SOLVENCY RATIO AS A TOOL FOR BANKRUPTCY PREDICTION

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Abstract
The current study evaluates the potential of the solvency ratio in predicting corporate bankruptcy. The research is focused on Romania and, in particular, on Timis County.
The interest for the solvency ratio was based on the recommendations of the scientific literature, as well as on the availability of information concerning its values to all stakeholders.
The event on which the research was focused was represented by the manifestation of bankruptcy 2 years after the date of the financial statements of reference. All tests were performed over 2 paired samples of 1176 companies in total.
The methodology employed in evaluating the potential of the solvency ratio was based on the Area Under the ROC Curve (0.646) and the general accuracy ensured by the ratio (64.5% out-of-sample accuracy). The results confirm the practical utility of the solvency ratio in the prediction of bankruptcy.

Keywords: *Corporate finance; Risk; Failure; Financial ratio; Classification accuracy.*

JEL Classification : *G32, G33, M21*

I. INTRODUCTION

After 2006, the annual frequency of bankruptcy cases in Romania has increased significantly, reaching a peak of almost 3% in 2013. The increased frequency of the annual bankruptcy cases was accompanied by an increase in the loan default ratio (Brîndescu-Olariu, 2015a).

The causes for these phenomena may be related to the manifestation of the economic crisis as well as to the changes generated by the entrance of Romania in the European Union. The purpose of the current research was not to determine the causes for default or bankruptcy, but to find tools for the assessment of the bankruptcy risk.

While an in-depth analysis can be performed on a company, the availability of the data is usually an important issue, the expertise required is high and the process is time-consuming. Since the 1860s, the ratio analysis has been used as a simpler alternative. However, the interpretation of the ratios and the accuracy of the analysis have always been in question within the scientific community, especially as the approach is based on statistics and the characteristics of the populations are constantly changing.

Previous research (Brindescu-Olariu, 2015a, Brindescu-Olariu, 2015b, Brindescu-Olariu, 2014a, Brindescu-Olariu, 2014b) has proven the usefulness of the autonomy ratio, debt ratio, equity working capital and labour productivity in the assessment of the bankruptcy risk for Romanian companies.

The current research sets out to test whether the solvency ratio is a useful predictor of the bankruptcy state for Romanian companies of today. The hypothesis of the research is that the solvency ratio is negatively correlated to the bankruptcy risk and thus can represent useful tools for its assessment.

If the research would prove the usefulness of the solvency ratio in the prediction of bankruptcy, it could be continued with the development of a methodology of analysis for the assessment of the bankruptcy risk.

Only publically available data was used, especially in the purpose of developing a methodology of analysis that would be simple and accessible to all stakeholders.

II. POPULATION AND METHODOLOGY

The population of interest consisted of all the companies within the Romanian economy. However, only data for the companies from the Timis County was available. Therefore, the target population was limited to the companies from Timis County. Research was not performed to verify whether the characteristics of the companies from Timis County are significantly different from those of the companies from the rest of the country. As a consequence, the conclusion of the research cannot be considered as applicable to all Romanian companies without prior testing. Nevertheless, no previous studies in this field have found such significant differences, so it is expected that the conclusions would be validated by tests at national level.

The research targets the bankruptcy risk within 2 years from the date of the financial statements taken as reference.

All companies from Timis County that submitted yearly financial statements to the fiscal authorities during the period 2009-2010 and that registered yearly sales of at least 10000 lei (approximately 2200 Euros) were included in the study. The source of the data was represented by the online publications of the Ministry of Public Finances of Romania.

Of the entire population considered in the study, 588 companies went bankrupt in the period 2011 – 2012, two years from the date of the financial statements of reference:

- of the 12,574 companies included in the research with financial statements for 2009, 159 went bankrupt in 2011 (1.26%); the rest of the companies continued their activity under normal conditions at least until the end of 2012.
- of the 15,071 companies included in the research with financial statements for 2010, 429 went bankrupt in 2012 (2.85%); the rest of the companies continued their activity under normal conditions at least until the end of 2012.

In order to simplify the explanations, the companies that went bankrupt 2 years after the date of the financial statements of reference will simply be referred to as „bankrupt", while the companies that continued their activity under normal conditions at least until the end of 2012 will be referred to as „non-bankrupt".

The companies that close their activity for other reasons than bankruptcy during the period of analysis were excluded.

