THE COMPARISON OF PREDICTION ABILITY OF SELECTED BANKRUPTCY MODELS IN THE GLASSMAKING INDUSTRY IN THE CZECH REPUBLIC

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Abstract

Financial analysis presents one of the most important areas of interest in every successful company, because it can provide a huge amount of indicators and models in different areas, as well as some complex models, namely bankruptcy and credibility models, where these models usually provide one specific number and compare this number with recommended value. This article presents the analysis of different bankruptcy models, more precisely, authors are focusing on not so frequently used bankruptcy models, namely Beerman's discriminating function and Beaver's model. The authors are evaluating one particular industry sector, glassmaking industry, with the aim to compare the results of above mentioned models themselves and also in different regions of the Czech Republic. The data used for calculation of above mentioned models have been obtained in database Albertina, where it is possible to find basic accounting data, which are necessary for calculation of every indicator from financial analysis. Covered period of time is since 2010 to 2014. The results show that there exist differences between different models, while there are no significant differences in the terms of companies' location. More details are described in this article.

Key words: Beaver's model, Beerman's discriminating function, financial analysis, Glassmaking industry

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Introduction

Even if authors already have an experience with the topic of financial analysis, they focus on a little bit different aspects in this article. First of all, specific companies have been selected for the analysis, namely companies from glassmaking industry sector. First reason for this selection is that this particular industry sector has had long tradition in the Czech Republic. Second reason is closely connected with the first one. Because of this long tradition there

exist a relatively huge amount of companies in this industry sector. An exact title of analysed industry sector is "manufacture of glass and glass products", where 91 companies with complete and available accounting reports were selected for analysis. Moreover, relatively unknown (at least in the condition of the Czech Republic) bankruptcy models have been used for the analysis, namely Beerman's discriminating function and Beaver's model. Additionally, in case of first mentioned model, it is possible to find two different sets of scales from two different authors, where this contradiction is one of the objects of this article.

As was already mentioned, authors themselves already published several articles about financial analysis (Kovárník & Hamplová, 2014, or Kovárník & Hamplová, 2015). However, there are other authors dealing with financial analysis as well, such as Altman and his colleagues (Altman, 1984, Altman & Kalotay, 2014, Altman & Narayanan, 1997), Čámská (2014) or Neumaierová (2005), however, these authors usually either create or evaluate one indicator. The aim of this article can be explained as the comparison of results of Beerman's discriminating function with two different sets of scales, where the Beaver's model is consequently used as a proof, which set is more corresponding with the reality and which set is not so correct one. Data for the analysis have been obtained in database Albertina. There exists higher number of companies in above mentioned industry sector; however, only 91 of them presented accounting data required for calculation of both bankruptcy models. Covered period of time is 2011 – 2014, where data from 2010 are used for calculation of the increase of long-term tangible assets.

1 Methodology

1.1 Beerman's Discriminating Function

Beerman's discrimination function is relatively complex bankruptcy model, where ten partial indicators are calculated, namely:

- x1 = depreciation / (beginning amount of long-term tangible assets + increase of long-term tangible assets)
- x2 = increase of long-term tangible assets / depreciation
- x3 = earnings before taxes / sales revenues
- x4 = notes payable / total liabilities
- x5 = inventory of supplies / sales revenue
- x6 = cash flow / total liabilities

- x7 = total liabilities / total assets
- x8 = earnings before taxes / total assets
- x9 = sales revenues / total assets
- x10 = earnings before taxes / total liabilities

Not only this model has ten partial indicators, but the scale of results is also very variable. Mostly bankruptcy models have the scale only with three different variants (safe zone / grey zone / distress zone), but in case of Beerman's function exist eight different variants depend on the final result of model, specifically:

- result lower than 0 – extremely good condition
- result lower than 0.2 – very good condition
- result lower than 0.25 – good condition
- result lower than 0.29 – average condition
- result lower than 0.31 – bad condition
- result same or higher than 0.31 – company is slightly endangered by insolvency
- result same or higher than 0.33 – company is endangered by insolvency
- result same or higher than 0.35 – company is strongly endangered by insolvency

The original paper, where this model was introduced, is from 1976 and it was published by University of Düsseldorf. However, authors of this article have not been able to get access to this original paper, this original paper is only mentioned by other authors, for example by Altman (1984). Therefore, authors have been using papers presented by other authors, where can be found the description and formula of Beerman's Model. However, as was already mentioned above, it is possible to find two different set of scales in different papers. These scales are subsequently used for multiplication of each partial indicators x1 – x10, and final result is compared with above mentioned scale of results, where eight different variants can occur.

