Global Journal of Business, Economics and Management

Volume 06, Issue 2, (2016) 130-137

www.wjbem.eu

Modeling of company´s default probability in relation to its credit risk

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Suggested Citation:

Weissova, I., Siekelova, A. & Kramarova, K. (2016). Modeling of company´s default probability in relation to its credit risk. *Global Journal of Business, Economics and Management: Current Issues. 6*(2), 130-137.

Received June 10, 2016; revised September 8, 2016; accepted November 14, 2016;
Selection and peer review under responsibility of Prof. Dr. Andreea Iluzia IACOB, Bucharest Academy of Economic Studies, Romania.

Abstract

The issue of bankruptcy is very discussed in the modern theory of the company. There are currently many companies that must deal with this issue. They obtain useful information and also use the appropriate tools in order to avoid bankruptcy. Therefore financial analysts are still looking for appropriate ways to predict the bankruptcy of the company. The practical part of the following contribution consists of three steps. At the beginning we randomly selected five Slovak companies. Next we chose four predictive models which are calculated for the last one year. Then we chose the method of Economic Value Added as a method by which we can measure the value of the company. We calculate the Economic Value Added for the last one year in selected companies. Finally, we compare the results of predictive models with the results of Economic Value Added to evaluate the risk of bankruptcy in selected companies. The aim of this paper will be captured the dependence between selected predictive models and Economic Value Added and based on these calculation capture credit risk of these companies.

Keywords: credit risk, predictive model, economic value added.

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1. Introduction

One of the cornerstones of economy is successful operation of companies. Nowadays, the failure of companies is becoming more common. There are lot of factors which have influence on the successful of company or on its failure; these factors are from external environment but also from the internal environment of company. Frajtova-Michalikova, Spuchlakova & Cug (2014) Financial instability of companies is closely linked with unpleasant consequences (Spuchlakova, Frajtova-Michalikova & Birtus, 2014). This is the reason why managers and financial analysts have been looking for the methods by which we will be able to predict the bankrupt of companies. The methods of prediction financial situation in companies currently have great importance for investors as well as for company owners. This paper deals with the issue of prediction financial situation in companies. In paper we will use selected predictive models which belong into the financial analysis ex ante. Just ex ante financial analysis is used to predict insolvency of company. And this analysis can be the source for timely implementation of corrective actions (Adamko, Kliestik & Birtus, 2014)

Works dealing with this issue have already appeared in the 30s of the last century. These papers compared the financial ratios between successful and unsuccessful companies. From this period comes working paper of P. J. Fitzpatrick which was the basis for other studies to the mid-sixties of the last century. Another important work was the study of W. H. Beaver, in which he showed that financial ratios indicators can be apply in the process of prediction of company´s financial situation but not all variables have the same significance (Kralovic & Vlachynsky, 2002) He used dichotomous classification test as the tool by which is possible to remove distorted data. But this model had weaknesses because several indicators determined company as a bankrupt company, other indicators determined company as a creditworthy company vice versa (Kollar & Bartosova,2014) This weakness was removed by models which were based on the more complicated statistical methods - multivariate discriminant analysis. E. I. Altman was the important representative of this method. Multivariate discriminant analysis is looking for a linear combination of indicators which will be distributing companies into to the group of bankrupt companies or creditworthy companies. Another important method was the method of logic regression of the J. A. Ohlson. This method is based on the search of the logical variable depending on the independent variables. The development of information technology has brought new models of prediction such as neural networks and genetic algorithms (Zalai, 2000; Gavlakova & Kliestik, 2014)

2. Theoretical aspects of selected predictive models

For the prediction of company´s financial situation can be used lot of models. But not every of these models are suitable for use in conditions of transitional economies such as Slovak economy. In our paper we chose four predictive models which could have sufficient predictive value in Slovak conditions. In this place we described our selected predictive models.

