THE DECLINING CREDIT QUALITY OF US CORPORATE DEBT: MYTH OR REALITY

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Abstract

In recent years, the number of downgrades in corporate bond ratings has exceeded the number of upgrades. This fact has led some to conclude that the credit quality of US corporate debt has declined. However, declining credit quality is not the only possible explanation. An alternative explanation of this apparent decline in credit quality is that the rating agencies are now using more stringent standards in assigning ratings. An ordered probit analysis of a panel of firms from 1973 through 1992 suggests that rating standards have indeed become more stringent. The implication is that at least part of the downward trend in ratings is the result of changing standards and does not reflect a decline in credit quality.

1 Introduction

Bond ratings have and continue to play a key role in corporate financing and investment decisions. A corporation that can issue higher rated bonds usually receives better terms than one that can only issue lower rated bonds. By law or policy, some investors can purchase only bonds with an investment-grade rating, a restriction which in some asset pricing models would affect the relative prices of financial assets.

Numerous articles in the popular press have presumed that the credit quality of the debt of US corporations has been declining over the last twenty years. The comprehensive study of Moody's rating changes of corporate debt by Lucas and Lonski (1992) is consistent with this presumption. To cite their statistics, Moody's in 1970 downgraded 21 issues and upgraded 23 issues—virtually the same number. Over the years, the number of bonds downgraded began to exceed by substantial margins the number of bonds upgraded. By 1990, Moody's downgraded 301 issues and upgraded only 61. Grundy (1996) documents similar trends in the ratings of preferred shares over the 1965 to 1990 period.

As the credit quality of a firm's corporate debt decreases, the firm will face a greater probability of financial distress, which at the extreme translates into bankruptcy. There is some debate as to the effect of financial distress upon a firm's value and the overall level of economic activity. In the Miller-Modigliani paradigm, the credit quality of a firm's debt should have no impact. However, in a less perfect world, the possibility of financial distress may effect a firm's ability and willingness to undertake new investments. Froot, Scharfstein, and Stein (1993) present an excellent summary of the avenues through which financial policies can interact with the investment decisions of an individual firm. Gertler (1988) contains a comprehensive survey of the relation between financial structure and aggregate economic activity.

Those writing about the declining credit quality of US corporate debt have generally accepted this decline in credit quality as fact. Yet, at least one writer has attributed the observed decline in credit ratings to the use of more stringent rating standards.[1] Under this alternative view, there may have been no real decline in credit quality, but even if there was, the real decline may be less than the data suggests.

The goal of this paper is to examine whether some of the apparent decline in credit quality of US corporate debt could be due to the use of more stringent standards on the part of rating agencies in assigning ratings. Specifically, would a company with the same accounting and equity risk measures, such as leverage ratios and beta coefficients, receive a lower rating today than in prior years? This question is examined using twenty years of data from 1973 through 1992.

The organization of the paper is the following: Section 2 contains a discussion of related literature. Section 3 sets forth the ordered probit model, and section 4 presents the definitions of the variables used in estimating this model. Section 5 describes the main empirical results, and Section 6 considers the robustness of these results. Section 7 concludes the paper.

2 Prior Literature.

Moody's and Standard and Poor's are the two major rating services for corporate debt. These services employ both publicly available information, such as accounting statements, and non-public information, such as confidential interviews with management, to assign quality ratings to individual corporate bonds. The intent of these quality ratings is to measure the probability that the issuer will honor the terms of the debt instrument.

The highest rating from S&P is AAA; the remaining and successively lower ratings are AA, A, BBB, BB, B, CCC, CC, and D. The rating of D is used for a bond that is in default, particularly in its payment of interest or principal. The rating of C is a special rating applied

[1] See Pender (1992).

only to income bonds on which no interest is currently being paid. A bond with a rating of BBB or above is known as an investment grade bond, while one with a rating of BB or lower is known variously as a high-yield bond, non-investment grade bond, or junk bond. In an attempt to refine these ratings further, S&P sometimes assigns a "+" or "–" to its ratings to indicate that the bond is at the upper or lower end of the rating category. The ratings of Moody's are similar.

Previous research on quality ratings divides logically into three branches: The first branch addresses the question of whether quality ratings measure what they are supposed to measure. Hickman (1958) was one of the first to examine this question and found generally positive relations between initial quality ratings and default. In another study, Ang and Patel (1975) found that S&P quality ratings had weak power in predicting what they term "financial distress" in the subsequent year. Kao and Wu (1990) found a positive relation between bond yields and quality ratings. These studies and others indicate that quality ratings do have some informational content.

Both the second and third branches examine the type of information contained in quality ratings. The second branch examines whether quality ratings convey information that the market place has not already incorporated into prices from other available information. A recent study of this type by Hand, Holthausen, and Leftwich (1992) finds that bond and stock prices of an issuing company change in the expected direction when either Moody's or S&P publishes an actual or potential change in rating. From this result, they conclude that ratings do contain information beyond that which is publicly available. Some previous studies, such as Katz (1974), Grier and Katz (1976), and Ingram, Brooks and Copeland (1983) reach similar conclusions, while others, such as Weinstein (1977) and Wakeman (1978), do not detect incremental informational effects.

The third branch analyzes how the rating agencies use public information in setting quality ratings. The early studies, such as Horrigan (1966), Pogue and Soldofsky (1969), and West (1970), assign ordinal numbers to the quality ratings and regress these numbers on accounting and other variables. Later studies, such as Pinches and Mingo (1973, 1975) and Altman and Katz (1976), use discriminant analysis in place of regression analysis. Kaplan and Urwitz (1979) employ an ordered probit model and find, like the earlier studies, that publicly available data predict with a fair degree of accuracy actual quality ratings. Ederington (1985) compares and contrasts these different statistical approaches.

The empirical results in this paper fall into this third and last branch of research, and the methodology generalizes and extends that of Kaplan and Urwitz. In contrast to Kaplan and Urwitz, who analyze a single cross-section of firms, the analysis in this paper utilizes panel data covering the years 1973 through 1992. With panel data, one can examine whether, conditional on the included variables, rating standards have become more stringent over time, and, if so, the importance of these more stringent rating standards in explaining the recent prevalence of downgrades over upgrades.

3 The Ordered Probit Model.

The empirical analysis in this paper utilizes an ordered probit model. This model relates the rating categories to observed explanatory variables through an unobserved continuous linking variable. The rating categories map into a partition of the range of the unobserved variable, which in turn is a linear function of the observed explanatory variables.

Define the following for bond i at year t: R_{it} as the rating category of bond i at time t, Z_{it} as an unobserved linking variable, and $X_{i,t-1}$ and $W_{i,t-1}$ as vectors of observed explanatory variables measured at time $t-1$ or before. The number of time periods in the sample will be denoted by T. The linking variable Z_{it} is continuous and its range is the set of real numbers. The vector $X_{i,t-1}$ will be used in the linear part of the model, and the vector $W_{i,t-1}$ will be used in modeling the variance of the disturbance terms. The vectors $X_{i,t-1}$ and $W_{i,t-1}$ may contain variables in common. The variable R_{it} is assigned the value of 7 if bond i at time t has a rating by S&P rating of AAA, 6 if AA, 5 if A, 4 if BBB, 3 if BB, 2 if B, or 1 if CCC or below.

The ordered probit model consists of two parts. The first part maps the rating categories into a partition of the unobserved linking variable Z_{it} as follows:

$$R_{it} = \begin{cases} 7 & \text{if } Z_{it} \in [\mu_6, \infty), \\ 6 & \text{if } Z_{it} \in [\mu_5, \mu_6), \\ \vdots & \\ 2 & \text{if } Z_{it} \in [\mu_1, \mu_2), \\ 1 & \text{if } Z_{it} \in (-\infty, \mu_1), \end{cases} \tag{1}$$

where μ_i are partition points independent of t.

