Rating Agency Responsiveness to Changes in the Economic Environment Facing Electric Utilities

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Abstract

This paper tests rating agency responsiveness to changes in the economic environment facing electric utilities. Logistic regression is used to model Standard & Poor's ratings of new preferred stocks for 1969-1972 and 1978-1981. During the unstable period 1978-1981, default risk, earnings quality, regulatory climate, and coverage ratios were primary considerations in the rating process. For the stable period 1969-1972, marketability, profitability, and coverage ratios were the most significant ratings determinants. These results indicate the preferred stock rating process responds to changes in the business risk facing utilities by focusing on different variables over time.

Introduction

Rating agency responsiveness to the changing environment facing utilities is essential. Ratings that ignore significant macroeconomic and industry changes do not provide investors with the best information. This paper develops a logistic regression model to compare rating agency evaluations of preferred stock between a stable operating period, 1969-1972, and an unstable one, 1978-1981. The results indicate that Standard & Poor's changes the weight it places on key variables to reflect changes in the operating environment of a utility. Preferred stock ratings are used as the basis for the analysis because preferred stock is a significant source of financing for electric utilities (as compared with industrial firms) and there is a paucity of research on the preferred stock rating process and on preferred stock valuation.

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Literature Review

Preferred stock ratings are tied closely to bond ratings.[1] Consequently, utility bond rating studies provide a foundation for the analysis of preferred stock ratings. Pinches, Singleton, and Jahankhani [11] find that fixed charge coverage ratios, measures of the regulatory climate, firm size, profitability, growth rate in profitability, and construction expenditure activity are among the most important variables determining utility bond ratings. Bhandari, Soldofsky, and Boe [1] find that the level and trend in fixed charge coverage, debt ratio, and return on assets can predict up to 90 percent of the rating changes for electric utilities. Wingler and Watts [17] find that utility bond rating changes are influenced heavily by the amount of noncash earnings (allowance for funds used during construction (AFUDC)).

Research dealing directly with the rating and valuation of preferred stock provides additional insights useful in evaluating the responsiveness of rating agencies to a changing economic environment facing electric utilities. Emanuel [5] develops an option-hedging model for the valuation of preferred stock that supports the importance of coverage ratios and debt ratios in the valuation of preferred stock. Zumwalt [18] uses principal components analysis and multiple discriminant analysis on a large set of financial variables to examine their ability to classify a sample of preferred stocks into their respective Standard & Poor's (S & P) rating categories. He finds that the best classification factors changed significantly over the three years of his study period. The observed lack of stability of the factor parameters in the Zumwalt study suggests that the rating process is a dynamic one. Related research dealing with the valuation of preferred stocks also suggests that investors and rating agencies may focus on different variables over time. Sorenson and Hawkins (SH) [13] find a significant clientele effect associated with preferred stocks bearing sinking funds, resulting in valuation differences over time. Gombola, Kahl, and Nunn [8] question the findings of SH and argue that the shift in returns between sinking fund and nonsinking fund preferred stock can be attributed best to shifts in Federal Reserve Board monetary policy.

In summary, prior work on bond and preferred stock ratings suggests that over time, rating agencies focus on and may place different weights on the set of factors considered to be important in determining the ratings of fixed income securities. This paper tests the proposition that rating agencies emphasize

[1]For example, Standard & Poor's states that "debt and preferred stock ratings are closely linked in that a corporation's senior debt rating acts as a ceiling to its preferred stock rating" [14, p. 83].

different factors over time, depending on the economic environment. Evidence is found that supports this proposition.

Methodology

The ordered logistic regression model is utilized to classify a sample of preferred stocks into their respective S&P assigned ratings.[2] The logistic regression model estimates weights of the logit function in order to maximize the likelihood of predicting the outcome of events, given a set of independent variables. In the current study, the logistic model indicates the probability of a given preferred stock belonging to the next higher rating, conditional on the values of the explanatory variables. The logistic model has been shown to be superior to multiple discriminant analysis (MDA) and probit models for rating municipal bonds [6] and for bankruptcy forecasting [3] even for small samples. Ederington [4], in a comprehensive comparison of various bond rating prediction models, finds that the unordered logit and the ordered probit models were statistically superior in performance to the MDA and OLS regression models. The inferior MDA and OLS regression model performance was attributed primarily to the violation of the joint multivariate normality assumption and the assumption of an interval scale dependent variable, respectively. Logistic regression also provides a more convenient test for the significance of coefficients than is possible with MDA.

