

# ANALYSIS OF ROMANIAN SMALL AND MEDIUM ENTERPRISES' BANKRUPTCY RISK

**Kulcsár Edina**

*University of Oradea, Faculty of Economic Sciences, Oradea, Romania  
kulcsaredina@yahoo.com*

**Abstract:** Considering the fundamental role of small and medium enterprises in Romanian economy, this paper aims to quantify the level of their bankruptcy risk for 2009 and 2012 period, after debuting of financial crisis. The main reason of selecting this type of companies is that they represent the backbone of national economy. They have an indispensable role, because they offer jobs for great part of population and their contribution for GDP stimulation is considerable. In this paper it was applied two default risk models, namely the well known Altman's Z-score model, based on five financial ratios and a bankruptcy predictor model developed by Teti et. al (2012) used firstly exclusively for Italian small and medium-sized enterprise for 2006-2009 period. The model proposed by Teti et. is based on the investigation of financially distressed and financially non-distressed Italian small and medium-sized enterprises during the financial crisis by using a discriminant analysis model. They conclude that there are four financial ratios, which characterized well the small and medium-sized enterprises bankruptcy risk. These variables are financial ratios, like: Debt/Total Assets, Return on Sales (ROS), EBIT/Interest Expenses and Working capital/EBIDTA. They consider that small and medium-sized enterprises require a particular approach in terms of bankruptcy risk analysis. In present study I try to compare the efficiency of traditional bankruptcy risk model with a small and medium-sized specific model. The necessary database for present analysis is ensured by simplified financial reports of 120 small and medium-sized enterprises registered in Bihor County. The selected enterprises are operating in manufacturing industry (21,67%) and trading (78,33%). Present investigation has an important value in actual economic background, where the healthiness and sustainability of small and medium-sized enterprises is a great issue. The results of study shows contradictory results after implementing above mentioned methods, so while after Altman model application, the investigated firms are non financially distressed, in case of second model applying the great part of firms have medium financial problems.

**Keywords:** corporate bankruptcy, small and medium-sized enterprise, credit risk, Z-score, discriminant analysis model

**JEL classification:** G3, G30, G32, G33

## 1. Introduction

Financial stability and sustainability has become an important objective and issue for company's managers and financial analysts in recent years, so the continuous tracking of bankruptcy risk became a significant deal in corporate sector. The assessment of this, is much more important in case of small and medium-sized enterprises, because in Romania small and medium-sized enterprises play especially role in job creation and economic growth stimulation. Therefore, the aim of this paper consist is examination of level of bankruptcy risk of small and medium-sized enterprises by using two methods. Bankruptcy forecasting techniques can help managers and analyst in detection in time of financial difficulties, so they often are associated with early warning mechanism (Ahn et al. 2000).

Present study was carried out by using two bankruptcy risk quantifying methods, ones commonly known by economists, the Altman's Z-Score method developed in 1968 and the second method developed by Teti et al. (2012), which was firstly used on basis of Italian small and medium-sized enterprises' annually financial reports between 2006 and 2009.

## **2. Review of literature**

The definition of situation of bankruptcy is quite different in international literature. According to Kraus and Litzenberger (1973), we can distinguish several forms of bankruptcy situation. Some of these can be identified with: high level of indebtedness, financial deficit, insolvency, non-performing loans, and liquidity problems. According to Farlex Financial Dictionary, the business failure or bankruptcy 'refers to a company ceasing its operations following its inability to make a profit or to bring in enough revenue to cover its expenses' (The Farlex Financial Dictionary, 2011).

Examination of Romanian small and medium-sized enterprises' bankruptcy risk is particularly important because in Romania more than 90% of employees work in various areas operating small and medium-sized enterprises and these companies have also a major contribution to the evolution of Gross Domestic Product. Due to the special characteristics of small and medium-sized enterprises, they are more sensitive and more vulnerable to changes of economic environment factors. Small and medium-sized enterprises are less diverse, so their activity restructuring and reduction can be more elaborate.