The second part relates the Z_{it}'s to the underlying observed variables as:

$$Z_{it} = \alpha_t + \beta' X_{i,t-1} + \epsilon_{it} \tag{2}$$

$$E[\epsilon_{it} | X_{i,t-1}, W_{i,t-1}] = 0 \tag{3}$$

$$E[\epsilon_{it}^2 | X_{i,t-1}, W_{i,t-1}] = [\exp(\gamma_o + \gamma' W_{i,t-1})]^2 \tag{4}$$

where α_t is the intercept for year t and β is the vector of slope coefficients. The random variable ϵ_{it} is a Gaussian disturbance term with a conditional expectation of zero. To allow for heteroskedasticity, the variance of ϵ_{it} is modeled as a function of $W_{i,t-1}$, where γ_o is a constant and γ is a vector of slope coefficients.

This specification allows the intercept to vary over time, while constraining the slope coefficients β to be constant over time. Changes in the intercept over time can be viewed as a measure of changes in standards used in assigning ratings. If α_t is sufficiently less than α_{t-1}, a bond with the same vector of explanatory variables will be associated with a lower rating at year t than at year $(t-1)$ as the partition points μ_i are held constant over time. Conversely, if α_t is sufficiently greater than α_{t-1}, the same vector of explanatory variables will be associated with a greater rating at year t than at year $(t-1)$. An analysis of the robustness of the empirical results to this particular specification, presented in Section 6, finds that the main empirical results of the paper are virtually unchanged when the slope coefficients β are allowed to vary over time.

Since the Z_{it}'s are unique up to a linear transformation, identification of the model requires two restrictions. The first restriction in this paper is to set the intercept for the first year of the panel to zero. This means that the remaining $T-1$ intercepts can be interpreted as changes in rating standards relative to the rating standards of the first year of the panel. The second restriction is to set γ_o in (4) to zero. If all elements of the slope coefficients γ are zero, the variance of the error is equal to 1.0, which is the usual assumption in an homoscedastic probit model in which the variance of the disturbance is set to 1.0.

The most probable category, and here the most probable rating category, is central to any probit analysis and in this paper plays a key role. It is customary to assign the maximum likelihood estimates as values to the parameters in the probit model in determining the most probable rating category, but in fact the most probable rating category can be determined for any arbitrary set of values assigned to these parameters. Specifically, for any observation given by $X_{i,t-1}$ and $W_{i,t-1}$, the primary analyses set the intercept in the linear part of the probit model to one of the estimates from earlier or later years, and the corresponding most probable category is calculated. In these calculations, all the other parameters of the probit model are equated to their maximum likelihood estimates.[2] Changes in the most probable rating categories from the use of different intercepts are a direct measure of changes in rating standards.

Let a be the value assigned to the intercept in the linear part of the probit model, and define θ as the set of the parameters of the probit model with the intercept set to a and the other parameters set to their maximum likelihood estimates. Conditional on θ and the explanatory vectors $X_{i,t-1}$ and $W_{i,t-1}$, the probability that a bond falls in rating category j

[2]In subsequent analyses, the slope coefficients in the linear part of the model are also allowed to vary.

is given by

$$Pr(R_{it} = j|\theta) = \begin{cases} Pr(a + \beta' X_{i,t-1} + \epsilon_{it} \geq \mu_6|\theta) & \text{if } j = 7 \\ Pr(\mu_j > a + \beta' X_{i,t-1} + \epsilon_{it} \geq \mu_{j-1}|\theta) & \text{if } j = 6, ..., 2 \\ Pr(\mu_1 > a + \beta' X_{i,t-1} + \epsilon_{it}|\theta) & \text{if } j = 1 \ . \end{cases} \tag{5}$$

Using Φ to represent the standard normal cumulative density, (5) can be rewritten as

$$Pr(R_{it} = j|\theta) = \begin{cases} 1 - \Phi(\frac{\mu_6 - a - \beta' X_{i,t-1}}{\sigma(W_{i,t-1})}) & \text{if } j = 7 \\ \Phi(\frac{\mu_j - a - \beta' X_{i,t-1}}{\sigma(W_{i,t-1})}) - \Phi(\frac{\mu_{j-1} - a - \beta' X_{i,t-1}}{\sigma(W_{i,t-1})}) & \text{if } j = 6, ..., 2 \ , \\ \Phi(\frac{\mu_1 - a - \beta' X_{i,t-1}}{\sigma(W_{i,t-1})}) & \text{if } j = 1 \end{cases} \tag{6}$$

where $\sigma(W_{i,t-1})$ is the standard deviation of the disturbance from (4). The value of j that maximizes (6) is the most probable bond rating category conditional on the parameter vector θ.

4 Definition of Variables

This study utilizes explanatory variables which are defined in similar ways to those used in prior research to facilitate comparison. The purpose of these variables is to measure the probability that a firm will honor the terms of its debt agreements. The variables themselves are calculated using data from years prior to that of the rating and thus can be viewed as predetermined with respect to the rating.

The primary accounting variables used in past studies are three: operating income to interest or the interest coverage ratio, the book value of long-term debt to the book value of total assets, and net income to the book value of total assets. The first and third variables should be positively related to improvements in credit ratings, and the second negatively.[3]

[3] In contrast to prior studies that have used time series averages of these variables, this study utilizes numbers from the immediately preceding annual report to calculate these ratios and does not average them over time. Whether to use averages or the immediately prior ratio depends upon how these ratios evolve over time. If the ratio in a particular year is the sum of a permanent component and a time independent transitory component, an average is preferred. If however, the ratio is better approximated by a random walk, the immediately preceding value is preferred. Preliminary work for this study used both averages and the immediately preceding value and found little sensitivity to the choice.

The values of the interest coverage ratio range from a low of -415 to a high value of 1565. A negative value of this ratio indicates that the company does not have operating income to cover its interest payments. This situation cannot persist and thus indicates that the future has to be in some way different from the past. To recognize this situation, any interest coverage ratio of less than zero was replaced with the value of zero and a dummy variable added with a value of one. The expected sign on this dummy variable is negative. Above some level of interest rate coverage, there is probably little difference in the ability of a company to service its debt. To reflect this possibility, any interest rate coverage greater than 10.0 was set to 10.0.[4]

In addition to these accounting ratios, past studies have used beta coefficients and standard errors from the market model. The hypothesis is that a firm will be less able to service its debt for given accounting ratios as its equity risk increases. These equity risk measures take into account both the variability of the underlying cash flows from operations and the degree of leverage. Further, separating equity risk into beta and non–beta risk allows for the possibility that these two measures of risk might be related to the debt rating in different ways. For example, for a given degree of leverage, variability to non–market factors might provide more information about the competency of management than variability due to general market movements. Management may have some control over non-market variability, while the type of business itself may largely determine the volatility due to general market movements. If so, how the variability of total returns breaks down into these two sources may convey information. The expected sign on these two relative measures of equity price risk is negative.

Prior studies ignored the fact that the betas and standard errors from the market model have a different metric: Betas are relative measures, and standard error are absolute mea-

[4]Since the use of 10.0 is arbitrary, the probit analyses reported below were also replicated with the maximum interest rate coverage set to 5.0 with little change in results.

sures. In a cross-sectional analysis, these differences in metric do not change the explanatory power of the model, but only affect the interpretation of the magnitudes of the slope coefficients. In a panel analysis, these two measures need to be placed on the same metric. The choice made in this paper is to make both measures relative by normalizing the standard error for each company for each year. Specifically, the standard error for each company in a particular year is divided by the average of the standard errors for all companies in the panel for that year and then one is subtracted.

Prior studies have also assumed a relation between debt ratings and firm size. The natural logarithms of each of the following variables are used to measure firm size: the book value of total assets measured in units of one hundred thousand dollars deflated by the CPI and the market value of equity measured in one hundred thousand dollars, also deflated by the CPI.[5] If larger companies tend to receive higher quality debt ratings, these two variables should be positively related credit ratings.