For the testing of the solvency ratio as a possible bankruptcy predictor, 2 paired samples were built. Thus, each of the 588 companies that went bankrupt in the period 2011 – 2012 was associated with a company that continued its activity in normal circumstances, from the same economic field, with the closest turnover in the year of reference for the financial statements included in the analysis.

The group of 1176 companies (588 pairs) was split in two. The pairs from 2010 were used for the in – sample determination of the cut-off value. The pairs from 2009 were used for out-of-sample testing.

The solvency ratio was calculated as follows:

$$\text{Solvency ratio} = \frac{\text{Total assets}}{\text{Total liabilities}} \times 100\%$$

Mathematically, there is no superior limit to the value of the solvency ratio. At the other end, as a company can have negative equity, the value of the liabilities can become greater that the value of the assets, and thus the solvency ratio can be lower than 100%.

It was speculated that the higher the solvency ratio, the easier it should be for the company to pay its debt on time.

The data was processed by using the SPSS software. The state of the company two years from the date of the financial statements of reference was defined as the dependent variable, a binary variable that can take the following values:

- 1, for the companies that went bankrupt 2 years after the date of the financial statements of reference;
- 0, for the companies that continued their activity under normal conditions at least until the end of 2012.

As an example, the value of the variable „State" was „1" for all the companies that went bankrupt in 2011 and it was associated with the solvency ratios of the respective companies from 2009. These companies were not included in the analysis for the following year (for 2010 with the financial statements and for 2012 with the state variable), even if they still existed.

Initially, the performance of the solvency ratio as a predictor of bankruptcy was tested through the Area Under the ROC Curve over the paired sample of 2010.

The ROC Curve reflects graphically the relationship between the sensitivity and the specificity for all possible cut-off values (van Erkel, Pattynama, 1998). The area under the ROC Curve thus isolates the classification performance of a classifier with no connection to a specific cut-off value, which makes it one of the most viable solutions for measuring the classification performance and for comparing classifiers (Hanely, McNeil, 1982, Faragi and Reiser, 2002).

The area under the ROC Curve (AUC), can take values between 0 and 1 (Skalska and Freylich, 2006). An AUC of 0.5 corresponds to a "by chance" classification accuracy, while an AUC of 1 corresponds to a perfect accuracy.

The evaluation of predictors by their AUCs is usually based on the following grid (Tazhibi, Bashardoost and Ahmadi, 2011):

0.5 – 0.6: fail;
0.6 – 0.7: poor;
0.7 – 0.8: fair;
0.8 – 0.9: good;
0.9 – 1: excellent.

In a second step, the general classification accuracy was determined for the 2010 sample, together with the optimal cut-off value, through te inspection of the coordinates of the ROC Curve. The general accuracy of the classification represents the percentage of companies correctly classified, a weighted average of the sensitivity and the specificity. The sensitivity represents the accuracy of the classification of bankrupt companies, while the specificity represents the accuracy of the classification of non-bankrupt companies.

The optimal cut-off value for the 2010 sample was used for out-of-sample tests (over 2009 sample). As the samples used were paired, the weight of the bankrupt companies was equal to the weight of the non-bankrupt companies (50%). For such a sample, the „by chance" accuracy is 50% (by classifying all 1176 companies as bankrupt, the analyst would be correct in 50% of the cases). A ratio is considered a useful classifier if it allows for a general accuracy at least 25% higher than the „by chance" accuracy (Chung, K., Tan, S., Holdsworth, D., 2008).

Based on this benchmark, the solvency ratio would be considered as potentially useful if would offer an out-of-sample general accuracy of at least 62.5% (a = 50% x 125%).

III. RESULTS

The Area Under the ROC Curve over the 2010 paired sample specific to the solvency ratio was of 0.646 (as shown in figure 1), which suggests a relatively poor, but valid classification accuracy (Tazhibi, Bashardoost and Ahmadi, 2011).