Sample

The logistic model was developed using a sample of newly issued electric utility preferred stocks rated by Standard & Poor's. New issues of preferred stock reflect the latest rating agency assessment of quality. The models were estimated for preferred stocks issued over two periods--1978-1981 and 1969-1972. The period prior to 1973 was one of relative stability in financial markets, oil prices, regulatory climate, and construction spending. After 1973, particularly during the 1978-1981 period, electric utilities have been subject to high and volatile

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[2]For details of the procedure, see Walker and Duncan [16]. For a brief overview of the logistic regression method, see Pindyck and Rubinfeld [12]. The unordered logit and probit models are different from their ordered counterparts as the former allow the relative importance of variables to vary across the ratings. For example, size may be more important for BBB-rated bonds than for AAA-rated bonds. The unordered models, however, do not take into account the ordinal nature of the ratings. Despite the increased flexibility of unordered models, Ederington [4] finds that the ordered models have better classification ability on the holdout sample than the unordered models.

levels of interest rates, oil price shocks, increased regulatory risk, and problems associated with nuclear plants and construction. Table 1 contrasts selected variables reflecting various dimensions of the macroeconomic and electric utility environment during the two sample periods. It is clear that 1978-1981 was unstable, characterized by high and volatile interest rates, high business risk (as evidenced in lower profit margins, higher fuel costs, and increased utility construction expenditures), and increased regulatory risk (as reflected by the AFUDC measure.)[3]

The 1969-1972 sample includes 71 preferred stocks with a mean issue size of $28.6 million and a standard deviation of $18.7 million. The S&P ratings for the sample are: BBB (9), A (32), AA (27), AAA (3). There were no issues with a BB rating or less. All preferred stocks in the early period sample had a call feature with an average call deferment period of 5.5 years. Of the 71 preferred issues, four were immediately callable, 46 were callable in five years, 16 in seven years, and five in ten years. Four of the 71 issues had a sinking fund. The 1978-1981 sample included 49 preferred stocks with a mean issue size of $44.5 million and a standard deviation of $24.4 million. The S&P ratings of the sample are: AA (11), A (16), BBB (17), and BB (5). There were no issues with an AAA rating. All preferred stocks in the later period sample had a call feature, with an average call deferment of 5.0 years. Of the 49 issues, three were immediately callable, 43 were callable in five years, and the remaining three in ten years. Twenty-nine of the 49 issues had a sinking fund. The major difference between the two samples is the greater frequency of the sinking fund feature in the later period sample. This difference should not influence the ratings received because, as stated by S&P: "The preferred stock evaluation does not accord different rating treatment to a perpetual issue versus a sinking fund obligation" [14, p. 84].

Variable Selection

The variables included in the model have been identified by rating agencies and earlier studies as being important in determining utility bond and preferred stock ratings. A listing of these variables and their definitions is provided below.

IPCOV = Earnings before interest and taxes divided by interest plus preferred stock dividends;

[3]AFUDC as a measure of the regulatory climate is defined in detail in the following section on variable selection.

D	=	Debt ratio, measured as long-term debt divided by long-term debt, preferred stock plus common stock;
ARE	=	Return on common equity, defined as earnings available to common stockholders divided by beginning of the year common equity;
PS	=	Size (dollar amount) of the preferred stock offering;
PAFUDC	=	Ratio of allowance for funds used during construction (AFUDC) divided by net income;
MB	=	Ratio of market price to book value per share of common stock;
SD	=	The standard deviation of the return on assets.

IPCOV measures a firm's ability to meet its debt interest and preferred stock dividend obligations.[4] A positive coefficient is expected because high coverage ratios should result in lower risk of default, a lower risk of the suspension of preferred stock dividends, and thus, higher ratings. The debt leverage ratio (D) is an indicator of the risk of the firm being unable to meet preferred stock obligations. IPCOV and D indicate the dynamic (cash flow) and stock (balance sheet) dimensions of default risk and are major variables used by rating agencies.

