

## THE COMPARISON OF DIFFERENT BANKRUPTCY MODELS IN THE CONDITIONS OF SELECTED COMPANIES

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### Abstract

This article continues with the evaluation of economic results of selected companies, namely of companies within HIT cluster, as was analysed in the article “The Application of the Bankruptcy Models in the Conditions of Selected Companies” presented on IDSE 2014 Conference. However, the aim of this article is to verify the hypothesis that different models applied on same companies provide comparable results. Specifically, this article compares results achieved by application of Altman Z-score, Taffler’s Model and IN Model. It is expected that the results of different models provide same or at least similar values. The results for each company have been calculated based on data available in the database Albertina. The compared period of time is 2010 – 2013, because for this period were available data in Albertina database in the moment of creation of this article. Hradec IT cluster (HIT cluster) has been established in 8th October 2008 in the industry sector called information technology. Fifteen companies from HIT cluster have been used for the analysis of the results of business success, while this cluster has sixteen members. The last member is University of Hradec Králové that means public university with no aim to create the net income. Therefore this subject has not been analysed with the bankruptcy models. The most of analysed companies have comparable results for different models. More detailed analysis is described within this article.

**Key words:** Altman Z-score, bankruptcy model, HIT cluster, IN Model, Taffler’s Model.

**JEL Code:** G33, M41

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### Introduction

This article continues with the analysis of the financial results of selected companies, namely of companies within HIT cluster, as was analysed in the article “The Application of the Bankruptcy Models in the Conditions of Selected Companies”, which was presented on IDSE 2014 (Kovarnik, Hamplova, 2014). This article dealt with the comparison of the results of

Altman Z-score of cluster members with average results of information technology industry sector.

The analysis showed that the average results of IT sector were in the grey zone of Altman Z-score in all analysed years, while major part of members achieved better results (safety zone or better results in the grey zone). However, the results of deep analysis of each of the indicators of Altman Z-score were completely different. The only higher than average indicator was  $T_1$  ((current assets – current liabilities) / total assets) while the other indicators were mostly below average. There were some extraordinary exceptions in some cases ( $T_4$  higher than 15 or  $T_5$  higher than 8), but the majority of the other indicators was below average.

This article continues with the analysis of financial health of selected members, but from the different point of view. It is well known that a lot of different indicators could be used for the evaluation of financial health. However, a huge number of these indicators evaluate same or at least similar aspect of financial health. The question remains whether these indicators give comparable results or not. Therefore, the authors choose three different bankruptcy models for the analysis, namely Altman Z-score, Taffler's Model, and IN Model (Altman, 2013), (Taffler, 1983), (Neumaierova, 2005) and the hypothesis can be formulated as follows. Different indicators evaluating same aspect of financial health provide same or at least comparable results.

The most of analysed companies have comparable results for different models. More detailed analysis is described within this article.

## 1 Methodology

The brief characteristic of three bankruptcy models, namely Altman Z-score, Taffler's Model, and IN Model, will be described in this chapter. The author will use these models in the following part of the article.

### 1.1 Altman Z-score

One of the most favourite bankruptcy models is Altman Z-score, called after Professor Edward Altman. Several variants of this model exist according to the type of business entity. Z-score for private companies could be calculated as follows:

$$Z = 0.717T_1 + 0.847T_2 + 3.107T_3 + 0.420T_4 + 0.998T_5, \quad (1)$$

where:

- $T_1 = (\text{current assets} - \text{current liabilities}) / \text{total assets}$
- $T_2 = \text{retained earnings} / \text{total assets}$
- $T_3 = \text{earnings before interest and taxes} / \text{total assets}$
- $T_4 = \text{book value of equity} / \text{total liabilities}$
- $T_5 = \text{sales} / \text{total assets}$  (Altman, & Kalotay, 2014), (Altman, 2013).

Zones of discrimination of this model are 2.9 and 1.2. If the result of  $Z$  is more than 2.9, the company is in the “safe zone” and there is no significant risk of bankruptcy. If the result is between 1.2 and 2.9, the company is in the “grey zone”, which means some risk of bankruptcy for such company and necessity to make some decisions for improving the situation. Moreover, an analysis of each  $T_i$  can reveal the most problematic indicator of such company. If the result is below 1.2, the company is in the “distress zone” and it will probably bankrupt (Altman, Yen & Zhang, 2010).

