AN ATTEMPT TO RATE COMPANIES BASED ON BANKRUPTCY PREDICTION MODEL

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INTRODUCTION

Rating is widely used as one of the means to evaluate the creditworthiness of a company not only by investors, but also by other stakeholders of the company. This paper attempts to rate companies using the SAF2002 model [1] , which was developed by the author in 2003 and is the most widely recognized bankruptcy prediction model in Japan, and verifies the applicability of the bankruptcy prediction model to corporate rating by comparing the results with the ratings assigned by Standard and Poor's ("S&P").

RATING BASED ON BANKRUPTCY PREDICTION MODEL

EXPLANATORY VARIABLE OF SAF2002 MODEL

The SAF (Simple Analysis of Failure) 2002 model predicts bankruptcy through verification analyses by Classification and Regression Trees or using artificial intelligence of the financial data of companies that failed between 1992 and 2001 in Japan considering business practice and institutional accounting. The SAF 2002 model uses the financial data of 1,407 cases of bankrupt companies and the financial data of 3,421 cases of non-bankrupt companies that are systematically sampled from 107,034 cases. The financial indices that contribute to corporate bankruptcy discrimination are identified out of 72 indices. The indices identified are shown in Table 1.

TABLE 1: INDICES FOR SAF 2002 MODEL

Rank	Name of Indices		R-Square	F Value	Pr > F
1	X7	Retained Earnings to Total Assets	0.1737	818.63	<.0001
2	X37	Inventory Turnover Period	0.0592	244.98	<.0001
3	X26	Interest Expenses to Sales	0.0175	69.27	<.0001
4	X10	Net Income before tax to Total Assets	0.0136	53.79	<.0001

To identify the most suitable model for bankruptcy discrimination before developing the model, a linear discriminant model, a quadratic model and a non-parametric normal kernel method model were developed, and the discriminant ratio of each model was compared. The comparison, made using holdout samples five times for each model, indicated that the linear model has the strongest discriminant power. Hence, the following linear discriminant model formula was developed using four indices.

$$SAF2002 = 0.0104X7 + 0.0268\,X10 - 0.0661X37 - 0.0237X26 + 0.7077$$

EXPLANATORY VARIABLE OF RATINGS

In the field of financial engineering, *the relationship between ratings and financial ratios* is widely analyzed [3][4][5][6][7][8]. The financial ratios with a high correlation with ratings assigned by Moody's and S&P are shown in Table 2. The top three financial ratios which served as highly explanatory indices were the same between ratings assigned by Moody's and S&P. Of the three indices, the owners' equity ratio and the ratio of retained earnings are financial ratios with a strong correlation, and the ratio of interest-bearing debt also has a

strong correlation with the owners' equity ratio in most companies. As the most useful financial ratio to distinguish companies under the SAF2002 model is the ratio of retained earnings to total equity, ratings based on the SAF2002 model may hardly differ from those assigned by Moody's and S&P.

TABLE 2: EXPLANATORY VARIABLES OF RATINGS BY MOODY'S AND S&P

	Moody's		S&P	
	Financial Ratios	Correlation coefficient	Financial Ratios	Correlation coefficient
1	Owners' equity	0.72	Ratio of interest-bearing debt	-0.64
2	Ratio of retained earnings	0.58	Owners' equity	0.63
3	Ratio of interest-bearing debt	-0.57	Ratio of retained earnings	0.61
4	Ratio of total capitalization	-0.54	Ratio of total capitalization	-0.59
5	Ratio of fixed assets to long-term liabilities	-0.48	Capital adequacy ratio	0.56

Source: Mizuho Securities, 2001. Prepared on the basis of Mizuho Securities Credit Commentary 01/11:36.

RATING CLASSIFICATION AND SAF VALUE

Sample data of 3,421 non-bankrupt companies used for developing the SAF2002 model was utilized to calculate the SAF value with respect to all sample companies. The calculated values were sorted in decreasing order and split up according to the classification as shown in Table 3. Ratings from AA to C were assigned with respect to each classification.

TABLE 3: SAF VALUE OF EACH CLASSIFICATION PERIOD –RATING LEVEL

Rating	AA	A	BB	B	C
SAF value	Highest-5%	5-25%	25-75%	75-95%	95-100%

The cut-off point for the SAF2002 model, which is 0.7, is located near the threshold for rated BB and B. While companies which went bankrupt despite having an SAF value of 0.7 or higher (misjudged companies) accounted for 13.51% of all companies, companies which went bankrupt with an SAF value of 1.00 or higher (= threshold for rating A) accounted for only 0.640%, or 9 out of 1,407 companies, and those which went bankrupt with an SAF value of 1.40 or higher (= threshold for rating AA) accounted for 0.142%, or 2 out of 1,407 companies. There were no companies which went bankrupt with an SAF value of 1.44076 or higher, so it is unlikely for a company with an AA rating to go bankrupt. With these in mind, if a company subject to analysis has an SAF value corresponding to an A rating or higher (i.e. SAF value of 1.0 or higher), it may be deemed to quality for investment.

Further, the rating threshold according to the sample data of all companies used for building the SAF2002 model (in which unlisted companies account for most of the companies) was calculated, as well as the threshold with respect to the SAF value of 2,101 listed companies found in the consolidated data in Nikkei NEED 2001 edition. They were then compared with each other, and the results are shown in Table 4.

