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Japan Credit Rating Agency,Ltd.

SME Credit Risk Estimation Model JCREST

We (Japan Credit Rating Agency (JCR)) are applying the techniques and knowledge we have cultivated over many years of credit rating business in a variety of ways.
Among them, SME credit risk estimation model JCREST was developed by applying the credit risk assessment know-how of SMEs at financial institutions and the academic financial engineering methods of the time. Since then, it has been renewed based on knowledge from the field of lending operations, as well as statistical modeling methods introduced by various banks under Basel II, and to this day it has been maintained through verification and analysis using the latest data every year.

■ Providing JCREST Model

JCREST is a statistical model that estimates the bankruptcy probability of a company based on financial information. JCR provides JCREST model in various forms.

[Overview]

JCREST model is built based on financial data of small and medium-sized enterprises (approximately 10,000 bankruptcy data and approximately 100,000 non-bankruptcy data).

The definition of bankruptcy includes not only legal bankruptcy but also private liquidation.

The model consists of seven types of industry models: `Construction industry' `Manufacturing industry', `Wholesale industry', `Retail industry, Restaurant business and Lodging industry', `Service industry', `Real estate industry' and `Other industries'.(*)

By calculating the necessary financial indicators from the financial information for the most recent two fiscal years and inputting them into the industry model, we can estimate the company's ‘probability of bankruptcy within one year’, ‘probability of bankruptcy within two years’ and ‘probability of bankruptcy within three years’.

The statistical method used in the model is the positive semidefinite logistic regression model (see reverse side of this paper), which is a highly generalized version of the logistic regression model used by many financial institutions.

[Maintenance Services]

The model is back-tested every year using the latest financial data, including multiple bankruptcy samples, and verified by a specialist committee of JCR's credit risk professionals. The results are then reported to model users.

[Use Cases]

Lending screening and ongoing credit management for financial institutions, credit management for business companies, individual debt evaluation in our credit risk analysis for structured finance, JCR SME Rating, JCR Customer Credit Assessment Service, etc.

※ In principle, JCREST targets Japanese companies that are small and medium-sized enterprises as defined by the Small and Medium Enterprise Basic Law and that can obtain the necessary financial information for two periods. However, certain industries are not covered, including finance, leasing, rental, self-employed individuals, investment corporations, schools, medical institution, public organizations, religious corporations, other foundations and associations, and various types of partnerships.

■ Overview of Statistical Methods of JCREST

JCREST is constructed using the statistical method of the logistic regression model, which is commonly used in the credit risk field.

Generally, the logistic regression model links the financial information of a target company to the probability of bankruptcy of that company via financial indicators, as shown in the following formula:

$$probability\ \ of\ \ bankruptcy$$

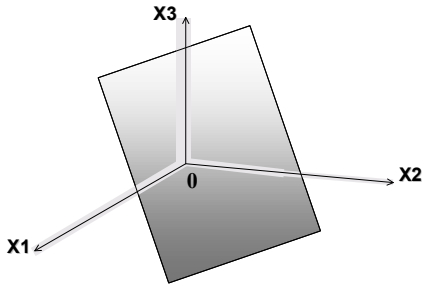
$$= \frac{1}{1 + \exp(k0 + k1 * Capital\ \ Adequacy\ \ Ratio + k2 * \frac{Interest\ \ bearing\ \ debt}{Current\ \ profit + Depreciation} + k3 * Profit\ \ Margin + \cdots)}$$

Here, the weights k0, k1, k2, k3, ... are calculated using statistical regression calculation methods so as to increase the accuracy of the bankruptcy probability based on the financial data of many bankrupt and non- bankrupt companies.

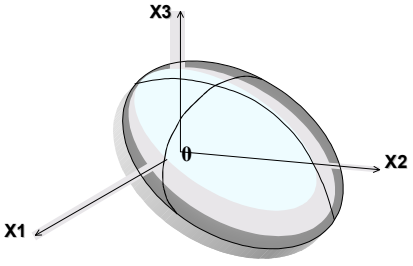
JCREST was developed using a theory and calculation method that claims that the accuracy of bankruptcy probability can be further improved by adding a quadratic semidefinite term to the calculation formula for the weights and financial indicators mentioned above (cf. Paper: Konno Hiroshi and Bu Son, Estimating the Probability of Bankruptcy Using Semidefinite Programming, 2001).

[Image of the paper]

A contour diagram of the relationship between financial indicators and the likelihood of bankr uptcy in a standard logistic regression model.



By adding semidefinite terms, the contour surface of the relationship between financial indicators and the likelihood of bankruptcy can be expressed as a sphere or a paraboloid, as shown below.



By searching for the optimal parameters k0, k1, k2, k3, ... by expanding not only planes but also spheres and paraboloids, the accuracy of the regression model's bankruptcy probability can be improved (the more the curve bulges outward, the higher the accuracy). In addition, it is possible to prevent overfitting by restricting the quadratic terms to positive semidefinite ones rather than making them more general.