1. Introduction

The implementation of the new Basel Accord for bank capital adequacy (Basel II) has seen many analysts focus on the credit risk modeling (De Laurentis, 2001). A considerable attention is dedicated on the distress prediction models specifically for the small and medium sized enterprises (SMEs) (Altman, Sabato, 2005).

The main goal of this paper is to construct a model to predict the SMEs probability of default (PD), using a Multiple Discriminant Analysis (MDA) (Altman, 1968), and to determinate the bank capital requirements considering the rule of Basel II for SMEs. The behaviour of financial measures for SMEs is analyzed and the most significant variables in predicting the entities credit worthiness are selected through a multivariate statistical approach on panel data of 491 firms in Calabria (with sales less than 50 millions of euros). The analysis used data collected in the Chambers of Commerce of the districts in Calabria in the period 2003-2006. Thanks to the Principal Component Analysis application, we reduced the initial number of variables to 9 accounting ratio categories which describe the main aspects of the SMEs profile: profitability, solidity and financial ability. These three factors explain about the 72% of total variability (Bolasco, 2004). Then we utilized Cluster Analysis to divide the sample of 491 firms into two clusters with similar characteristics inside the clusters and different ones between the same clusters (350 failed and 141 non-failed).

2. The principal issues

We use a MDA to maximize the distance between the two groups of firms (defaulted and non-defaulted) and to determine the final score. We apply a statistical forward stepwise selection procedure of the 9 variables selected and utilized in the Principal Component Analysis. Of the 9 chosen variables, 3 variables are selected as doing the best overall job together in the prediction of the SMEs default. All of the slopes (signs) follow our expectations: we expect a positive relationship between the PD and all the predictors except interest expense on sales. The good discriminant ability is shown from the canonical correlation (0.616) and the Lambda statistic value ($p<.01$). In our model
the final score is given by the sum of the constant and the product between the slopes and the value of each of the predictors:

$$Y = 0.598 - 0.068 \times X_1 + 0.100 \times X_2 + 0.056 \times X_3$$

where: $X_1$ = interest expense on sales  
$X_2$ = Return on asset (ROA)  
$X_3$ = Return on investment (ROI)

Considering a cut-off point equal to 0.369 (determined as an average between the average score of the failed firms and the average score of the non-failed firms), the type I and type II error rates, which measure the accuracy of each model in correctly classifying defaulted and non-defaulted firms, are respectively 28% and 8%.

To restrict the final output in a range between 0 and 1 and so to determine a value representative of the PD of the firms in Calabria, an exponential transformation is used. Lastly, we determine the banks capital requirements applying the IRB approach provided by Basel II:

$$Correlation (R) = 0.12 \times (1 - \text{EXP}(-50 \times PD)) / (1 - \text{EXP}(-50)) + 0.24 \times [1 - (1 - \text{EXP}(-50 \times PD))/(1 - \text{EXP}(-50))] - 0.04 \times (1 - (S-5)/45)$$

$$Capital\ requirement\ (K) = \left[\text{LGD} \times N \times (1 - R)^{-0.5} \times G\ (PD) + (R / (1 - R))^{0.5} \times G\ (0.999)\right] - PD \times LGD\ x \ (1 - 1.5 \times b)^{-1} \times (1 + (M - 2.5) \times b)$$

$$Risk-weighted\ assets\ (RWA) = K \times 12.50 \times EAD$$

In conclusion, the analysis prompts two important observations. From the point of view of the firms, it is interesting to show as the SME sector in Calabria is characterized by an average risk level. In particular, the 67% of firms is associated to a higher investment grade, the 31% is lower investment grade and only the 2% is non investment grade according to the rating proposed by Moody’s. From the point of view of the banks, Basel II has some important effects on the banks capital requirements for SMEs. In fact the IRB approach produces a major capital absorption compared with the standard approach (8%). Specifically, the average of the capital requirements registered by the firms analyzed is equal to 9.76%.

References