The return on common equity (ARE) is expected to have a positive relationship with ratings. A high return on equity is indicative, *ceteris paribus*, of a lower probability of default.

Consistent with the approach used by Cohan [2], the size of the preferred stock issue (PS) is included as a measure of marketability. Larger preferred stock issues (or preferred stock offerings from larger firms) generally are considered to be more marketable and, therefore, may have higher ratings, *ceteris paribus*.[5]

PAFUDC is used as a measure of earnings quality and the risk of a utility's construction program. Some regulatory commissions have allowed current

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[4]In rating utility preferred stocks, Standard & Poor's considers both pretax and after tax preferred coverage ratios. Results are shown using the after tax preferred coverage measure (IPCOV). The models were replicated with the pretax preferred coverage ratio with no significant changes. The correlation between the pretax and after tax preferred coverage ratios was 0.99 for the 1969-1972 sample period and 0.92 for the 1978-1981 sample period.

[5]It is possible that a measure of preferred stock float would provide a better indication of an issue's marketability. The lack of trading data for several of the sample offerings precluded using the float measure for analysis. Also, there is no evidence in the S&P rating guidelines that float measures are used in the rating process. Many other studies, including Cohan's [2] comprehensive bond study, used issue size as a measure of marketability.

revenues to reflect at least a portion of construction expenditures. Other commissions have not permitted utilities to earn a current return on construction work in progress (CWIP). In the latter case, the utilities are permitted a noncash earnings entry reflecting the financing costs of construction. This treatment results in a cash flow burden that may be particularly severe, given the long lead time before a major nuclear or coal plant comes on stream. The expected sign for PAFUDC is negative.

MB is a measure of the ability of the firm to earn its true cost of capital. It provides a measure of the return being earned relative to risk and thus may be viewed as a measure of overall regulatory risk. French [6] and Trout [14] demonstrate a statistically significant relationship between market-to-book ratios for electric utilities and the factors contributing to regulatory risk for the period 1978-1981. In addition, the equality of means of the MB ratios across the three *Value Line* regulatory climate rating groups were tested. At the 0.01 level of significance, the null hypothesis that the mean MB is equal across the three *Value Line* regulatory climate categories is rejected. Using the Bonferroni multiple comparisons test, it is found that the MB ratios are significantly different between all pairs of *Value Line* categories. The mean MB ratio for the above average category was 0.90. For the average category, the mean MB ratio was 0.81. For the below average category, the mean MB was 0.72. The differences between all pairs of these means is significant at the 0.05 level. The MB measure of regulatory risk was used rather than a direct measure of regulatory risk because regulatory climate measures were not available until the mid- to late 1970s. A positive relationship between the MB ratio and preferred stock ratings if expected.

The standard deviation of return on assets (SD) is expected to have an inverse relationship with preferred stock ratings. Because preferred stock dividends are paid with after tax earnings, the higher the variability in the ratio of net income to total assets, the greater is the default risk for preferred stockholders. Because SD is controlled to some extent by a company's regulators, SD also may proxy for a portion of the regulatory risk dimension.

All variables were measured for the year prior to the issuance of the preferred stock except for ARE, PAFUDC, and SD. ARE and PAFUDC are averages for the three years prior to the issuance of preferred stock. SD was estimated using annual return on asset figures for the three years prior to the issuance of new preferred stock. The SD measure was computed over a three year period, rather than a longer period to reflect the recent actions of the utility commission. Three years was chosen because this period corresponds to the term of many state regulatory commission appointments.

