwise as a result of a taxpayers', revolt in 1930 which resulted in only half of the 1930 tax levy being collected.

To complete the analysis of the Fall River default experience some mention should be made about the expenditure side of the local budget. Current budget expenditures, which had been increasing rapidly during the 1920's, were actually reduced from $17.3 million in 1930 to $16.3 million in 1932.[27] However, officials found it very difficult to reduce current expenditures substantially, primarily due to the presence of the budget items of public welfare, soldiers' benefits, old age assistance, debt service and to a lesser extent fuel and light and garbage contracts. The cost of public relief, for example, grew from $695,000 in 1930 to $1,350,000 in 1932.[28]

It is important to follow the consequences of the Fall River default from the point of view of the bondholders. Appeals by creditors were made to the state and by the end of 1931 the legislature had made provision (Chapter 44, Acts of 1931) for the formation of the Fall River Finance Commission (which ruled the city for a full ten years). The loss to the bondholders involved no loss of principal or interest, although there was an opportunity cost associated with the delayed payment.

From the brief summary of Fall River's difficulties it is not easy to focus on one cause of the bond default, although it is clear that the

[26] (11), p. 35.
[27] *Ibid.*, p. 3.
[28] *Ibid.*, p. 3.

default was related to the movement and inter-regional relocation of industry as well as to the overall economic depression which began in 1939. What does become clear upon further examination of the Fall River situation is that the default occurrence involves a political decision upon the part of the local public officials as to whether bondholders should not be paid their interest and principal or whether the recipients of other expenditure items should suffer. Such a choice can be a function of the legal environment in the state (concerning the rights of bondholders and the possibility of bondholders being bailed out) as well as the make-up of the bondholders and other creditors.

The preceding analysis in coordination with the rarity of bond defaults on general obligation issues leaves open the question of whether credit rating agencies can actually predict defaults with reasonable accuracy. It is known that Moody's was not a very good predictor of defaults when it rated bonds in the 1920's, but what is not known is whether rating agencies today can predict such defaults. It is natural to pose the question of whether or not defaults could have been predicted in the 1930's given the state of today's knowledge. An affirmative answer to this question will provide strong evidence that credit rating agencies perform their tasks well, while a negative answer will give evidence to the contrary. Unfortunately, conclusive results cannot be obtained because the economic and political structure relating to bond defaults has changed over the past four decades.[29]

The test of the hypothesis in question was carried out by the 'simulation' of the credit rating behavioral equation estimated in section I. Using a classification rule derived from the credit rating equation, predicted fitted values and credit ratings were obtained for a sample of 35 Massachusetts cities and towns in the year 1930.[30] Included in the sample of 35 were Fall River and Millville, the only Massachusetts communities to default during that period. Out of the entire sample, only two communities were rated by simulation to be Baa, and Fall River and Millville were not among these. The simulated fitted values or rating index for Fall River and Millville fell very close to the median of the entire sample. The limited evidence provides no

[29] Legislation affecting local government finance has certainly changed, as has the responsibility for welfare provision, and the dependency upon serial bond issues. However, other apparent causes of defaults are still potential causes of defaults today, so that the simulation test to follow is a relevant one.

[30] The fitted values are obtained by evaluating the credit rating equation (without the rating dummy variables) using 1930 observations for all of the community attributes appearing in the equation. In actual practice, the credit rating behavioral equation was re-estimated because of the lack of median family income data in 1930.

substantiation to the hypothesis that rating agencies can predict defaults.

IV. *Conclusions*

This paper brings into focus issues concerning the process by which published credit ratings are determined. The published ratings were found to bear an effect on municipal borrowing costs which is independent of the market's own rating of the given issue. For this reason alone, the credit rating process is worthy of the recent attention that it has received.

A credit rating should attempt to measure, to the extent that it is possible, the probability of default of a bond issue. Evidence presented about the rating process leaves some doubt as to whether this is in fact the sole objective of the rating agencies. The analysis of bond defaults (and the simulation experiment) provides sufficient reason to doubt that existing rating procedures are capable of predicting defaults when and if they do occur. Note that the argument is not that defaults will not occur, but that because defaults occur infrequently and because the reasons for these occurrences are both political and economic, the prediction of such defaults is very difficult. It is not inconceivable, that with the limited tools at hand, discrimination between probabilities of default is impossible. A natural consequence of this belief is to suggest that individual investors would do well to hold a portfolio of Baa rated general obligation municipal issues if the decision to hold municipals already has been made.

Published ratings are simply a means of conveying information from the rating agencies to the market. There is a social cost to the rating process, the cost of having some communities receive the benefit of a higher rating than they might otherwise get while other communities receive unusually low ratings. However, it is important to realize that the elimination of the rating agencies would not bring an end to borrowing cost differentials because the market's independent rating would still remain. To the extent that rating agencies are simply mirroring information which the market would act upon even if rating agencies did not exist, then rating agencies are providing a service which allows for the elimination of extremely large staffs of of analysts in each and every underwriting firm and commercial bank.

