Copula-Based Credit Risk Assessment for a Large Scale Small to Medium Enterprises' Financial Data including Missing Values

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A copula is a general tool to construct multivariate distributions and to investigate dependence structure between random variables. A copula is a function expressing multivariate simultaneous distribution by dividing it into a peripheral distribution of each variable and a dependence structure between distributions. In the situation where the creditworthiness of each business loan depends on each other, it would have a strong dependency structure between distributions at the tail of the distribution. Since it is possible to incorporate strong dependence into risk assessment by using the copula, it draws attention in financial practice. Also, since missing values are included when credit risk assessment is performed using financial data of small and medium enterprises, conventional listwise elimination method that excludes such cases with missing values, or the average value substitution method which fills by the average value of the financial data before and after the year which is used, but the number of effective cases that can be used in the analysis becomes smaller. The variance of the estimated value is not taken into consideration. As a statistical missing value processing method, EM algorithm, multiple substitution method, etc. are proposed, but there are few applications in consideration of the structure peculiar to financial data. Therefore, in this research, we consider situations where extremely large values, negative values, clusters in the vicinity of zero and the likes are mixed as a structure peculiar to financial data including missing values. When dealing with the future value of each asset as a random variable, the shape of the distribution, especially the shape of the skirt depends strongly on the interdependence among the random variables; therefore by using the copula, we will estimate the probability of bankruptcy of small and medium size companies based on industry and scale.

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