One set has been presented by Kralicek (Kralicek at al., 2008, Marinič, 2014), other one has been presented by Czech authors (Vochozka, 2011, Sedláček, 2011). The sets of scales are described in following Tab. 1. Brief analysis of Tab. 1 shows that some indicators have same scale (x1 and x10), while the values of other indicators are the same for both sets, but in different order. The question remains, which of these sets is more corresponding with the reality. The authors of this paper will use the Beaver's Model for verification, which of presented scales more correspond with reality.

Tab. 1: Different Sets of Scales for Beerman's Function

Result	Kralicek	Czech version
x1	0.217	0.217
x2	0.012	- 0.063
x3	- 0.105	0.012
x4	0.165	0.077
x5	0.268	- 0.105
x6	- 0.063	- 0.813
x7	0.077	0.165
x8	- 0.813	0.161
x9	0.061	0.268
x10	0.124	0.124

Source: own processing based on (Kralicek at al., 2008, Marinič, 2014, Vochozka, 2011, Sedláček, 2011)

1.2 Beaver's Model

Beaver used in his model a little bit different approach. He analysed not only companies, which really bankrupt, but also companies with signals of bankruptcy. He also did not calculate any scale or total number as other authors, but he described problematic development of each indicator. The evaluator has to analyse a development of five different indicators and problematic development of them means high risk of bankruptcy. (Beaver, 1968, Beaver, 1966).

The five analysed partial indicators together with problematic development are as follows:

- owner's equity / total assets, decrease
- added value / total assets, decrease
- notes payable / total liabilities, increase
- cash flow / total liabilities, decrease
- working capital / total assets, decrease

2 The Results of Beerman's Discriminating Function

As was described above, even if both authors use same indicators and same final scale for evaluation, scales for the calculation of each partial indicator are different. Therefore it is

obvious that both versions provide extremely different results. Following Tab. 2 shows the frequency of each potential result for both versions of Beerman's function in every year.

Tab. 2: Frequency of Results for Beerman's Function

Indicator	Kralicek				Czech version			
	2011	2012	2013	2014	2011	2012	2013	2014
extremely good condition	2	5	4	1	31	36	37	82
very good condition	37	35	36	11	16	11	12	5
good condition	11	15	10	4	2	6	8	0
average condition	10	8	8	5	0	6	4	0
bad condition	3	2	7	6	2	1	2	1
slightly insolvency endangered	0	0	0	0	0	0	0	0
endangered by insolvency	8	9	7	7	4	4	3	2
strongly insolvency endangered	20	17	19	57	36	27	25	1
Total	91	91	91	91	91	91	91	91

Source: own processing based on (Kralicek at al., 2008, Marinič, 2014, Vochozka, 2011, Sedláček, 2011)

It is obvious that these results are completely different, not only in mutual comparison, but also in every year, where in both cases shows the year 2014 extraordinary results. In both versions exist only few companies with bad condition, and no company slightly risk of insolvency. However, the first version have has usually the highest number of companies with very good condition, with the only exception of the year 2014, where 57 companies have been strongly endangered by insolvency. The second version, on the other hand, present more extreme results, where there have existed a lot of companies with extremely good condition (the highest amount in 2012 and 2013, the second highest amount in 2011), but also a lot of companies with strong risk of insolvency (the highest amount of companies in 2011 and second highest in 2012 and 2013). However, the year 2014 has presented extraordinary results, where 82 companies have had extremely good condition.

Considering the fact that it is same model with same indicators, and moreover, it is the same group of companies, it is possible to make a partial conclusion that the situation of analysed companies changed in the year 2014. The question is whether this situation improved (and correct set of scales is the second one) or worsened (and correct one is the first version).