2.1. Springate model

This model was developed by Gordon Springate in 1978. At the beginning this model worked with nineteen financial ratio indicators but later they were reduced to four most important. This model uses multidimensional discriminant analysis and the breaking point for this model is 0.862. If the company achieves Springate score lower than 0.862 this company is classified as bankrupt company. If the company achieves Springate score higher than 0.862 this company is classified as creditworthy company. Springate (1978), Formula for Springate score is following:

$$S = 1.03x_1 + 3.07x_2 + 0.66x_3 + 0.4x_4 \quad (1)$$

Result of Springate model divides companies into the following groups:

$S > 0.862$	creditworthy zone
$S < 0.862$	bankrupt zone

2.2. Poznanski model

This is the one of the most popular predictive model which was created in Poland. This model was created for Poland companies in the Poland conditions which are similar as Slovak conditions. This model is based on the four financial ratios. Accuracy of this model was established on the 92.98 % (Sivak , 2004; Misankova,Kocisova, Frajtova-Michalikova & Adamko, 2014)

$$FD = 3.562x_1 + 1.588x_2 + 4.288x_3 + 6.719x_4 - 2.368 \quad (2)$$

Breaking point for this model is 0. If the company achieves Poznanski score lower than 0 this company is classified as bankrupt company. If the company achieves Poznanski score higher than 0 this company is classified as creditworthy company.

$FD > 0$	creditworthy zone
$FD < 0$	bankrupt zone

2.3. IN05 model

Another model which we chose for prediction of financial situation of company is IN05. It is a creditor-ownership model of Neumaier husbands. This model was created in Czech Republic. We can state that this model could be also applied in Slovak companies. Basic formula for IN05 model is following:

$$IN05 = 0.13x_1 + 0.04x_2 + 3.97x_3 + 0.21x_4 + 0.09x_5 \quad (3)$$

The two previous models had two main categories for companies. But this model IN05 has three categories it means bankrupt zone, creditworthy zone and grey zone. When company belong into the grey zone it is specific situation when we do not know how will be the future situation in company (Neumaierova & Neumaier,2002)

$IN05 > 1.6$	creditworthy zone
$0.9 < IN05 < 1.6$	grey zone
$IN05 < 0.9$	bankrupt zone

2.4. CH-index

This model was created in Slovak republic. This was the first model in Slovakia which was focused on the predictive analysis. For the need of this model were tested 1, 123 companies. Findings confirmed the feasibility of using this model for evaluation the financial health of company in Slovak republic. But this model was focused on the companies from agriculture and it can be its disadvantage (Chrastinova, 1998) Formula for CH-index is following:

$$CH = 0.37x_1 + 0.25x_2 + 0.21x_3 - 0.1x_4 - 0.07x_5 \quad (4)$$

Ch-index has three categories for companies, namely: bankrupt zone, creditworthy zone and grey zone. Involving the company into the categories is based on these results:

$CH > 2.5$	creditworthy zone
$2.5 > CH > -5$	grey zone
$CH < -5$	bankrupt zone

3. Methodology

In this paper we tried to test the dependence between the results from selected predictive models with the results of Economic Value Added. Our hypothesis was tested into the five Slovak companies with different type of business. We compared these results from the 2014. The practical part of this paper consists of three basic parts. *In the first part* we had to choose several companies from Slovak Republic. We decided for five companies which are situated in Slovakia. In this paper these companies are called Company 1, Company 2, Company 3, Company 4 and Company 5. In addition, we had to choose suitable predictive models which we were able to apply into the selected companies. Finally, we chose four predictive models which were described in the theoretical part of this paper. Namely, we choose Springate model, Poznanski model, IN05 model and CH-index (Kliestik et al., 2015).

In the second part we had to calculate our selected predictive models in every of companies. We calculated these models in the one year – 2014. Furthermore we had to calculate Economic Value Added (EVA). The reason for this calculation was followed. We tried to determine the applicability of selected predictive models in the Slovak conditions. For this task we wanted choose the method by which we are able to determine the value of company. Our testing of applicability of selected predictive is based on the comparison between results from these models with the results of method by which we are able to measure the value of company (Kral & Kliestik, 2015; Adamko, Kliestik & Birtus, 2014)

The last part of our paper is devoted to statistic method which we used in this paper. For testing the statistical significant relationship between predictive models and economic value added we used as a testing statistic *Kendall tau.* Result from Kendall tau, it means P value we compared with our level of significance (Rimarcik, 2007; Buc & Kliestik, 2013)

4. Results

Our results of EVA were following if the result of EVA was lower than 0 it meant that company did not create the value for its shareholders and company was involved into the bankrupt zone. If result of EVA was higher than 0 it meant that company create the value for its shareholders and company

was involved into the creditworthy zone. In this practical part of our paper we calculated selected predictive models in five companies. This calculation was in the year 2014. Results of our calculation are captured in the four tables. These tables also show results of economic value added in selected companies (Adamko, Kliestik & Birtus, 2014).