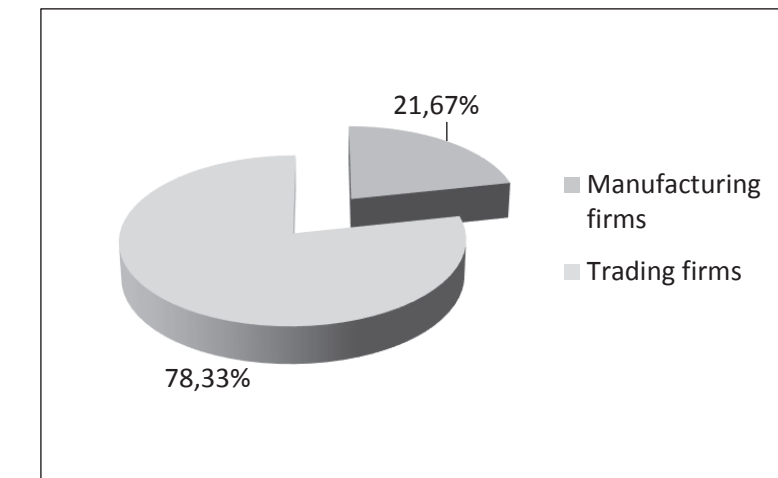
In this article, we consider small and medium-sized enterprises those companies that fit with a European Commission 2003/361/EC Regulation, according to with small and medium-sized enterprises are those companies which has fewer than 250 employees, their annual turnover not exceed 50 million EUR and total assets value is below than 43 million EUR (European Commission, 2003).

Since the recently debuted financial global crisis, the quantification of bankruptcy risk and its continuous monitoring has gained an important role, so this is why in present study I try to evaluate the risk of bankruptcy by implementing two methods, firstly a general bankruptcy forecasting method and secondly a small and medium-sized specific method. The reason why I used the second method is the fact that in the international literature recently grows up the number of arguments according to with small and medium-sized businesses require a specific financially and bankruptcy forecasting approach. After their research on on U.S small and medium-sized enterprises' market, Altman and Sabato (2007) conclude that both in the bank rating and in overall common business rating, small and medium-sized businesses require a specific bankruptcy and credit risk treatment (Altman and Sabato, 2007).

## **3. Research methodology**

First I attempt to evaluate the bankruptcy risk by using the well-known Altman's (1968) model, which permits a commonly risk analysis independently from the size of the company, on the other hand I apply Teti et al. (2012) developed model, which allows a specific approach for small and medium-sized enterprises' bankruptcy risk.

The analysis of bankruptcy risk was carried out on basis of 120 small and medium-sized enterprises annual simplified financial reports registered in Bihor County. The companies involved in present study are operating in various fields of national economy, of which 26 are activating in manufacturing industry (21,67%) and 94 companies are working in retail and wholesale trading (78,33%). The data of analyzed enterprises' were ensured by their simplified financial statements. The financial data were collected for 4 years from 2009, after debuting of financial crisis to 2012.



**Figure 1:** Distribution of investigated firms operating sectors  
Source: Own calculation

The bankruptcy risk prediction can be performed using several methods. The domestic and foreign literature mentions different methods. Among them, the corporate bankruptcy prediction models can be divided in two major groups, on the one hand we can talk about methods which have been identified and validated by using discriminant analysis statistical method and on the other hand methods that are based on logistic regression, which are sometimes called as logit models (Sirirattanaphonkun & Pattarathamams, 2012). The main characteristic of models based on discriminant analysis is that they attempt to predict the bankruptcy risk by taking into account, with different weights of different financial ratios. These ratios are indicators which can be determined on basis of small and medium-sized

enterprises' simplified financial statements. According to Fulmer, Moon, according to Gavin and Erwin (1984), the models based on discriminant analysis are useful when the aim is listing of specific variable in a particular group, for example good or bad, solvent or insolvent. The Altman's Z-Score model is based on this statistical method. In the foreign literature we can find more reviews that argues the strengths and weaknesses of above mentioned methods. According to Terdpaopong (2011) the logistic regression based models are more flexible than models based on discriminant analysis so in this way models have the ability to avoid the impact of the lack of multivariate normality, outliers, multicollinearity. Several foreign research, Ooghe et al. (1995), Mossman et al. (1998), and Charitou Trigeorsis (2002) Becchetti and Sierra (2002), shows that the results obtained by using of discriminant analysis models and logistic regression based methods has no significant differences. In this study has been applied two discriminant analysis based methods, the well-known Altman's Z-Score model which tries to predict bankruptcy risk by using five financial variables and Z value model, and model developed by Teti et al. (2012) which was tested on Italian small and medium-sized enterprises. Based on Altman's (1968) and Terdpaopong and Mihret (2011) Thai small and medium-sized enterprises methods, the second used model takes into account 4 financial ratios with different weights.