The empirical model includes a dummy variable associated with subordination. For 22.6 percent of the sample, only subordinated ratings were available. In order to pool these firms with those having non-subordinated ratings, the probit analyses utilizes a dummy variable which is defined as one for the subordinated group and zero otherwise. The purpose of this dummy variable is to capture the increased riskiness of subordinated debt given the other explanatory variables. The expected sign on this dummy variable is negative.

If larger companies are more stable than smaller ones, their firm characteristics could more informative. To allow for this possibility, the standard deviation of the disturbance is assumed to be a function of the natural logarithm of the market value of equity deflated by the CPI. The expected sign is negative.

The data sources available to this study enable the construction of a panel covering the twenty years from 1973 through 1992. The financial ratios and book value of assets come

[5]The CPI is normalized to 1.0 for year-end 1972.

from the 1992 and 1993 Compustat files, which include the annual industrial file, the full coverage file, and the research file.[6] The equity market values and the daily stock returns used in estimating the market model regressions come from the CRSP daily stock files. The beta coefficients and the standard errors of the residual from the market model are estimated over the prior year using the CRSP value-weighted index as the measure of the market return. A stock is required to have 200 daily returns to be included for a given year. The beta estimates are adjusted for nonsynchronous trading effects using the Dimson (1979) procedure with one leading and one lagging value of the market return.

The bond ratings are those of S&P and come from three data sources: the 1992 Compustat file, the 1993 Compustat file, and the University of Wisconsin Milwaukee Fixed Income Data Base.[7] The 1992 Compustat files contain ratings from 1978 through 1991 and are the primary source of ratings for these years. The 1993 Compustat files contain ratings from 1985 through 1992 and are the primary source of ratings for 1992. The University of Wisconsin files contain ratings for the entire 20 years of the panel and are the primary source of ratings for the years 1973 through 1977. When the primary source does not contain a rating but a rating is available from one of the other sources, that other source is used.

The number of companies in the panel varies from a low 342 in 1973 to a high of 1026 in 1987 (Table 1), and the total number of sample points in the panel is 14430. The change in the number of companies from one year to the next is gradual except for the increase from 419 companies in 1977 to 621 in 1978 with a large portion of this increase attributable to companies whose bonds carry ratings of below investment grade. The primary reason for smaller sample size prior to 1978 stems from the merging of two distinct data sets,

[6] Explanatory variables calculated using Compustat data are Interest Coverage, Book Debt to Assets, Net Income to Assets, Book Assets and the Subordinated Dummy. The Interest Coverage is calculated as [pretax income (170) + interest expense (15)] / [interest expense (15)]; Book Debt to Assets is calculated as [long-term debt (9)] / [total assets (6)]; and Net Income to Assets is calculated as [net income (172)] / [total assets (6)]. Book Assets uses total assets (6). The numbers in parentheses are the Compustat item numbers.

[7] As with the financial ratios, the Compustat files include the annual industrial file, the full coverage file, and the research file.

coupled with the decision to merge only records that unambiguously matched each other. A secondary reason is the growth of companies issuing lower grade debt following 1977. Whatever the reasons for this change in the size and composition of the sample from 1977 to 1978, this change does not appear to have introduced any bias in the overall empirical results as shown by two types of analyses presented in Section 6.

5 Empirical Results

The empirical results in this section are consistent with the hypothesis that S&P has applied over the years 1973 through 1992 more stringent standards in assigning rating categories, at least in terms the firm characteristics used as explanatory variables in this study. Were it not for improvements in firm characteristics of some companies through time, the results suggest that the number of downgrades that occurred over these twenty years would have been even greater.

5.1 Model Estimates

Estimation of the parameters of the probit model for the panel data covering the years 1973 through 1992 is based upon standard maximum likelihood techniques.[8] The disturbance term is assumed to be normally distributed with standard deviation as specified in (4) and is assumed to be uncorrelated with the explanatory variables and with other disturbances.

An examination of the generalized residuals from (2) suggests that the time series of the residuals of individual companies are autocorrelated, contrary to the assumption of zero correlation. If there is such autocorrelation, the maximum likelihood estimators are still consistent, but the standard errors of these estimators are not. Newey and West (1987) provide a general procedure to obtain consistent standard errors in the presence of such

[8]See Maddala (1983) and Hausman, Lo, and MacKinlay (1992) for details on maximum likelihood estimation of the ordered probit model.

autocorrelation, and this paper utilizes their approach to calculate a second "adjusted" set of standard errors.[9]

The estimated coefficients on the firm characteristics all have the correct predicted sign (Table 2) and are significant at the usual levels on the basis of either variant of their standard errors with two exceptions. The two exceptions are net income to assets and deflated book assets, which are significant at the five percent level using the unadjusted standard error but not significant at this level using the adjusted standard error.

In a probit model, there are no natural magnitudes for the linking variable, making it difficult to interpret the economic significance of the size of the estimated coefficients. To aid in interpreting these coefficients, Table 2 also presents for each explanatory variable the product of its estimated coefficient and the corresponding standard deviation of the independent variable itself. This product represents the change in the conditional expectation of Z_{it} in response to a change of one standard deviation in the value of this explanatory variable. A comparison of this change to the size of the partitions provides a measure of the economic importance of a variable.

The variance of the standard errors of the probit model decreases with increases in firm size as measured by deflated market equity. This result is consistent with the hypothesis that firm characteristics are more informative for larger firms than smaller firms.

The intercepts display a steady downward trend over time (Figure 1 and Table 2) The rank order correlation between the intercepts and time is -0.95, which is significant at the one percent level. This decline in the values of the intercepts is consistent with the application of increasingly more stringent standards over time in assigning ratings in terms of the firm characteristics identified in this study.

[9]To calculate the Newey-West standard errors, the partial derivatives of the log likelihood function are interpreted as the moment conditions in Hansen's (1982) generalized method of moments technique. A lag length of 30 is used with the data ordered first by firm and then by year. The standard errors are consistent as the number of firms increases. The appendix of Campbell, Lo, and MacKinlay (1996) provides further discussion of this approach.

A comparison of the most probable ratings to the actual ratings can be used to assess the goodness-of-fit of a probit model. For the model in this paper, the most probable rating is within plus or minus one rating category of the actual rating for most companies (Table 3). The model underpredicts both the high and low rating categories. In general as the explanatory power of a probit model with multiple categories declines, the underprediction for some categories will become more pronounced with a corresponding overprediction for other categories. In the extreme case of no explanatory power, the most probable category will always be the same, namely the category with the most observations.

Perhaps surprisingly, of the 1165 observations with a BB rating, only 29 have a most probable prediction of BB. Indeed, 511 of these bonds have a most probable prediction of BBB, and 485 of B. This paucity of BB predictions is due to the narrow width of the range of Z_{it} for the BB category relative to the width for the BBB and B categories combined with relatively large standard errors of the residual from the probit model. The illustration in Figure 2 gives an example from the panel which illustrates the interaction between the partition sizes and the standard errors of the probit model.

5.2 Economic Importance

The decline in the intercepts is consistent with the application of more stringent standards in assigning ratings, but it provides no direct evidence on the economic importance of this statistical result. One way to ascertain the economic significance of this change is to compare the rating that the probit model would predict for a particular year using the firm characteristics for that year with the rating that the probit model would predict for an earlier or later year but using the same firm characteristics (Table 4). Thus, keep the data the same, but vary the year of the rating standard.