Analysis of Results

The estimates of the logistic regression model using standardized variables for the 1978-1981 period are presented in Table 2. The estimated coefficients indicate that higher ratings are associated with firms having a high interest and preferred dividend coverage ratio, a low debt ratio, a low proportion of AFUDC to net income, a high market price to book value ratio, and a low standard deviation of return on assets, all at a 5 percent significance level. The significance of PAFUDC and MB suggest strongly that capital costs of preferred stock (to the extent lower ratings imply higher costs of financing) are affected adversely by earnings quality concerns and regulatory risk. An examination of the correlation matrix for the independent variables revealed no significant multicollinearity problems. Because the model was estimated using standardized variables, it is possible to determine the relative importance of the individual variables from the size of their coefficients. The order of importance of the statistically significant variables was found to be: IPCOV, MB, D, PAFUDC, and SD. The importance of the coverage ratio (IPCOV) is consistent with the emphasis of rating agencies on the firm's cash flow ability to meet its fixed obligations. The relative importance of the MB ratio is indicative of the role played by regulatory risk in establishing preferred stock ratings during this period.

Table 3 presents a classification matrix for the logistic model. The top half of the table shows the within sample classification efficacy. Of the sample of 49 stocks, 28 or 57 percent were classified correctly. This is somewhat better than the accuracy obtained by Zumwalt (approximately 50 percent) and similar to the accuracy achieved in electric utility bond rating models. The model's ability to classify ratings in the extreme groups (AA and BB) is significantly below that for the intermediate groups. All misclassifications are within one rating of the original.

Within sample classification procedures are biased upward if used as a measure of predictive ability. To test properly for predictive ability, the estimated model should be used to classify a holdout sample of bonds. The limited sample size precluded this approach. Instead, the Lachenbruch[6] jackknife approach is used. This procedure involves estimation of the model using n-1 observations, where n is the sample size. The estimated model then classifies the one omitted observation. This procedure is repeated n times, omitting a different observation each time. These results are shown in the bottom panel of Table 3. The overall accuracy across ratings is 45 percent. The classification ability was lowest for the BB rating group.

[6]For details, see Lachenbruch [9] and Lachenbruch and Mickey [12].

In contrast, the 1969-1972 period was one of stability in terms of the capital costs, oil prices, construction expenditures, and the regulatory climate for utilities. The standardized logistic model estimates for the 1969-1972 period are presented in Table 4. Only three of the seven variables were found to contribute significantly to explaining the ratings. These are IPCOV, PS, and ARE in order of importance. During the stable period of 1969-1972, marketability and profitability measures, in addition to coverage measures, were among the most important determinants of preferred stock ratings. In contrast, ratings in the period of 1978-1981 were impacted more by measures of default, earnings quality, and regulatory risk. Thus, it appears that rating agencies emphasize different factors depending upon the economic environment, becoming more conscious of solvency and earnings quality factors in an unstable period compared to a stable period.

A particularly interesting result is that the measure of regulatory risk, MB, was significant in the 1978-1981 period but not in the 1969-1972 period. During the earlier period, the risks of plant disallowances, prudency reviews, and significant regulatory lag, to name a few, were practically non-existent. To the extent that ratings determine capital costs, firms currently operating in adverse regulatory climate areas incur higher costs for their preferred stock financing.

The classification power of the model during the 1969-1972 period is shown in Table 5. The logistic model accurately classified 61 percent of the sample. All misclassified ratings were within one rating category of the original. The Lachenbruch classification matrix appears in the bottom half of Table 5. Fifty-seven percent of the issues were classified correctly.

Additional insight into the dynamics of the rating process was obtained using the estimated model for each period to classify the sample of preferred stocks from the other period. If the rating process placed relatively greater emphasis on default risk, earnings quality, and regulatory risk in the 1978-1981 period compared to the 1969-1972 period, then the model estimated over the 1978-1981 period systematically should underpredict the ratings for the sample of bonds taken from the 1969-1972 period. Conversely, the model estimated over the period 1969-1972 should overpredict ratings for preferred stocks in the 1978-1981 period.

The analysis was confined to BBB, A, and AA ratings, as these are the only ones common to the sample for both periods. The models were estimated using the standardized variables discussed earlier in order to avoid confounding effects of changes in the relative importance of explanatory variables and secular and cyclical shifts in the levels of the variables.