The Altman Z-Score value can be described as the following formula (1):

$$\text{Altman Z-Score} = 1,2X_1 + 1,4 X_2 + 3,3 X_3 + 0,6 X_4 + 0,999 X_5 \quad (1)$$

where,

$X_1$  = Working Capital/Total Assets  
 $X_2$  = Retained Earnings/Total Assets  
 $X_3$  = Earnings Before Interest & Tax /Total Assets  
 $X_4$  = Market Value of Equity/Debt  
 $X_5$  = Sales/Total Assets

If the Altman's Z-Score value is located above 3 there is no bankruptcy risk, so the company works properly. When Z-Score values are moving between 1,81 and 2,99 means that companies face difficult financial situation characterized by declining of performance, the company is on the threshold of the bankruptcy. Altman places companies with such performance in "grey zone". If the Z-Score value is situated below 1,81, the risk of bankruptcy is obvious (Altman, 1968, 27 p.).

The bankruptcy prediction model used for Italian small and medium-sized enterprises developed by Teti, Dell 'Acqua and Brambilla (2012) can be described by the following formula:

$$\text{Italian SME's Z value} = -5,57 X_1 + 11,31 X_2 + 0,03 X_3 - 0.01 X_4 \quad (2)$$

where,

$X_1$  = Debt/Total Assets

$X_2$  = Return on Sales (ROS) = Net result / Sales

$X_3$  = Earnings Before Interest & Tax (EBIT) /Interest expenses

$X_4$  = Working Capital/ Earnings Before Interest, Tax, Depreciation and Amortization (EBITDA)

Teti et al. (2012) after their research on Italian small and medium-sized enterprises concluded that those firms which have Z value greater than -2,50, the risk of bankruptcy is very low. If Z value is situated between -3,75 and -2,49, the bankruptcy risk is medium, which can be associated also with deterioration of corporate performance and earnings. If Z value is situated below -3,76, the risk of bankruptcy in case of those small and medium-sized enterprises it is obvious.

The analysis of small and medium-sized enterprises bankruptcy risk was performed using R statistics software system, which one of the greater advantages is that is an open source program, dispose with modules necessary for this study. Another great benefit of this software is that can be linked with Excel Spreadsheet. In this study, the 'StatDA' modules were used.

For presenting the evolution of annual bankruptcy risk of investigated small and medium-sized enterprises, I have used a complex diagram called edaplot, which shows the distribution of data by boxplot, histogram and point cloud.

#### 4. Results of the research

For bankruptcy risk quantifying two methods were applied, first the well known Altman's Z-Score bankruptcy forecasting method and Teti et al. bankruptcy risk prediction model, which suits for small and medium-sized enterprises bankruptcy risk quantifying. The second one was developed on basis of Italian small and medium enterprises financial statements between 2006 and 2009.

The main statistical characteristics of applying those two methods are presented in Table 1. and Table 2.