## 1.2 Taffler’s Model

Formulated in 1977, this model is another frequently used bankruptcy model. Its basic idea is similar to the previous model, while this one used only four partial indicators, namely:

$$T = 0.53R_1 + 0.13R_2 + 0.18R_3 + 0.16R_4, \quad (2)$$

where:

- $R_1 = \text{earnings before taxes} / \text{current liabilities}$
- $R_2 = \text{current assets} / \text{total liabilities}$
- $R_3 = \text{current liabilities} / \text{total assets}$
- $R_4 = \text{sales} / \text{total assets}$

Zones of discrimination of this model are 0.3 and 0.2. That means that if the overall result is higher than 0.3, the company is in the “safe zone” with no significant risk of bankruptcy. The result between 0.2 and 0.3 presents “grey zone” with some potential risk of bankruptcy and the necessity to make some decisions for improving of the position of the company. Results below 0.2 present “distress zone” with significant risk of bankruptcy (Taffler 1983).

## 1.3 IN05 Model

This model, created by Neumaier’s, analyse the risk of the bankruptcy in the condition of the Czech Republic. It has five partial indicators within, namely:

$$IN05 = 0.13A + 0.04B + 3.97C + 0.21D + 0.09E, \quad (3)$$

where:

- A = total assets / liabilities
- B = earnings before interest and taxes / interest payable
- C = earnings before interest and taxes / total assets
- D = sales / total assets
- E = current assets / current liabilities

The zones of discrimination of this model are 1.6 and 0.9. In the case that the result of IN05 is higher than 1.6, the company is in the “safe zone”, it is successful company with no significant risk of bankruptcy. The explanation of the grey zone, which means the results between 0.9 and 1.6, could be formulated as company with some potential risk of bankruptcy. The result below 0.9 presents the “distress zone”, which means that such company will probably bankrupt (Neumaierova, 2005), (Camska, 2014).

#### **1.4 Characteristics of the Cluster**

As mentioned above, cluster is a geographical location of different subjects, especially private companies, but also public organizations, suppliers, banks and other subjects, where all of these subjects are able to create competitive advantage thanks to the membership (Kovarnik, 2007), (Kovarnik & Stejskal 2009), (Stejskal & Hajek 2012).

HIT cluster was established on 8<sup>th</sup> October 2008. There are fifteen members these days, namely:

- AG COM, joint-stock company,
- ALTEC, joint-stock company,
- DERS, ltd.,
- FG Forrest, joint-stock company,
- GIST, ltd.,
- ORTEX, ltd.,
- T-MAPY, ltd.,
- University of Hradec Králové,
- CSF, ltd.,
- MF SERVIS, ltd.,
- Koncept Hradec Králové, ltd.,
- GMC Software Technology, ltd.,

- Technologic Center Hradec Králové, public benefit corporation,
- High School and College of Applied Cybernetics, Ltd.,
- UNI-EPOS, Ltd.

University of Hradec Králové is a public university; therefore there is no aim to create net income. The other members are private business entities and these institutions have been analysed in this article.

### 1.5 The Aim and the Methodology

As mentioned above, the basic aim of this article is to verify the hypothesis that the different indicators evaluating same aspect of financial health provide same or at least comparable results. The members (private companies) of HIT cluster have been selected for the verification of this hypothesis, and the Altman Z-score, Taffler's Model, and IN Model, have been used for the calculations.

The data for the calculations are available in Albertina database. The analysed period is from 2010 to 2013, because for this period the data were available in database in the moment of creation of this article. However, because of the length of the article are described only results for period 2011 – 2013 in the following Tables, while the analysis deals with the year 2010 too.

## 2 The Financial Analysis of Selected Companies

In the following Tables are final results of different models for above mentioned companies in the years 2011, 2012, and 2013. Unfortunately, three companies have not published their results for year 2013 in the moment when this article was created, therefore the table for 2013 is not complete.