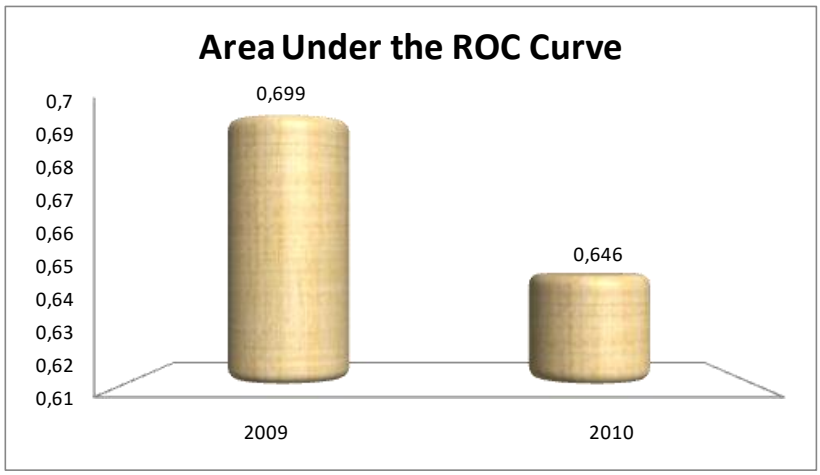

Figure 1. Area Under the ROC Curve over the 2 paired samples – solvency ratio

Based on the coordinating points of the ROC Curve for 2010, an optimal cut-off value was determined (solvency ratio = 116%). By classifying all the companies from the 2010 paired sample that registered solvency ratios lower than 116% as bankrupt and all the companies from the 2010 paired sample that registered solvency ratios higher than 116% as non-bankrupt, the general classification accuracy would be of 62.2% (as shown in figure 2).

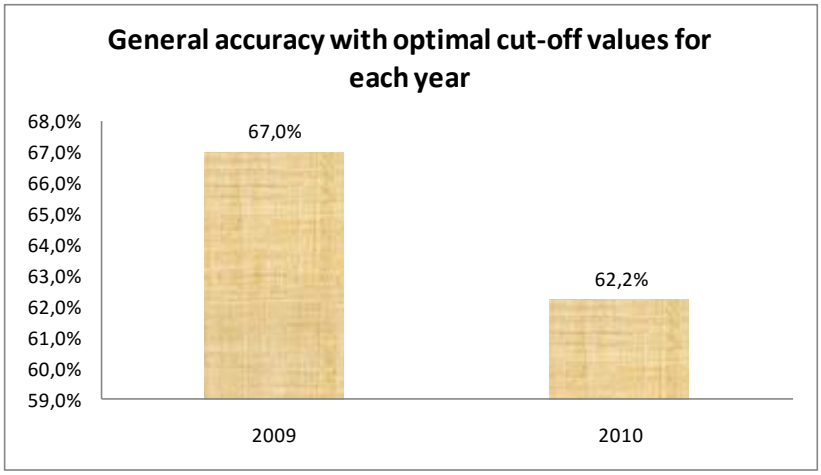

Figure 2. General accuracy with optimal cut-off values for each year

Thus, the in-sample general accuracy is positioned just below the 62.5% benchmark. Out of sample accuracy tests were performed over the 2009 paired sample, using the cut-off value from 2010. The general accuracy over the 2009 sample was of 64.5%, above the 62.5% benchmark.

IV. CONCLUSIONS

The Areas Under the ROC Curve for both paired samples show that the solvency ratio can be used a tool for the assessment of the bankruptcy risk. This conclusion is sustained by an out-of-sample general classification accuracy of 64.5%. The results of the study confirm that companies with high solvency ratios show lower

bankruptcy risks. The cash inflows that contribute to the payment of the debt are usually based on the liquidation of the assets as well as on the return on assets. Companies with high solvency ratios have large asset values compared to their liabilities, as important parts of the assets are being financed through equity, or even unearned revenues (especially subsidies) and provisions. Thus, the assets being financed through other types of financing sources than debt contribute to the payment of debt and its costs.

At the same time, companies with high solvency ratios show greater guarantees in the eventuality of a forced liquidation, which may attenuate the risk perceived by the creditors and thus reduce the pressure for filing for bankruptcy.

The conclusion is considered valid for the companies from Timis County. It is expected that the solvency ratio would be a useful bankruptcy predictor for all Romanian companies, as no research has proven significant differences in this field among Romanian companies.

The paired samples were useful in evaluating the potential of the solvency ratio. Nevertheless, as the frequency of bankruptcy within the paired samples is significantly different compared the bankruptcy frequency specific to the target population (50%, compared to approximately 2%), an optimal cut-off value for the entire population cannot be determined. The research proves the potential of the solvency ratio in the prediction of bankruptcy and underlines the need for determining an optimal cut-off value through research over the entire population (or a sample with the same structure).

A connection between the solvency ratio and the return on equity is also expected, as low solvency ratios involve greater leverage.

V. REFERENCES

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