Following Tab. 3 shows the connection between these two different versions from Kralicek's point of view. In other words, table presents the frequency of each possible results for every result of Kralicek version. The aim is to show whether there is some match or not. This table has been prepared only for the year 2014 (Tab. 3).

Tab. 3: Results Frequency for Beerman's Function from Kralicek Point of View in 2014

Kralicek	Czech version	Frequency
extremely good condition	extremely good condition	1
very good condition	extremely good condition	11
good condition	extremely good condition	4
average condition	extremely good condition	4
	very good condition	1
bad condition	extremely good condition	4
	very good condition	1
	endangered by insolvency	1
endangered by insolvency	extremely good condition	7
strongly insolvency endangered	extremely good condition	51
	very good condition	3
	bad condition	1
	endangered by insolvency	1
	strongly insolvency endangered	1
Total		91

Source: own processing based on (Kralicek at al., 2008, Marinič, 2014, Vochozka, 2011, Sedláček, 2011)

It is obvious that the results of both variants have been really different in the year 2014 (see Tab. 3). There have been only 2 matches, while 51 companies have presented completely opposite results (extremely good condition in one case and strong insolvency danger in other one) or strong insolvency danger in one case and very good condition for the second variant (3 companies). This comparison was not so extreme in other years, for example in the year 2011 both variants present same result for 22 companies, however, there are also some completely different results possible to find, where one version present extremely good result, while the other version present strong insolvency danger (5 companies), or very good condition and strong insolvency danger (12 companies), or extremely good condition with one variant and endangered by insolvency according to the other variant (2 companies).

These matching results can be explained in following way. There have been companies with so extremely good or so extremely bad financial health that these results are same for both variants. However, the majority of non-matching results support the hypothesis that one of presented variant is not correct and the scale has been written down in a wrong way by the authors. The verification will be done by the next model, namely Beaver's model.

3 The Results of Beaver's Model

As was explained in the methodology part of this article, Beaver in his model does not calculate any complex value, however, he evaluates and analyses the development of five different partial indicators.

Because of limited space of this article have been selected only 3 companies for the verification, more precisely those companies where bot variants have presented different results in every analysed year. These companies are NH Glass, Preciosa GS, and Skleněná Bižuterie.

First company have been strongly endangered by insolvency according to first variant and extremely good according to the second variant in 2011, 2012, and 2014, while in 2013 showed first variant very good condition, and second one showed strong danger of insolvency. Second company have been strongly endangered by insolvency according to first variant and extremely good according to the second variant in 2011 and 2014, endangered by insolvency according to the first variant in 2012 and 2013, where the second variant showed good condition (2012) and very good condition (2013). In case of third company, there has been strong danger of insolvency and extremely good condition in all analysed years.

Following Tab. 4 presents results of Beaver's model in four analysed years for three selected companies.

Tab. 4: Results of Beaver's Model

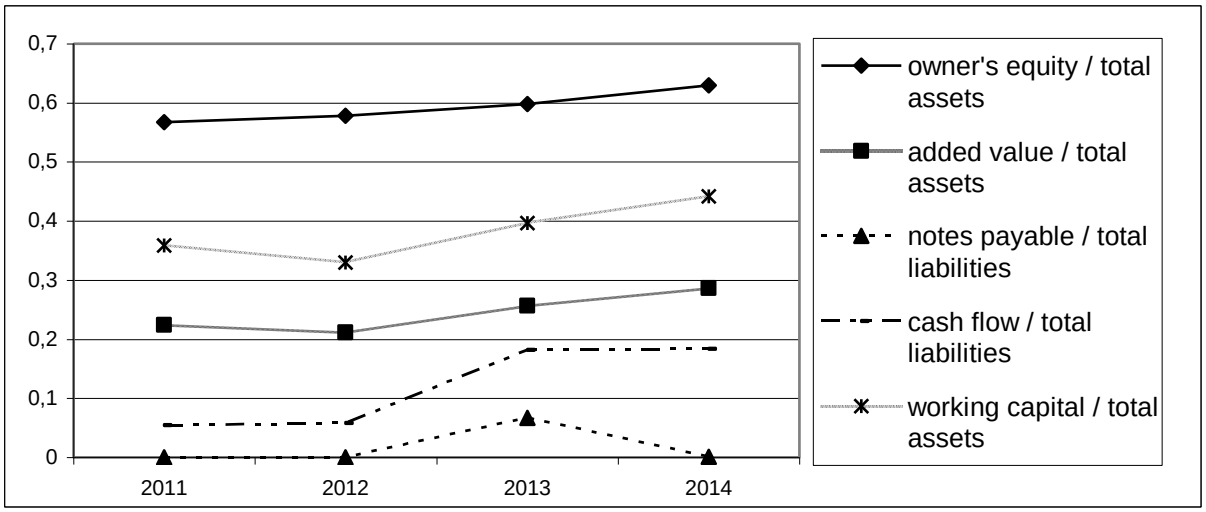
Company	Indicator	Year			
		2011	2012	2013	2014
NH Glass	owner's equity / total assets	0.046517	0.04379	0.005143	0.085327
	added value / total assets	0.409738	0.045397	0.090966	0.164635
	notes payable / total liabilities	0.253961	0.649221	0.575489	0.643995
	cash flow / total liabilities	- 0.08321	- 0.08888	- 0.05312	0.00611
	working capital / total assets	- 0.62602	- 0.2303	- 0.23098	-0.22591