As an illustration, the panel contains 625 companies in 1980. Consider first the predicted rating for a company using its 1980 firm characteristics and the 1980 rating standards, which is determined by the 1980 intercept–in short, the base year prediction. Consider next the predicted rating for that company using its 1980 firm characteristics but using the 1985 rating standards instead of the 1980 rating standards, which means using the 1985 intercept rather than the 1980 intercept. If the more stringent standards were economically important, a substantial portion of companies would have lower predicted ratings using the 1985 standards in comparison to the 1980 standards. In fact, 138 companies, or 22.1 percent, would have received lower predicted ratings. Also consistent with more stringent rating standards, 118 companies, or 17.8 percent, would have received higher predicted ratings using the standards of five years earlier, again applied to their 1980 firm characteristics.

On average, 17.0 percent of the firms would have had lower predicted ratings using the probit model five years forward in time in comparison to the base prediction, 39.4 percent 10 years forward in time, 56.4 percent 15 years forward in time, and 58.2 percent 19 years forward in time. On average going back in time, 15.6 percent of the companies would have greater predicted ratings using a model five years earlier, 34.8 percent ten years earlier, 47.7 percent fifteen years earlier, and 50.0 percent 19 years earlier.

5.3 Changes in Firm Characteristics

The actual rating that a company receives over the years is a function of the rating standard as well as changes in its characteristics. Even if the rating standards are becoming more stringent over time, a company could maintain or better its rating if in some way it improves its characteristics. The data suggest that on balance companies did improve their firm characteristics over time, and were it not for this improvement, the number of downgrades would have been greater that actually occurred.

For instance, consider those 496 companies which were in the panel in 1983 and also in 1988. Now, keep the rating standards constant at those of 1983, but vary the firm characteristics. Using the 1983 rating standards to make predictions, 99 of these 496 companies would have had greater predicted ratings on the basis of their 1988 firm characteristics than on the basis of their 1983 firm characteristics (Table 5, Panel A). Similarly calculated, 53 would have had poorer predicted ratings. These two comparisons suggest that on balance these 496 firms improved their financial characteristics over these five years since only the firm characteristics are being changed, not the rating standards themselves.

Yet, when one applies the 1988 rating standards instead of the 1983 standards to the 1988 firm characteristics, the story changes. Now, only 36 firms have higher predicted ratings in comparison to the base year prediction, while 117 firms have lower predicted ratings. Thus, despite the apparent improvement in firm characteristics, the more stringent rating standards have resulted in more predicted downgrades than upgrades.

If the predictions from the probit models mirror to some extent the actual rating process, the probit model should predict the greatest proportion of firms with actual upgrades to have improved firm characteristics, a smaller proportion of firms with no change in ratings, and the least proportion of firms with actual downgrades. The data are consistent with this prediction. Again using the 1983 standards to obtain predictions for both the 1983 and 1988 firm characteristics, 39 percent of the 77 firms with actual upgrades would have had predicted upgrades, but only 10 percent of the 150 firms with actual downgrades would have had predicted upgrades.

A summary measure of these changes by year is the sum of the changes in predicted ratings and changes in actual rating over all years from 1973 through 1987. This pooling does lead to some double counting as many firms will be counted more than once, but it nonetheless does provide useful summary statistics and is consistent with the changes by year. Of the 6348 firms in this pool, 1301 would have received greater predicted ratings on the basis of their firm characteristics five years later in comparison to their predicted ratings in the base year, where in each case the rating standard of the base year is used to calculated the predicted rating. Similarly calculated, 946 firms would have received lower predicted ratings. Thus, using the same rating standard, the firm characteristics over a five-year period on balance improved.

But when one also varies the rating standards, the story changes. Now, only 817 firms would have received greater predicted ratings using both their firm characteristics five years later and the rating standards of that year in comparison to the predicted ratings of the base year.

This analysis suggests that there would have been more downgrades over the twenty years from 1973 through 1972 than there actually were had some firms not taken steps to improve their financial and market risk characteristics. In a real sense, just to maintain a given rating would often have required a firm to effect some improvement in its financial and market risk characteristics.

6 Robustness

The specification of the probit model that the slope coefficients on firm characteristics are constant over time is an important assumption as it allows the time series behavior of the intercept to be interpreted directly as a measure of changing rating standards. But if the coefficients change over time, it is possible that a model with constant coefficients might understate the values of the linking variable before adding in the intercept in early years and overstate the values in the later years. Since the specification used in this study allows the intercepts to vary from year to year, fitting a probit model to the panel data could overcome such over and understatements through a series of intercepts with a downward trend, falsely pointing to more stringent rating standards over time.

To determine the sensitivity of the results to constraining the slope coefficients to be constant, the probit model was reestimated year by year with no constraints on the relation between the estimated coefficients across years. The signs of the coefficients matched the predicted signs most of the time. Over the twenty yearly probit models, the signs of the coefficients on interest coverage, deflated market equity, the subordinated dummy, beta coefficients, and the standard error from the market model all had the correct sign every year (Table 6). Net income to assets and deflated book equity have the most variability in signs, but still conformed to the predicted signs over fifty percent of the time.

The year-by-year probit models do not permit a direct measure of changing standards as did the pooled model with variable intercepts. However, it is possible to obtain from the yearly probit models a measure of changing standards through the comparison of the predicted rating for a firm's financial and market risk characteristics for a specific year using the estimated standards of that year with the predicted ratings using the standards for later and earlier years applied to the same firm characteristics—the same approach as was used earlier to measure the economic importance of the changing intercepts. The results of this analysis (Table 7) are very similar to the earlier analysis using the pooled probit model (Table 4). For example, using ten-year later standards, the year-by-year probit models show that on average of 39.7 percent of the firms would have received lower predicted ratings. The corresponding percent for the pooled probit model is virtually the same—39.4 percent. Using the ten-year earlier standards, the year-by-year probit models show that an average of 30.1 percent of the firms would have received greater predicted ratings. The corresponding percent for the pooled probit model is again virtually the same—34.8 percent.

Another possible source of bias in the intercepts stems from the changing composition of the panel over time. First, the number of firms steadily increases from 342 in 1973 to 1026 in 1987 and then gradually decreases. In estimating the probit model, this pattern effectively gives more weight to the middle part of the panel than the later and particularly the earlier part. Second, the cross-sectional distribution of the percentage distribution of ratings changes year-by-year with a shift from higher rated to lower rated bonds. If the underlying specification of the model were non-linear or there were omitted variables which were correlated with the included variables, it is possible that the trend in the intercept may be generated as a partial correction to the misspecification of the model used in this paper.

One way to address this possible source of bias is to reformulate the panel in such a way that the number of observations each year is constant and the cross-sectional distribution of the numbers of firms in each rating class each year is also constant. Thus, a new panel is constructed with 300 sample points in each of the 20 years for a total of 6000 observations. Within each year, the 300 sample points are picked to have the same cross-sectional distribution of ratings as the overall sample. To illustrate, 5.2 percent of the firms in the overall sample have a rating of CCC or below. A sample of 300 firms would thus have 16 firms in this rating category to be consistent the overall percentage of 5.2. When there are more than 16 firms with CCC or below in a given year, the first 16 by ordered by CUSIP number are sampled. If there are less than 16, the firms are repeatedly sampled by CUSIP order, thus including some companies more than once.

The probit model, defined by (2) through (4), is reestimated using this reformulated panel. The results are virtually identical to the probit model estimated on the entire panel. All the coefficients have the predicted sign (not shown), and the intercept declines steadily over time (Figure 3). The rank order correlation coefficient between the intercept and time is -0.95, which is the same as that for the overall sample.

In summary, the results from the year-by-year analysis are broadly similar to the constrained ones. Further, the changing composition of the sample does not appear to have introduced any serious biases. These two analyses of robustness provide support for the reasonableness of the constrained model and some comfort with the conclusions drawn from it.