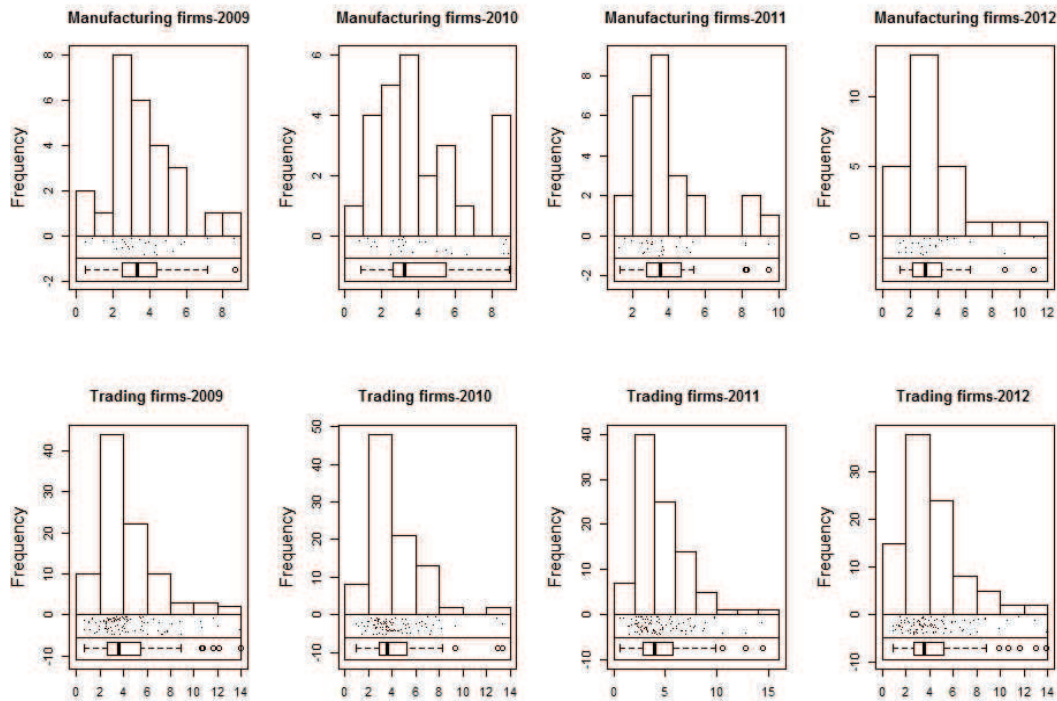
**Table 1:** Bankruptcy risk main statistics (Altman bankruptcy risk model)

Years	Manufacturing firms				Trading firms			
	2009	2010	2011	2012	2009	2010	2011	2012
<b>Minimum</b>	0,52	0,83	1,32	1,25	0,67	0,98	0,61	0,89
<b>Quartile 1</b>	2,55	2,70	2,81	2,34	2,68	2,89	2,78	2,68
<b>Median</b>	3,30	3,23	3,55	3,13	3,61	3,58	3,99	3,53
<b>Arithmetic Mean</b>	3,66	4,13	3,96	3,71	4,33	4,23	4,56	4,27
<b>Quartile 3</b>	4,38	5,38	4,61	4,25	5,48	5,15	5,67	5,22
<b>Maximum</b>	8,66	8,93	9,45	11,02	13,93	13,39	14,39	13,89

Source: Own calculation

The evolution of Z-Score values after applying Altman method to manufacturing and trading operating small and medium-sized enterprises are illustrated in Table 1. and Figure 2. Both the table and figure clearly shows that the Z-Score values' interquartile range are situated between 2,34 and 5,38 in the case of enterprises operating in manufacturing sector in the investigated period. In case of small and medium-sized enterprises operating in trading sector, the Z-Score in the investigated period is situated between 2,68 and 5,67, which means that although slightly, but examined trading companies dispose with favorable situation than manufacturing companies regarding the bankruptcy risk. The value recommended by Altman for companies with good financial position is situated above 3. After investigating the trend of lower quartile during the investigated period in case of manufacturing firms, we find a slightly increase of values in 2010 and 2011 compared to 2009 and reducing of Z-Score values in 2012, that suggest that the situation is better in years 2010 and 2011 than in the years 2009 and 2012 regarding to bankruptcy risk. By analyzing the upper quartile values, we find that the highest values were reached in 2010 and a decline of values in 2011 and 2012. By examination of the average value it is clear, overall, the investigated small and medium-sized enterprises operating in manufacturing sector reached Z-Score values above 3 in analyzed 4 years, so we can conclude that these companies are not threaten by bankruptcy risk. By analyzing in evolution, the average shows the best possible values in 2010. We can get similar findings after examinations of the point cloud and the boxplot diagram. Looking at the boxplot diagram, we can see that the manufacturing small and medium-sized enterprises' Z-Score values, only in 2012 year follow distribution closer to the normal distribution.