The top half of Table 6 shows the classification of the 1969-1972 sample using 1978-1981 model parameters. The 1978-1981 model underpredicts the ratings. For instance, of the 32 AA bonds in the 1969-1972 period, 23 were classified correctly by the 1969-1972 model. The 1978-1981 model, however, classified only 13 correctly, and 15 were classified in the lower BBB rating. The bottom half of Table 6 shows the classification results for the 1978-1981 preferred stock issues using the 1969-1972 model parameters. The 1969-1972 model overpredicts the ratings. For example, for preferred stock rated BBB, the same period model correctly predicted the rating of 13 of the 17 issues. The 1969-1972 model predicted the rating of only one issue correctly and classified 15 issues in the higher A rating category.

Conclusions and Implications

The logistic model of preferred stock classification shows that during the unstable period of 1978-1981, interest coverage, regulatory climate, default risk, and earnings quality were primary considerations in the rating process. During the stable years of 1969-1972, the coverage ratio, profitability, and marketability were more important in determining preferred stock ratings.

These results imply that the preferred stock rating process for electric utilities reflects over time changes in the business risks facing utilities. The results also indicate that the parameter estimates derived from statistical models designed to replicate bond and preferred stock ratings are not stable over time. The actual rating process is dynamic (and judgmental) with respect to the emphasis of factors used in the determination of ratings. Thus, it appears that rating agencies rationally emphasize different factors over time, depending upon the economic environment--becoming more conscious of solvency and earnings quality factors in an unstable period compared to a stable period.

From a regulatory perspective, the results indicate that ratings are affected adversely by low quality earnings. To the extent that low earnings quality leads to lower bond and preferred stock ratings (and hence higher capital costs), the impact is not favorable to ratepayers, *ceteris paribus*.

The results of this study also have implications for investors who may use similar models to classify nonrated preferred stocks. Utility preferred stock issues that are placed privately normally are not rated. A rating model such as the one derived in this paper should be useful to institutional buyers of private placement preferred stock. The results suggest the need for institutional investors to update the rating models they use when there are fundamental changes in the business risk facing a firm or industry.

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Table 1
Intra-Industry and Macroeconomic Differences
Between 1969-1972 and 1978-1981 Periods

Variable	1969-1972	1978-1981
Economic Indicators:		
Average Annual Change in GNP Deflator	4.50%	8.40%
Average Industrial Production Index	109.90	149.20
Profitability Index	100.40	92.30
Capital Investment Index	114.00	109.90
Average T-bill Rate (3 mon.)	5.38%	10.74%
Volatility of 3 month T-bill Rates (standard deviation computed over the 48 months in each subperiod)	1.31	2.83
Industry Indicators:		
Operating Income/Operating Revenue for electric utilities	21.00%	14.30%
Average Fuel Cost/KW hour	$0.36	$1.91
Construction Expenditure ($ billion)	15.40	34.30
AFUDC/share ($)	1.67	4.45

Source: Various issues of *Business Conditions Digest*, *Federal Reserve Bulletin*, *Moody's Public Utility Manual*, and *Edison Electric Institute Statistical Year Book*

Table 2
Estimates of the Logistic Regression Model Using
Standardized Variables, 1978-1981

Variable	Estimated Coefficient	Standard Error of Coefficient	Chi-Square (Wald Statistic)	P-value
ALPHA 1	4.027	0.7939	25.73	<0.0001
ALPHA 2	0.461	0.4195	1.21	0.2713
ALPHA 3	-2.249	0.5282	18.12	0.0001
IPCOV	1.284	0.6092	4.44	0.0351**
D	-0.939	0.4494	4.37	0.0366**
ARE	0.227	0.3774	0.36	0.5477
PS	-0.149	0.3034	0.24	0.6245
PAFUDC	-0.913	0.4441	4.23	0.0397**
MB	1.201	0.5022	5.71	0.0168**
SD	-0.680	0.3421	3.95	0.0468**

MODEL LIKELIHOOD RATIO CHI-SQUARE = 44.32
MODEL P-VALUE < 0.0001

*** significant at the 1 percent level
** significant at the 5 percent level
* significant at the 10 percent level

Table 3
Classification Matrix, 1978-1981
Classification of Original Sample

Original Rating	AA	A	BBB	BB	Total
		Rating Classified by Model			
AA	4 (36.4)*	7 (63.6)	0 (0.0)	0 (0.0)	11 (100.0)
A	2 (12.5)	11 (68.8)	3 (18.7)	0 (0.0)	16 (100.0)
BBB	0 (0.0)	5 (29.4)	11 (64.7)	1 (5.9)	17 (100.0)
BB	0 (0.0)	0 (0.0)	3 (60.0)	2 (40.0)	5 (100.0)
Total	6	23	17	3	49