In conclusion, rating agencies can and do provide a service, but the nature of that service needs clarification. If rating agencies are seriously attempting to predict probabilities of default, then their processes of analysis need substantial improvement so that unwarranted differences in borrowing costs caused by published ratings are eliminated. Rating techniques should be improved at least to the point that variables actually leading to defaults are in fact important in the rating decision. A final test of the rating agencies' ability to predict defaults awaits some modern day default experiences.

APPENDIX

Data Description and Sources

Data used for the regression described in the text include credit ratings and characteristics of 128 towns and cities in New England (primarily in 1970). 75 cities and towns are in Massachusetts, 35 in Connecticut, 13 in Rhode Island, and 5 in Maine. New Hampshire cities were not included because most 1970 bonds issues which were rated by Moody's were sewerage issues which were guaranteed by the state and therefore 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, Director of Research of the Municipal Services Division of Dun & Bradstreet. Dun & Bradstreet receives most of its information from individual governmental units, from individual bond prospectuses, and from the Bureau of the Census. 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). A somewhat arbitrary choice was made in selecting Moody's ratings as the basis for concentration. The decision was made primarily because Moody's is still the predominant authority in the rating field. Of the 128 communities in the sample, 9 were rated as Aaa, 44 as Aa, 69 as A, and 6 as Baa. The proportions of ratings appearing 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 bonded debt includes all long-term debt of a general obligation nature and self-supporting debt, e.g. school bonds, sewer bonds, water bonds.

Gross Direct Debt includes gross bonded debt and all unfunded debt, i.e. tax anticipation and bond anticipation notes.

Direct Net Debt equals gross bonded debt minus all self-supporting debt and sinking funds (e.g. water, utility, and parking bonds).

Overall Net Debt includes debt of overlapping districts, e.g. country debt, metropolitan water district debt, MBTA debt.

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

(2) The debt-payout ratios are based on a table of expected payout dates for all existing municipal debt. The 5-year debt-payout ratio lists the percentage of the total debt presently in existence which will be paid out at the end of 5 years. The 10-year ratio is defined accordingly.

(3) The Current Account Surplus item is a measure of the ability of the community to handle its short-term financing. It is equal to the difference between current obligations of the community (appropriation balances and other unexpended balances) minus cash balances on hand. A current account deficit does not imply bankruptcy, nor does it imply that short-term financing is necessary. It simply compares short-term liabilities to cash on hand.

(4) 1969 actual tax rates were used rather than 1970 rates because 1969 data were used by the rating agencies. However, most of the assessed value data were 1970 data, so that no direct calculations of revenues received in either year is possible.

(5) Median family income data were unavailable for several small towns with 1960 population under 10,000. In those cases, the median family income of the country 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 date 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 very 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 not 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 represents 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.

Bibliography

1. Bahl, Roy, "Measuring the Creditworthiness of State and Local Governments: Municipal Bond Ratings," *Proceedings of the National Tax Association*, September 1971.
2. Brown, Fraser, *Municipal Bonds*, New York, Prentice-Hall, 1922.
3. Hastie, K. Larry, "Determinants of Municipal Bond Yields," *Journal of Financial and Quantitative Analysis*, Vol. VII, No. 3, June 1972.
4. Hempel, George H., *The Postwar Quality of State and Local Debt*, New York, National Bureau of Economic Research, 1971.
5. Hillhouse, Albert M., *Municipal Bonds: A Century of Experience*, New York, Prentice-Hall, Inc., 1936.
6. Jantscher, Gerald R., "The Effects of Changes in Credit Rating on Municipal Borrowing Costs," Brookings Reprint 177, 1970, The Brookings Institution, Washington, D.C.
7. Kessel, Reuben A., "A Study of the Effects of Competition in the Tax-Exempt Bond Market," *Journal of Political Economy*, July-August, 1971.
8. Oakes, Eugene, *Studies in Massachusetts Town Finance*, Cambridge, Harvard University Press, 1937.
9. Phelps, Charlotte, "The Impact of Tightening Credit on Municipal Capital Expenditures in the United States," *Yale Economic Essays*, Vol. 1, Fall 1961, pp. 275-321.
10. Raymond, William L., *State and Municipal Bonds*, Boston, Financial Publishing Company, 1923.
11. Reports of the Fall River Finance Commission, 1932- , Public Document No. 151. (Reports, Fall River Board of Finance).
12. Robinson, Roland I., *Postwar Market for State and Local Government Securities*, Princeton, Princeton University Press, 1960.
13. Rubinfeld, Daniel, "Multiple Regression with A Qualitative Dependent Variable," unpublished, 1972.
14. Rubinfeld, Daniel, "Credit Ratings and the Market for General Obligations Municipal Bonds," unpublished, 1972.
15. State of Connecticut, Taxation Document, No. 255, Causes of the Financial Breakdown of the Local Government of Fall River, Massachusetts, and Means Taken by Massachusetts to Re-establish the Finances of that City. By William H. Blodgett, Tax Commissioner, State of Connecticut. 1933.

16. U.S. Congress, Joint Economic Committee, Subcommittee on Economic Progress, *Hearings on Financing Municipal Facilities,* 90th Congress, 1st and 2nd Sessions, 1967, 1968, Vols. I and II.
17. VAN DE WOESYNE, ROYAL, *State Control of Local Finance in Massachusetts,* Harvard University Press, Cambridge, Massachusetts, 1935.