**Figure 2:** Evolution of bankruptcy risk of manufacturing and trading firms by using Altman default risk model (2009-2012)



Source: Own calculation

In case of trading companies, looking at the lower quartile, it can be founded that in 2010, the lower quartile increase slightly and then decrease in 2011 and 2012, but nor in a year do not reached the limit value of 3. In all 4 investigated years, the upper quartile reached values above 5. The evolution of this is also fluctuating during the investigated period. We can see a decrease in 2010 followed by an increase in 2011 and a further a decline in 2012. We can find similar developments in evolution of Z-Score average values, in 2011 reaching the greatest value 4,56. The average for each 4 examined years take values above 4, which indicates that compared with firms operating in manufacturing sector, trading firms are better situated in terms of bankruptcy risk. We can see similar findings after analyzing boxplot and point cloud. By examining of histogram, we can find that compared with manufacturing firms, trading small and medium-sized enterprises Z-Score distribution is closer to normal distribution, during the investigated 4 years.

Table 2. and Figure 3. presents the evolution results Z value of bankruptcy risk after applying of Italian bankruptcy risk prediction model, which is small and medium-sized enterprises risk specific model. The study is also based on Bihor County's 120 manufacturing and trading small and medium businesses' annual simplified financial statements.

**Table 2:** Bankruptcy risk main statistics (Italian SME's bankruptcy risk prediction model)

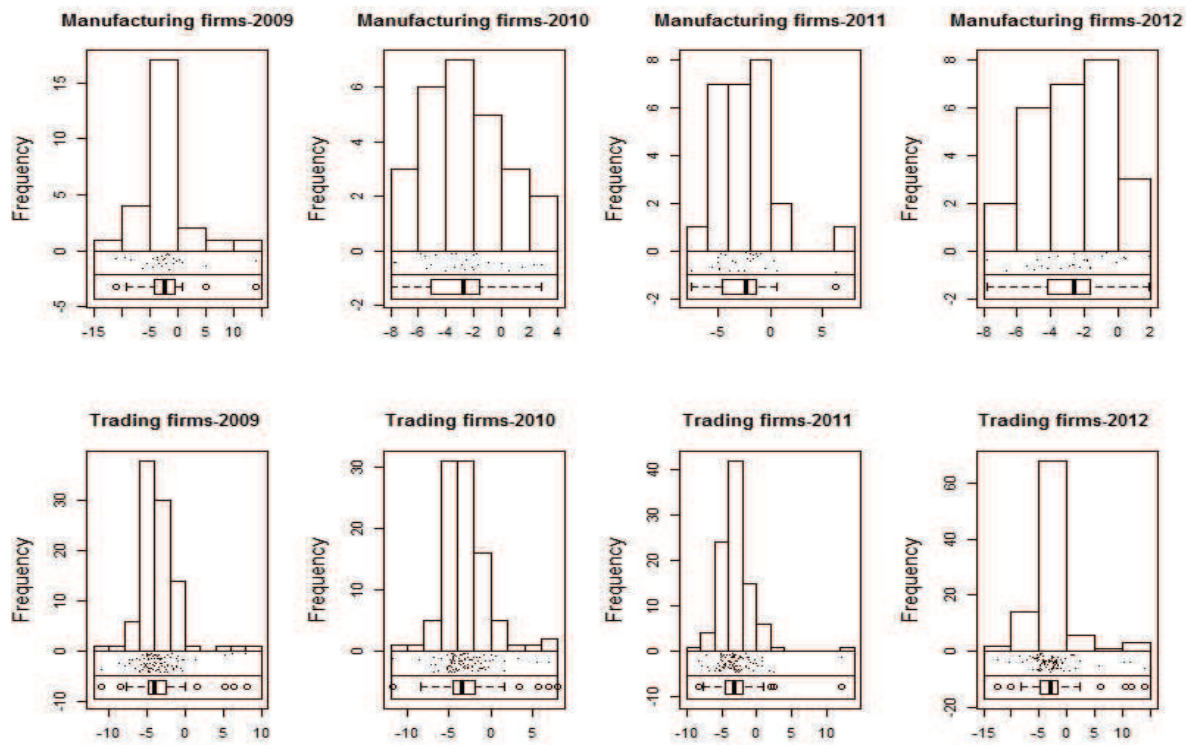
Years	Manufacturing firms				Trading firms			
	2009	2010	2011	2012	2009	2010	2011	2012
<b>Minimum</b>	-11,01	-7,92	-7,58	-7,75	-10,96	-11,74	-8,31	-12,38
<b>Quartile 1</b>	-4,14	-4,97	-4,60	-4,14	-4,87	-4,56	-4,52	-4,73
<b>Median</b>	-2,28	-2,74	-2,44	-2,57	-3,99	-3,39	-3,21	-3,13
<b>Arithmetic Mean</b>	-2,26	-2,88	-2,55	-2,66	-3,56	-2,98	-2,99	-2,79
<b>Quartile 3</b>	-0,83	-1,68	-1,41	-1,59	-2,56	-1,86	-2,09	-1,76
<b>Maximum</b>	14,01	2,81	6,20	1,92	8,07	7,96	12,22	13,89