7 Conclusion

There is a widespread belief among practitioners that the credit quality of US corporate debt has declined over the recent past, and trends in the actual bond ratings are consistent with this belief. However, part of this decline in the level of actual bond ratings could be due to the use of more stringent rating standards in assigning ratings. The empirical results of this paper, which are based upon an analysis of a panel of firms over the twenty years from 1973 through 1992, are consistent with this explanation. The data suggest that if it were not for the use of more stringent rating standards, the level of actual bonds ratings might have actually been higher today than in the past. As a word of caution, all of these results are conditional on the firm characteristics that this study utilizes. Another explanation of the empirical results is that this study has omitted a key variable or variables whose yearly average values display a time trend. In this case, the changing intercept in the model could be just compensating for such omitted variables. If this explanation is correct, then the firm characteristics used in this study and similar variants used in prior studies are inadequate to model the rating process.

Although the main focus of this study is the changing standards used in assigning ratings, the study found evidence, perhaps for the first time, that accounting ratios and market-based risk measures are more informative for larger companies than smaller companies. If true, the implications are broad. Depending upon their design, cross-sectional empirical studies of corporations may need to model explicitly the informativeness of the explanatory variables. Regulatory agencies might wish to impose different reporting requirements upon corporations as a function of their size. Finally, the size of firm may be a factor in determining its cost of capital.

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Figure 1

Plot of the Estimates of the Intercept from the Ordered Probit Model for the Panel Data from 1973 through 1992

The estimates of the intercept plotted over time come from the ordered probit model estimated on the panel data of 14330 observations from 1973 through 1992. The variance of the disturbances is modeled as a function of the deflated market equity. The intercept for 1973 is set to zero as part of the identification of the model. Lower values of the intercept imply more stringent grading standards, given the explanatory variables of the model.

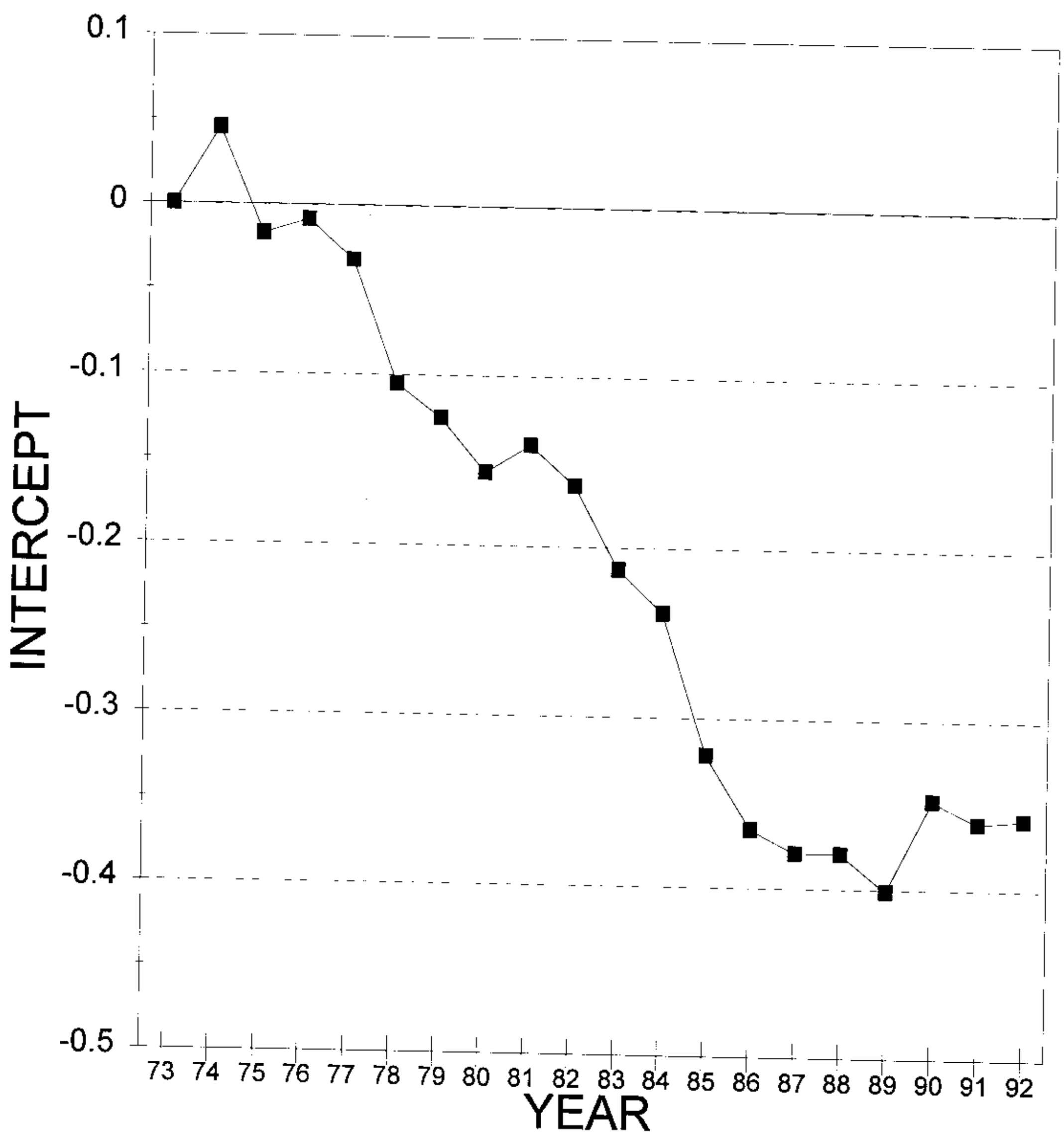


Figure 2

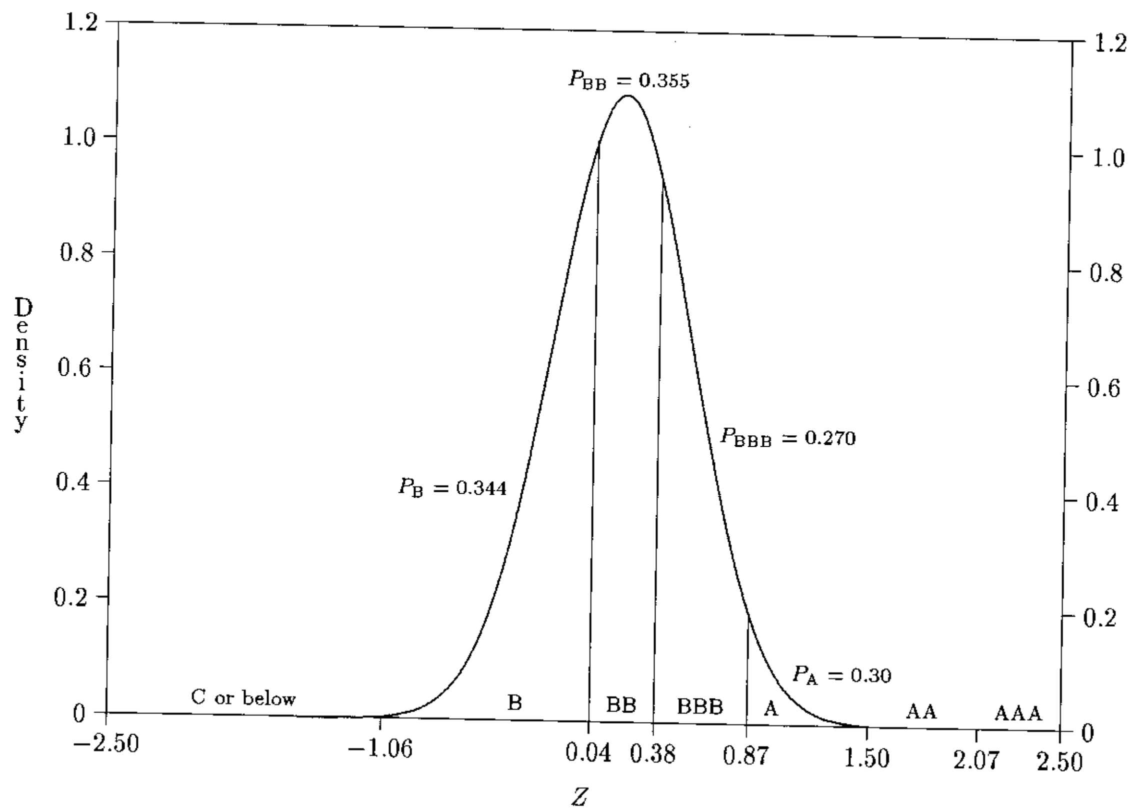
The Sensitivity of the Most Probable Rating to Small Changes in Parameters

The Company:

Name: Santa Fe Pacific Corporation
Rating: BB
Date: 1989

Calculation of Most Probable Rating

Conditional on the firm characteristics, the expected value of Z_{it}, $E(Z_{it} \mid X_{i,t-1}, W_{i,t-1})$ is 0.185 and the variance of the disturbance e_{it}, $\sigma(e_{it} \mid X_{i,t-1}, W_{i,t-1})$ is 0.366. The graph below sets forth the probability of each rating class for this company, and the most probable is BB.