TABLE 4: SAF VALUE AT THE THRESHOLD OF EACH RATING

	95%(C)	75%(B)	25%(BB)	5%（A）
SAF samples	0.391315	0.689762	1.009081	1.378331
NIKKEI Listed	0.264002	0.613416	1.042071	1.397863

As indicated by the results shown in Table 4, although there was a minor discrepancy at the

95% point, there was no significant difference between the data on unlisted companies and the data on listed companies in terms of thresholds, and the ratings were classified by more or less the same SAF values. Their values were extremely similar, verifying that the ratings assigned under the SAF2002 model are widely applicable to both listed and unlisted companies.

SAF RATING TO LISTED BANKRUPT COMPANIES

Next, a survey was conducted in order to determine the rating classification to which failed listed companies actually belonged immediately before going bankrupt. Of the 39 listed companies which went bankrupt between April 2001 and June 2003, and the analysis here targeted 31 companies for which financial statements were obtainable for the two-year period immediately before going bankrupt. The SAF values of these companies immediately before going bankrupt were checked to identify their ratings, by comparing them with the thresholds (Nikkei Listed companies) in Table 4. As clearly indicated by the results, companies which went bankrupt had a low SAF value, and were mainly assigned a rating of B or C. In particular, companies which went bankrupt in recent years were in a poor financial position, with most of them being rated C. Also, a survey on the SAF value based on the sample data of 1,408 bankrupt companies used for building the SAF2002 model revealed that companies with a threshold of 0.262314 or higher, which corresponds to the threshold of C rating, accounted for 77.18% of all companies. In short, companies with an SAF value that corresponds to a C rating, that is, below 0.262314, are extremely likely to go bankrupt.

ISSUER RATING BASED ON SAF2002 MODEL

Of the issuer ratings published by S&P, long-term issuer rating is deemed to involve the evaluation of the debtor's overall ability to fulfill the obligations (creditworthiness). The evaluation focuses on the debtor's ability and willingness to fulfill the obligations on the due date, and does not take into account the nature or the terms of specific obligations, the treatment in the event of bankruptcy or liquidation, the priority order under law, or the legitimacy or the binding power of the obligations.

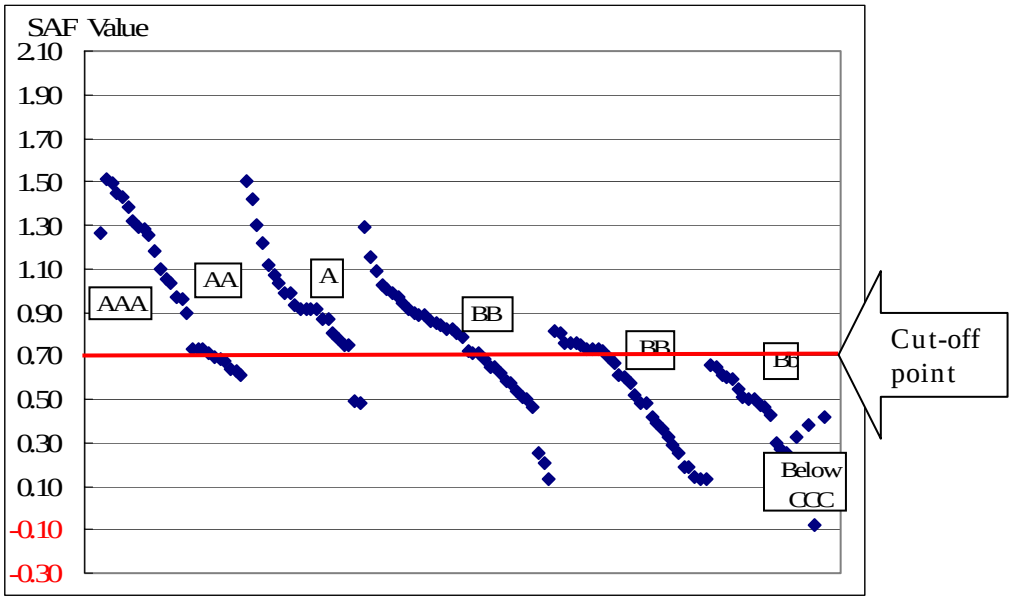

Figure 1: The Distribution of the SAF Values of each S&P Rating

The same applies to the creditworthiness of those providing guarantees, insurance and other measures to complement credit; the evaluation is concerned with the overall ability of issuers to fulfill the obligations without taking them into account, and is not a rating of specific bonds. Hence, the long-term issuer rating is expected to be similar to the evaluation results derived under the SAF2002 model.

The distribution of the SAF values of 209 Japanese companies whose long-term issuer ratings are published by S&P were confirmed in accordance with the financial results for the year ended March 2002, as shown in Figure 1. It shows that the cut-off point of SAF2002 model, 0.7, is located about a third from the bottom of BBB under S&P's rating classification, which is a rating of bonds with medium-grade security. It also shows that the rating assigned by S&P and the SAF value are clearly correlated with each other. Bonds rated BB or below by S&P may be deemed to have a much higher possibility of bankruptcy.

CONCLUSION

This paper attempted to rate companies using the SAF2002 model, and verifies the applicability of the bankruptcy prediction model to corporate rating by comparing the results with the ratings assigned by Standard and Poor's ("S&P"). The results indicate that well-run companies tend to have an SAF rating similar to the S&P rating, whereas former government-affiliated companies such as East Japan Railway Company, NTT and Electric Power Companies are generally rated leniently by S&P, making the SAF rating appear to be more representative of their actual business status. In particular, their ratings of electric power companies and gas companies are high but are not necessarily consistent with their respective financial positions. Because the myth that companies involved in public utilities *cannot go bankrupt* still exists, the ratings of such companies are generally *lenient* and deviate from the SAF ratings in practice.

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