Table 1. Results of Springate model and EVA

	Springate model 2014	EVA 2014
Company 1	0.2198	-1 865 063.71
Company 2	0.6720	68 741.19
Company 3	3.5156	252 802.95
Company 4	0.6508	2 160 647.65
Company 5	1.0736	41 122.86

In table 1 we can see that Springate model ranked Company 1, 2 and 4 into the bankrupt zone in 2014. But Company 3 and 5 this model ranked into the creditworthy zone with low probability of company´s failure. EVA was higher than 0 in Company 2, 3, 4 and 5 in Company 1 was EVA lower than 0 vice versa. It means that EVA ranked Company 1 into the bankrupt zone and other companies into the creditworthy zone.

Table 2. Results of Poznanski model and EVA

	Poznanski model 2014	EVA 2014
Company 1	0.4794	-1 865 063.71
Company 2	-1.3585	68 741.19
Company 3	1.5921	252 802.95
Company 4	1.2254	2 160 647.65
Company 5	4.8342	41 122.86

Table 2 shows that Poznanski model ranked Company 2 into the bankrupt zone but EVA ranked this company into the creditworthy zone. We can state that other companies were ranked into the creditworthy zone by Poznanski model. EVA ranked Company 1 into the bankrupt zone and other companies into the creditworthy zone. It means that results from Poznanski model and results from EVA are similar.

Table 3. Results of IN05 and EVA

	IN05 2014	EVA 2014
Company 1	0.5135	-1 865 063.71
Company 2	1.9912	68 741.19
Company 3	1.1177	252 802.95
Company 4	2.2069	2 160 647.65
Company 5	1.2216	41 122.86

In table 3 we can see that model IN05 ranked Company 1 into the bankrupt zone and EVA also ranked this company into the bankrupt zone. IN05 ranked Company 1, 4 and 5 into the creditworthy

zone as well as EVA. Company 3 was ranked into the grey zone it means we do not know to say about future situation in this company.

Table 4. Results of CH-index and EVA

	CH-index 2014	EVA 2014
Company 1	-12,6972	-1 865 063.71
Company 2	13,0190	68 741.19
Company 3	2,8952	252 802.95
Company 4	3,7095	2 160 647.65
Company 5	2,7043	41 122.86

Table 4 shows very interesting results. Because CH-index was created in the Slovak Republic but in this comparison with EVA this model achieved the worst results. CH-index ranked every of selected companies into the bankrupt zone but EVA ranked only Company 1 into the bankrupt zone.

The second part of practical part is dedicated to testing the dependence between predictive models and economic value added. For testing this dependence we used trial version of SPSS program. The level of significance we determined on the 0.05 and we calculated P value by Kendall tau. Subsequently, we captured the dependence thanks to comparison between P value and level of significance. Kendall tau showed that between Springate model and Economic Value Added is not statistic significant relationship.

$$Sig\ (2-tailed) = 0.414 > 0.05$$

Kendall tau showed that between Poznanski model and Economic Value Added is not statistic significant relationship.

$$Sig\ (2-tailed) = 0.617 > 0.05$$

Kendall tau showed that between IN05 model and Economic Value Added is not statistic significant relationship.

$$Sig\ (2-tailed) = 0.617 > 0.05$$

Kendall tau showed that between CH-index and Economic Value Added is statistic significant relationship.

$$Sig\ (2-tailed) = 0.000 < 0.05$$

Based on the previous results and comparison we can state that three of the selected models failed and their dependence between probability of company failure and its Economic Value Added do not exist. It means that success of applicability of Springate model, Poznanski model and IN05 in the Slovak companies is low. But result of comparison between CH-index and Economic Value Added was different. This model achieved the best results. This model showed that here exist dependence between this model and Economic Value Added. It means that this model has better applicability in the Slovak companies.

5. Conclusion

This paper was dedicated to dependence between selected predictive models and Economic Value Added. The aim of this paper was captured the applicability of these model in the Slovak companies. Results were almost same in every of selected predictive models. Generally, we can state that this dependence is not significance. But CH-index achieved the best results.

Acknowledgements

The contribution is an output of the science project VEGA 1/0656/14 - Research of Possibilities of Credit Default Models Application in Conditions of the SR as a Tool for Objective Quantification of Businesses Credit Risks.

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