Changes in Parameters

Increasing the standard deviation of the disturbance will flatten the normal curve reducing the probability of rating category BB, which of course increases the probability that the rating will be other than BB. For example, increasing the standard deviation of $\sigma(e_{it} \mid X_{i,t-1}, W_{i,t-1})$ slightly from 0.366 to 0.40 reduces the probability of BB from 0.355 to 0.327 and increases the probability of B from 0.344 to 0.355 and BBB from 0.270 to 0.273, changing the most probable category from the correct category BB to category B. A major reason for this sensitivity to small changes in $\sigma(e_{it} \mid X_{i,t-1}, W_{i,t-1})$ is that the size of the partition of Z corresponding to category BB is small in comparison to that corresponding to category B.

In this particular example, $E(Z_{it} \mid X_{i,t-1}, W_{i,t-1})$ fell almost in the middle of the Z interval corresponding to BB. If $E(Z_{it} \mid X_{i,t-1}, W_{i,t-1})$ were shifted to the right or left, the differences in the sizes of the partitions corresponding to the adjacent categories would ultimately shift enough probability from category BB to B or BBB, making one of these the most probable.

Figure 3

Plot of the Estimates of the Intercept from the Ordered Probit Model Using a Time-Equalized Panel from 1973 through 1992

The Panel from 1973 through 1992 contains different numbers of firms per year and different cross-sectional distributions of rating categories per year. A time-equalized panel was constructed from this overall panel so as to have the same number of firms in each year and the same cross-sectional distribution of rating categories. The estimates of the intercept plotted over time come from the ordered probit model estimated on this time-equalized panel. The variance of the disturbances is modeled as a function of the deflated market equity. The intercept for 1973 is set to zero as part of the identification of the model. Lower values of the intercept imply more stringent grading standards, given the explanatory variables of the model. A comparison of the time pattern of these intercepts with those from the order probit model estimated on the overall panel discloses any biases that might have occurred due to an unequal number of observations and to changing cross-sectional distributions of rating categories.

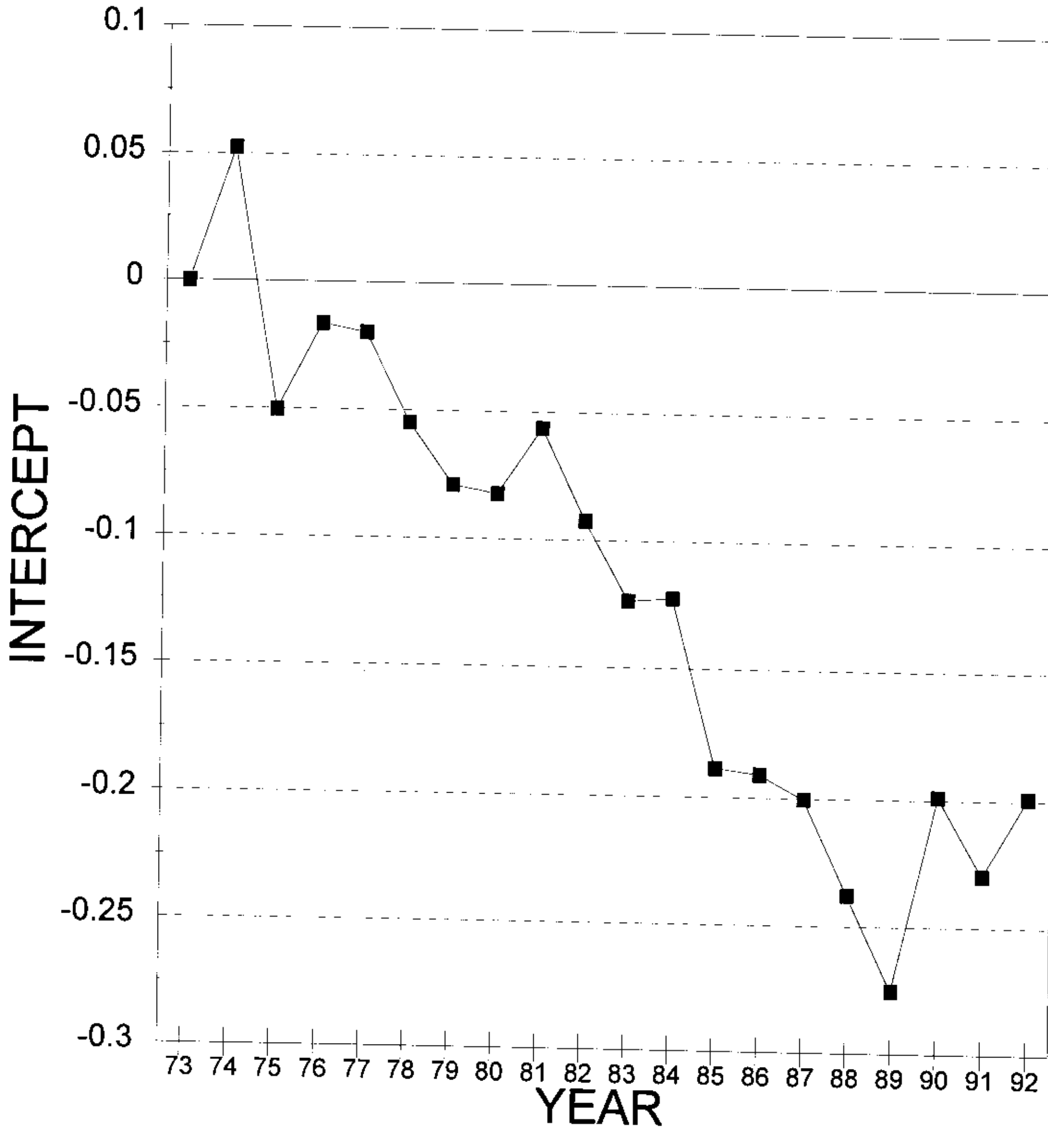


Table 1

Companies with Rated Bonds
Cross-Classified by S&P Quality Rating and Year
1973 - 1992

This study is based upon a panel of companies covering the twenty years from 1973 through 1992. Compustat was the primary source for the data on this panel of companies. Other sources include the CRSP daily stock files and a file of bond ratings from the University of Wisconsin. Panel A gives the number of bonds cross-classified by S&P Quality Rating and year as well as the total by year, and Panel B gives the percentage breakdown by year.