Preciosa GS	owner's equity / total assets	0.142336	0.118432	0.136525	0.147019
	added value / total assets	0.056837	0.164408	0.170479	0.161034
	notes payable / total liabilities	0	0	0	0
	cash flow / total liabilities	- 0.00856	0.021735	0.047625	0.04087
	working capital / total assets	0.604494	0.669758	0.640492	0.582697
Skleněná Bižuterie	owner's equity / total assets	0.566791	0.577615	0.598192	0.629832
	added value / total assets	0.223734	0.211652	0.256487	0.28591
	notes payable / total liabilities	0	0	0.06699	0.000733
	cash flow / total liabilities	0.05394	0.058225	0.181511	0.183722
	working capital / total assets	0.358208	0.329334	0.396737	0.44194

Source: own processing based on (Beaver, 1968, Beaver, 1966)

For better visualisation are results of one selected company (Skleněná Bižuterie) described in following Fig. 1.

Fig. 1: Results of Beaver's Model for Skleněná Bižuterie



Source: own processing based on (Beaver, 1968, Beaver, 1966)

As was explained, all indicators should not decrease, with only exception of third indicator (notes payable / total liabilities), where increase is a bad signal. In case of Skleněná Bižuterie, first and fourth indicators have been positively developing; they have been increasing in whole analysed period. Second and fifth indicator had negative development between 2011 and 2012 (decrease), however, they have been increasing since 2012 (positive development). As far as last indicator is concerned, negative development is increase, while it occurred between 2012 and 2013. It was 0 between 2011 and 2012, and decreasing between 2013 and 2014. Even if these results are not absolutely clear, there exist more positive signals

and the development suggests in majority indicators no signal of bankruptcy (for example between 2013 and 2014 was positive development in all five indicators).

In case of other analysed companies, the development is also not clear, but positive signals prevail. These results support the second version of Beerman's discriminating function, in other words, with respect to the results of Beaver's model, the second set of scale for Beerman's discriminating function seems to be more accurate.

Conclusion

This article deals with the issue of financial analysis, more precisely with so called bankruptcy models. These models analyse the risk of bankruptcy for selected company, where usually one specific number is calculated, and this number is compared with determined scale. Authors have been using two relatively not so frequently used models, namely Beerman's discriminating function and Beaver's function. However, it is possible to find Beerman's function with two different sets of scales, therefore the aim of this article is to compare these two sets and based on the results of Beaver's function decide, which set is more corresponding with reality. Calculation was made based on general available data in database Albertina for 91 companies from glass-making industry sector.

As was expected, both sets of indicators have provided mostly different results, in some cases completely opposite ones (strong risk of insolvency / extremely good condition). Beaver's model does not calculate one specific number, but it analyses development of five partial indicators. Three companies with different results of two sets of scales of Beerman's function in every year have been selected for analysis with Beaver's model. This analysis shows mostly positive signals in all three analysed companies. It will support the results of second set of scales of Beerman's function as more accurate.

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