Classification Using Jacknife Procedure

Original Rating	AA	A	BBB	BB	Total
		Rating Classified by Model			
AA	4 (36.4)	5 (45.4)	2 (18.2)	0 (0.0)	11 (100.0)
A	4 (25.0)	8 (50.0)	4 (25.0)	0 (0.0)	16 (100.0)
BBB	1 (5.9)	5 (29.4)	9 (52.9)	2 (11.8)	17 (100.0)
BB	0 (0.0)	0 (0.0)	3 (80.0)	2 (20.0)	5 (100.0)
Total	9	18	19	3	49

*Figures in parentheses are percentages

Table 4
Estimates of the Logistic Regression Model Using Standardized Variables, 1969-1972

Variable	Estimated Coefficient	Standard Error of Coefficient	Chi-Square (Wald Statistic)	P-value
ALPHA 1	3.236	0.5440	35.40	<0.0001
ALPHA 2	-0.4158	0.3139	1.75	0.1853
ALPHA 3	-5.3651	1.0186	27.74	0.0001
IPCOV	1.2955	0.4451	8.47	0.0036***
D	-0.4608	0.3032	2.31	0.1286
ARE	0.8156	0.4782	2.91	0.0881*
PS	1.1384	0.3305	11.86	0.0006***
PAFUDC	-0.4496	0.3772	1.42	0.2333
MB	-0.1057	0.4302	0.06	0.8059
SD	-0.0902	0.2812	0.10	0.7485

MODEL LIKELIHOOD RATIO CHI-SQUARE = 51.47
MODEL P-VALUE < 0.0001
*** significant at the 1 percent level
** significant at the 5 percent level
* significant at the 10 percent level

Table 5
Classification Matrix, 1969-1972
Classification of Original Sample

Original Rating	Rating Classified by Model AAA	AA	A	BBB	Total
AAA	2 (66.7)*	1 (33.3)	0 (0.0)	0 (0.0)	3 (100.0)
AA	0 (0.0)	15 (55.6)	12 (44.4)	0 (0.0)	27 (100.0)
A	0 (0.0)	7 (21.9)	23 (71.9)	2 (6.2)	32 (100.0)
BBB	0 (0.0)	0 (0.0)	6 (66.7)	3 (33.3)	9 (100.0)
Total	2	23	41	5	71

Classification Using Jacknife Procedure

Original Rating	Rating Classified by Model AAA	AA	A	BBB	Total
AAA	1 (33.3)	2 (66.7)	0 (0.0)	0 (0.0)	3 (100.0)
AA	1 (3.7)	14 (51.9)	12 (44.4)	0 (0.0)	27 (100.0)
A	0 (0.0)	7 (21.9)	23 (71.9)	2 (6.2)	32 (100.0)
BBB	0 (0.0)	0 (0.0)	6 (66.7)	3 (33.3)	9 (100.0)
Total	2	23	41	5	71

*Figures in parentheses are percentages

Table 6
Cross Validation of 1969-1972 and 1978-1981 Models
Classification of 1969-1972 Sample by Model Estimated from 1978-1981 Sample

Original Rating	Rating Predicted by Model AA	A	BBB	Total
AA	11 (16)	12 (11)	4 (0)	27
A	4 (8)	13 (23)	15 (1)	32
BBB	1 (0)	1 (6)	7 (3)	9
Total	16	26	26	68

Classification of 1978-1981 Sample by Model Estimated from 1969-1972 Sample

Original Rating	Rating Predicted by Model AA	A	BBB	Total
AA	5 (4)	6 (7)	0 (0)	11
A	4 (2)	12 (11)	0 (3)	16
BBB	1 (0)	15 (4)	1 (13)	17
Total	10	33	1	44

*Figures in parentheses represent classification by model estimated from the same period sample