Year	Rating							
	AAA	AA	A	BBB	BB	B	CCC or Below	Total
A. Number								
1973	19	89	148	51	14	18	3	342
1974	19	87	160	52	17	20	3	358
1975	23	93	185	59	18	18	5	401
1976	23	104	179	65	18	15	4	408
1977	23	103	184	66	20	17	6	419
1978	37	120	226	87	55	81	15	621
1979	41	124	230	86	54	88	22	645
1980	35	114	226	91	47	95	17	625
1981	34	128	240	115	47	109	19	692
1982	30	141	222	128	51	101	29	702
1983	31	144	227	140	65	127	50	784
1984	24	148	241	137	75	148	52	825
1985	24	142	281	175	74	206	58	960
1986	25	133	267	184	83	245	75	1012
1987	27	128	261	184	93	246	87	1026
1988	24	118	273	185	84	220	78	982
1989	22	122	260	198	83	193	60	938
1990	23	112	254	210	85	149	64	897
1991	19	96	228	186	75	135	48	787
1992	26	111	262	225	107	129	46	906
Total	529	2357	4554	2624	1165	2360	741	14330
B. Percentage								
1973	5.6	26.0	43.3	14.9	4.1	5.3	0.9	100
1974	5.3	24.3	44.7	14.5	4.7	5.6	0.8	100
1975	5.7	23.2	46.1	14.7	4.5	4.5	1.2	100
1976	5.6	25.5	43.9	15.9	4.4	3.7	1.0	100
1977	5.5	24.6	43.9	15.8	4.8	4.1	1.4	100
1978	6.0	19.3	36.4	14.0	8.9	13.0	2.4	100
1979	6.4	19.2	35.7	13.3	8.4	13.6	3.4	100
1980	5.6	18.2	36.2	14.6	7.5	15.2	2.7	100
1981	4.9	18.5	34.7	16.6	6.8	15.8	2.7	100
1982	4.3	20.1	31.6	18.2	7.3	14.4	4.1	100
1983	4.0	18.4	29.0	17.9	8.3	16.2	6.4	100
1984	2.9	17.9	29.2	16.6	9.1	17.9	6.3	100
1985	2.5	14.8	29.3	18.2	7.7	21.5	6.0	100
1986	2.5	13.1	26.4	18.2	8.2	24.2	7.4	100
1987	2.6	12.5	25.4	17.9	9.1	24.0	8.5	100
1988	2.4	12.0	27.8	18.8	8.6	22.4	7.9	100
1989	2.3	13.0	27.7	21.1	8.8	20.6	6.4	100
1990	2.6	12.5	28.3	23.4	9.5	16.6	7.1	100
1991	2.4	12.2	29.0	23.6	9.5	17.2	6.1	100
1992	2.9	12.3	28.9	24.8	11.8	14.2	5.1	100

Table 2

Ordered Probit Model Estimates for the Panel Data from 1973 through 1992

The estimates are for the ordered probit model parameters using a panel data sample of 14330 observations from 1973 through 1992. The variance of the disturbances is modeled as a function of the deflated market equity. The first set of standard errors is calculated under the assumption that the disturbances are pairwise uncorrelated. The second, or adjusted set is calculated using the Newey and West (1987) procedure to account for possible autocorrelation in the disturbances across time for individual firms in the linking variable regression.

	Coefficient	Standard Error	Z-Statistic	Adjusted Standard Error	Adjusted Z-Statistic	Coefficient × Variable SD
Betas						
Interest Coverage	.027	.002	10.95	.005	5.20	.083
Interest Coverage Dummy	-.123	.023	-5.35	.053	-2.33	-.029
Book Debt to Assets	-1.082	.048	-22.41	.128	-8.48	-.180
Net Income to Assets	.349	.092	3.79	.180	1.94	.028
Deflated Book Assets	.017	.006	2.95	.012	1.43	.026
Deflated Market Equity	.178	.010	18.71	.024	7.31	.293
Market Model Beta	-.149	.012	-12.23	.024	-6.13	-.074
Residual Standard Dev'n	-.309	.013	-22.96	.039	-7.86	-.309
Subordinated Dummy	-.494	.023	-21.14	.063	-7.83	-.207
Year Dummies						
1973	—	—	—	—	—	
1974	.045	.035	1.28	.019	2.42	
1975	-.017	.034	-.50	.021	-.80	
1976	-.086	.034	-2.53	.032	-2.73	
1977	-.032	.033	-.96	.025	-1.27	
1978	-.105	.032	-3.34	.032	-3.25	
1979	-.125	.031	-3.97	.034	-3.72	
1980	-.157	.032	-4.94	.036	-4.41	
1981	-.141	.031	-4.49	.034	-4.08	
1982	-.164	.031	-5.22	.038	-4.37	
1983	-.213	.032	-6.72	.044	-4.84	
1984	-.238	.032	-7.49	.045	-5.30	
1985	-.322	.033	-9.89	.053	-6.06	
1986	-.365	.033	-10.99	.058	-6.35	
1987	-.371	.033	-11.14	.059	-6.28	
1988	-.379	.033	-11.40	.056	-6.73	
1989	-.401	.034	-11.92	.058	-6.89	
1990	-.347	.033	-10.55	.054	-6.45	
1991	-.360	.034	-10.75	.055	-6.61	
1992	-.358	.033	-10.88	.055	-6.52	
Lower Boundary for Rating Category						
AAA	2.066	.100		.272		
AA	1.498	.076		.199		
A	.872	.056		.128		
BBB	.377	.045		.089		
BB	.038	.042		.077		
B	-1.006	.055		.127		
CCC and below	$-\infty$	—				
Variance Parameters						
Deflated Market Equity	-.109	.005	-20.54	.016	-6.88	

Table 3

Actual Ratings versus Predicted Ratings Using the Panel Probit Model 1973 - 1992

A measure of the goodness of fit of the probit model that is estimated over the panel and whose estimated coefficients are presented in Table 2 is the matrix of actual ratings versus predicted ratings. The matrix given in this table shows, for instance, that the panel contains 529 companies with bonds carrying a AAA rating. The predicted ratings for these bonds are: AAA for 159, AA for 276, A for 88, BBB for 5, and B for 1.

Actual Rating	Predicted Rating							
	AAA	AA	A	BBB	BB	B	CCC or Below	Total
AAA	159	276	88	5	0	1	0	529
AA	33	854	1385	67	0	17	1	2357
A	5	496	3383	616	3	50	1	4554
BBB	0	35	1341	1009	7	231	1	2624
BB	0	2	142	511	13	485	12	1165
B	0	1	43	212	6	1904	194	2360
CCC or Below	0	0	5	16	0	384	336	741
Total	197	1664	6387	2436	29	3072	545	14330

Table 4

The Effect of Changing Rating Standards on Predicted Ratings Based Upon the Pooled Probit Model 1973-1992

One way to measure the effect of changing standards on predicted ratings is first, to ascertain the predicted rating for a company for the year of its financial and market risk characteristics using the rating standards of that year, termed the base-year prediction; and second, to compare this predicted rating to the rating that would be predicted using an earlier or later standard. The prediction using an earlier or later standard is based upon the financial and market risk characteristics of the base year. To summarize these comparisons, this table presents the net number of firms that would receive a predicted upgraded or downgraded rating as a percentage of the firms in the base year. Such percentages are shown for rating standards of 5 years, 10 years, 15 years, and 19 years later or earlier than the base year. The rating standards themselves come from the pooled probit model given in Table 2.