Source: Own calculation

In case of manufacturing small and medium-sized enterprises, we can see that in the four examined years, the interquartile range of Z value is situated between -4,97 and -0,83, while trading small and medium-sized businesses' interquartile range lies between -4,87 and -1,76. Based on it, it can be concluded that manufacturing firms dispose with a better position regarding to the bankruptcy risk, because the upper quartile values are greater than -2,50 points. The lower quartile values for examined each 4 years show values below -3,76. If we analyze the evolution of this, we can find that 2009 and 2012 shows a better situation than years 2010 and 2011 on this aspect. If we analyze the upper quartile we can see that it takes values greater than -2,50 in the investigated period, which is favorable aspect. The greatest value is recorded in 2009 and the lowest one in 2010. By analyzing the evolution of average we can conclude, that the companies operating in manufacturing sector only in 2009 record values above -2,50 (-2,26), while in other three years the average is situated below -2,50. This means that between 2010 and 2012, the small and medium-sized businesses have a medium bankruptcy risk level, which is reflected in the deterioration of performance and earnings too. In evolution, we can see that the year 2010 is the worst possible in terms of bankruptcy risk, although this not clearly indicates the danger of bankruptcy, because the average values is situated above -3,76 limit value. We can find similar evolution by investigation of point cloud and boxplot. By looking at the edaplot complex diagram, we can see that in the case of manufacturing firms, the Z values do not follow a normal distribution in analyzed period.

In case of trading small and medium-sized enterprises, the lower quartile shows an increase in 2010 and 2011 and then a decrease in 2012, in all analyzed 4 years recording values below -3,76. The upper quartile evolution shows excepting year 2009, values situated above the -2,50 limit value, which is a positive aspect. The best value is recorded in 2010 and 2011 in case of trading small and medium-sized enterprises.

**Figure 3:** Evolution of bankruptcy risk of manufacturing and trading firms by using Italian sme's bankruptcy risk model (2009-2012)



Source: Own calculation

After analyzing the evolution of arithmetic mean of Z values it can be observed that unfortunately, during the analyzed 4 years, the values do not reach values above  $-2,50$ , in all 4 years they remain below this target value. In the years 2010 and 2012 the values are closer to the expected above  $-2,50$  value. Regarding to this, we can conclude that the results of Italian bankruptcy prediction model shows that investigated small and medium-sized businesses have a medium risk bankruptcy risk level, because the average values are situated between  $-2,49$  and  $-3,75$ . This evolution is most probably influenced by very high and very low outlier values, which are characteristic for some trading companies' Z value. After the examination of point cloud, boxplot and histogram we can see same findings. Looking at the edaplot complex diagram we can see that in the case of trading companies, the Z values follow distribution closer to the normal only in 2011.

After application of these two bankruptcy forecasting methods, we can get the conclusion that the methods retrieve different results. While the results of Altman's method during the investigated 4 years show that both manufacturing and trading companies dispose with favorable financial position in terms of bankruptcy, the results recorded by application of Italian Z value bankruptcy prediction model shows that both manufacturing and trading small and medium-sized enterprises are characterized by a medium bankruptcy risk level, except the manufacturing companies in 2009. This means, that the second bankruptcy prediction technique identifies the bankruptcy risk earlier than the first method, so this method probably suits better for small and medium-sized enterprises' specific features. The application of first method demands more caution from analysts and managers.



## 5. Conclusion

Almost in all European Union member state, it is recognized fact, that the small and medium-sized enterprises represent the driving force, the backbone of the economy, so the examination of these small businesses' financial position and bankruptcy risk factors is essential.