Percentage Upgraded or Downgraded (Downgraded in Parentheses)								
Rating Standards					Rating Standards			
19 Years Earlier	15 Years Earlier	10 Years Earlier	5 Years Earlier	Base Year	5 Years Later	10 Years Later	15 Years Later	19 Years Later
				1973	(16.1)	(34.2)	(62.9)	(58.2)
				1974	(24.3)	(42.7)	(66.5)	
				1975	(25.9)	(55.4)	(60.1)	
				1976	(9.8)	(42.9)	(41.9)	
				1977	(20.0)	(53.2)	(50.4)	
			15.0	1978	(15.3)	(40.4)		
			23.3	1979	(15.8)	(40.0)		
			17.8	1980	(22.1)	(26.4)		
			6.9	1981	(32.8)	(32.2)		
			18.2	1982	(28.6)	(26.8)		
		26.7	12.9	1983	(21.8)			
		37.6	13.7	1984	(21.9)			
		42.7	24.4	1985	(2.6)			
		39.5	31.0	1986	0.4			
		46.5	26.9	1987	1.9			
	51.0	35.6	22.9	1988				
	61.3	37.6	22.0	1989				
	44.0	22.9	2.8	1990				
	35.8	29.6	(1.1)	1991				
50.0	46.5	28.9	(2.2)	1992				
50.0	47.7	34.8	15.6	Average	(17.0)	(39.4)	(56.4)	(58.2)

Table 5

Decomposing the Joint Effects of Changing Rating Standards and Changing Firm Characteristics 1973-1992

The empirical finding that there have been more downgrades than upgrades in the recent past [e.g., Lucas and Lonski (1992)] could be due to some combination of both changing rating standards and changing firm characteristics. To decompose these two effects, for each firm, two comparisons are made: The first is the predicted rating using the firm characteristics five years later and the rating standard of the base year to the predicted rating using the firm characteristics of the base year and the rating standard of the base year. This comparison measures the effect of changing firm characteristics alone. The second is the predicted rating using the firm characteristics five years later and the rating standard five years later to the predicted rating using the firm characteristics of the base year and the rating standards of the base year. This comparison measures the joint effect of both changing firm characteristics and changing rating standards. The rating standards are measured by the pooled ordered probit model. Only firms with data in the base year and five years later are included. For the comparisons, the firms are classified into an overall group and three subgroups: those which saw their actual ratings from the base year to five years later upgraded, unchanged or downgraded. Results are presented for the entire sample as well as for selected time periods.

		Number of Firms					
		Predicted Change in Rating Using Financial Characteristics of Firm Five Years Later and Rating Standards of Base Year in Comparison to Base Year Predictions			Predicted Change in Rating Using Both Firm Financial Characteristics and Rating Standards Five Years Later in Comparison to Base Year Predictions		
Base Year	Total	Upgraded	Unchanged	Downgraded	Upgraded	Unchanged	Downgraded
A. All Firms							
1973	262	51	183	28	36	183	43
1978	444	80	302	62	48	307	89
1983	496	99	344	53	36	343	117
1973-1987	6348	1301	4101	946	817	4122	1409
B. Firms Upgraded							
1973	29	10	19	0	8	18	3
1978	67	27	37	3	18	44	5
1983	77	30	44	3	16	52	9
1973-1987	906	363	504	39	281	545	80
C. Firms with Unchanged Ratings							
1973	185	39	134	12	26	136	23
1978	261	46	189	26	26	195	40
1983	269	54	204	11	19	204	46
1973-1987	3778	810	2627	341	475	2707	596
D. Firms Downgraded							
1973	48	2	30	16	2	29	17
1978	116	7	76	33	4	68	44
1983	150	15	96	39	1	87	62
1973-1987	1664	128	970	566	61	870	733

Table 6

The Signs of the Ordered Probit Model Estimates for Each Year of the Panel from 1973 through 1992

For each year from 1973 through 1992, a separate ordered probit model is estimated. The variance of the disturbances in each year is modeled as a function of the deflated market equity. This table presents the signs of the estimated parameters for each year as well as the predicted sign and the number of years for which the estimated sign agreed with the predicted sign. A superscript "a" indicates that the corresponding estimated coefficient is significant at the five percent level, where the standard error is calculated on the assumption that the disturbances are pairwise uncorrelated.

	Linear Model								Standard Error
	Interest Coverage	Interest Coverage Dummy	Book Debt to Assets	Book Equity to Assets	Deflated Book Equity	Deflated Market Equity	Subordinated Dummy	Beta	Deflated Market Equity
Predicted Sign	+	−	−	+	+	+	−	−	−
Number with Predicted Sign	20	18	19	13	12	20	20	20	20
Year:									
1973	+	−	−	+	−	+[a]	−	−[a]	−[a]
1974	+[a]	−	−	−	−	+[a]	−	−[a]	−[a]
1975	+	+[a]	−	−[a]	−[a]	+[a]	−	−	−[a]
1976	+	−	+	−[a]	−[a]	+[a]	−	−[a]	−[a]
1977	+	−	−	−	−[a]	+[a]	−	−[a]	−[a]
1978	+	−	−[a]	+	+	+[a]	−[a]	−[a]	−[a]
1979	+[a]	−	−[a]	−	+	+[a]	−[a]	−[a]	−[a]
1980	+[a]	−	−[a]	−	+[a]	+[a]	−[a]	−[a]	−[a]
1981	+[a]	−	−[a]	+[a]	+	+[a]	−[a]	−[a]	−[a]
1982	+	−[a]	−[a]	+	+	+[a]	−[a]	−[a]	−[a]
1983	+[a]	−	−[a]	+[a]	+[a]	+[a]	−[a]	−	−[a]
1984	+	−	−[a]	+[a]	−	+[a]	−[a]	−[a]	−[a]
1985	+[a]	+	−[a]	−	+[a]	+[a]	−[a]	−[a]	−[a]
1986	+[a]	−	−[a]	+	+	+[a]	−[a]	−	−[a]
1987	+[a]	−	−[a]	+[a]	+	+[a]	−[a]	−	−[a]
1988	+[a]	−[a]	−[a]	+	−	+[a]	−[a]	−[a]	−[a]
1989	+[a]	−[a]	−[a]	+	+	+[a]	−[a]	−[a]	−[a]
1990	+[a]	−[a]	−[a]	+	−	+[a]	−[a]	−[a]	−[a]
1991	+[a]	−	−[a]	+	+[a]	+[a]	−[a]	−	−[a]
1992	+[a]	−	−[a]	+	+	+[a]	−[a]	−[a]	−[a]

Table 7

The Effect of Changing Rating Standards on Predicted Ratings Based Upon the Year-by-Year Probit Models 1973-1992

One way to measure the effect of changing standards on predicted ratings is first, to ascertain the predicted rating for a company for the year of its financial and market risk characteristics using the rating standards of that year, termed the base-year prediction; and second, to compare this predicted rating to the rating that would be predicted using an earlier or later standard. The prediction using an earlier or later standard is based upon the financial and market risk characteristics of the base year. To summarize these comparisons, this table presents the net number of firms that would receive a predicted upgraded or downgraded rating as a percentage of the firms in the base year. Such percentages are shown for rating standards of 5 years, 10 years, 15 years, and 19 years later or earlier than the base year. The rating standards themselves come from the year-by-year probit models using the explanatory variables given in Table 2.

Percentage Upgraded or Downgraded (Downgraded in Parentheses)								
Rating Standards					Rating Standards			
19 Years Earlier	15 Years Earlier	10 Years Earlier	5 Years Earlier	Base Year	5 Years Later	10 Years Later	15 Years Later	19 Years Later
				1973	(0.3)	(19.0)	(28.1)	(37.7)
				1974	(26.0)	(63.1)	(72.9)	
				1975	(29.4)	(66.6)	(71.3)	
				1976	(25.2)	(71.3)	(55.4)	
				1977	(7.4)	(17.9)	(18.9)	
			(8.7)	1978	(12.1)	(29.5)		
			11.6	1979	(26.2)	(47.1)		
			21.1	1980	(27.2)	(37.6)		
			(1.0)	1981	(56.1)	(33.1)		
			0.9	1982	(12.5)	(12.1)		
		0.3	5.4	1983	(6.4)			
		36.4	25.0	1984	(23.6)			
		59.0	28.4	1985	(7.4)			
		55.0	40.8	1986	11.3			
		23.8	9.6	1987	7.4			
	5.3	5.4	9.7	1988				
	56.3	47.2	25.2	1989				
	57.5	39.0	10.7	1990				
	39.9	26.7	(16.3)	1991				
16.1	23.5	7.9	(2.8)	1992				
16.1	36.5	30.1	10.6	Average	(16.1)	(39.7)	(49.3)	(37.7)