In this study, after application of two bankruptcy forecasting methods based on discriminant analysis statistical method, I found different results. After applying the well-known Altman method, I found that neither manufacturing nor neither trading investigated small and medium-sized enterprises are not in danger of bankruptcy risk. By comparing enterprises operating in these two industries, I conclude on basis of average values, that trading small and medium-sized enterprises have a better financial position than manufacturing firms because the average Z-Score indicates higher values for these companies. The results of Z value retrieved by applying the second bankruptcy forecasting method are different. According to this method, the enterprises operating in manufacturing sector dispose with a better financial position that trading companies. The second method results show that both manufacturing and trading companies are characterized by a general, medium bankruptcy risk level, which is also reflected by the deterioration of performances and earnings. The average value shows acceptable result on aspect of bankruptcy risk, higher than -2,50 only in the year 2009 for manufacturing companies. By comparing these two industries, it can be concluded manufacturing firms have a better financial position than trading firms.

Comparing these two applied methods, I consider that the second one can quickly detect the bankruptcy risk, so the usage of this model may be preferable in case of small and medium-sized enterprises. Applying of the first method need more caution from analysts and managers. In my opinion, present research supported the fact that small and medium-sized businesses require a special approach regarding to the bankruptcy risk quantifying.

## Bibliography

1. Ahn, B.S., Cho, S.S., and Kim, C.Y. (2000) 'The integrated methodology of rough set theory and artificial neural network for business failure prediction'. *Expert Systems with Applications*, 18, 65-74.
2. Altman, E., and Sabato, G. (2007) Modelling Credit Risk for SMEs: Evidence from the U.S. Market. *Abacus*, 43(3), 332-357.
3. Altman, E.I. (1968) 'Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance*, 23 (4), 589-609.
4. Becchetti, L. and Sierra J., (2002) 'Bankruptcy risk and productive efficiency in manufacturing firms', *Journal of Banking and Finance*, Vol. 27.
5. Charitou, A. and Trigeorgis L., (2002) 'Option-based bankruptcy prediction', paper presented at 6th Annual Real Options Conference, Paphos, Cyprus, 4-6 July
6. European Commission (2003) 'Commission recommendation: Definition of small & medium sized enterprises'. *Journal*, c(2003) 1422, 39. [http://www.eif.org/attachments/guarantees/cip/CIP\\_SME\\_definition.pdf](http://www.eif.org/attachments/guarantees/cip/CIP_SME_definition.pdf)
7. Fulmer, J.G., Moon, J.E., Gavin, T.A., and Erwin, J.M. (1984) 'A bankruptcy classification model for small firms'. *Journal of Commercial Bank Lending*, 11 (July), 25-37
8. Kraus, A., and Litzenberger, R.H. (1973) 'A statepreference model of optimal financial leverage'. *Journal of Finance*, 28 (4), 911-922.
9. Mossman, Ch.E., Bell G.G., Swartz L.M. and Turtle H., (1998) 'An empirical comparison of bankruptcy models', *The Financial Review*, Vol. 33, nr. 2

10. Ooghe, H., Joos P. and De Bourdeaudhuij C., (1995) 'Financial distress models in Belgium: The results of a decade of empirical research', *International Journal of Accounting*, Vol. 30
11. Sirrattanaphonkun, W. and Pattarathammas, S. (2012) 'Default prediction for small-medium enterprises in emerging market: Evidence from Thailand', *Seoul Journal of Business*, Volume 18, Number 2, 27 p.
12. Terdpaopong, K. (2011) 'Identifying an SME's debt crisis potential by using logistic regression analysis', *RJAS* Vol. No. 1 Jan.-Jun.
13. Terdpaopong, K. and Mihret D.G. (2011) 'Modelling SME credit risk: a Thai Empirical Evidence', *Small Enterprise Research*, Vol. 18, No. 1, pp. 63-79
14. Teti, E., Dell'Acqua A. and Brambilla, M. (2012) 'Bankruptcy predictors during the financial crisis. A study of Italian SME's', 33 p.
15. The Farlex Financial Dictionary (Ed.) (2011) 'The Farlex Financial Dictionary', [http://encyclopedia.thefreedictionary.com/Business+failure#cite\\_note-0](http://encyclopedia.thefreedictionary.com/Business+failure#cite_note-0).