**Tab. 1: Results for selected companies in 2011**

Company	Altman Z-score		Taffler's Model		IN05	
	Result	Zone	Result	Zone	Result	Zone
AG COM	2.72246	grey	0.633975	safe	1.857552	safe
ALTEC	3.340097	safe	0.782706	safe	1.160871	grey
DERS	2.258901	grey	0.730758	safe	1.570807	grey
FG Forrest	2.987809	safe	0.673651	safe	1.852284	safe
GIST	8.293669	safe	2.908111	safe	223.5767	safe

ORTEX	4.008459	safe	0.754555	safe	1.719146	safe
T-MAPY	3.631932	safe	0.639968	safe	1.534981	grey
CSF	2.567149	grey	0.654301	safe	1.12042	grey
MF SERVIS	4.091279	safe	1.223765	safe	2.032147	safe
Koncept HK	11.29949	safe	7.99742	safe	8.400629	safe
GMC	8.393599	safe	1.595971	safe	2.298073	safe
Technologic Center HK	0.966232	distress	0.241751	grey	0.676199	distress
High School	3.682524	safe	0.962194	safe	1.517683	grey
UNI-EPOS	1.463018	grey	0.189001	distress	0.73263	distress

Source: own calculations based on Albertina databases

**Tab. 2: Results for selected companies in 2012**

Company	Altman Z-score		Taffler's Model		IN05	
	Result	Zone	Result	Zone	Result	Zone
AG COM	3.45737	safe	0.717176	safe	1.067271	grey
ALTEC	3.367811	safe	0.68801	safe	1.098726	safe
DERS	1.488741	grey	0.296677	grey	0.677022	distress
FG Forrest	2.395441	grey	0.497607	safe	1.110307	grey
GIST	5.659557	safe	1.717543	safe	2.592383	safe
ORTEX	3.554046	safe	0.579493	safe	1.159983	grey
T-MAPY	3.256146	safe	0.697056	safe	2.509093	safe
CSF	2.299117	grey	0.612725	safe	0.826101	grey
MF SERVIS	3.997026	safe	0.963759	safe	1.674847	safe
Koncept HK	16.25106	safe	8.614735	safe	16.80404	safe
GMC	5.203015	safe	1.102769	safe	1.645907	safe
Technologic Center HK	0.862829	distress	0.213515	grey	0.633562	distress
High School	3.254063	safe	0.767665	safe	1.1871	grey
UNI-EPOS	-0.30301	distress	0.106835	distress	-8.62087	distress

Source: own calculations based on Albertina databases

**Tab. 3: Results for selected companies in 2013**

Company	Altman Z-score		Taffler's Model		IN05	
	Result	Zone	Result	Zone	Result	Zone

ALTEC	4.201632	safe	1.1070705	safe	14.1791	safe
DERS	1.731553	grey	0.35528019	safe	0.77492	distress
GIST	9.319854	safe	2.72432506	safe	4.30783	safe
ORTEX	2.316571	grey	-0.0364635	distress	-3.3167	distress
T-MAPY	3.830796	safe	0.20909951	grey	-3.701	distress
CSF	3.107445	safe	0.73992364	safe	1.0463	grey
MF SERVIS	2.701207	grey	0.78491009	safe	1.82274	safe
Koncept HK	13.79484	safe	14.7233964	safe	12.3814	safe
GMC	5.411386	safe	1.13258046	safe	1.8702	safe
Technologic Center HK	0.367436	distress	0.3515311	safe	0.31247	distress
UNI-EPOS	0.983982	distress	0.26172432	grey	2.39565	safe

Source: own calculations based on Albertina databases

The results in 2010 were calculated by authors, but because of the range of this article are not described in table. However, in 2010 were results of all three indicators same for eight companies, while six companies achieved different result in one indicator. However, this difference was only for one category, in other words either safe – grey or grey – distress zone.

The situation in 2011 is described in the Table 1. Six companies had same results of different indicators in this year, while eight had different ones. Nevertheless, these differences are again only for one category. Interesting fact is that there are companies which had same results in one year and different results in the following year and on the contrary, companies with different results in one year and same results in the following one.

In the year 2012, again seven companies had some results for every analysed indicator, but some of these companies were different than in the year 2011. Obviously, seven companies had different results.

In the last year (2013) were analysed only eleven companies. Four of them had some results for every indicator. Moreover, in this year had four companies very different results, namely all three options in three cases (safe – grey – distress) and two opposite options in other case (safe – distress).

Of course, it is necessary to add some information to this analysis. First of all, authors of these indicators usually claim some rate of efficiency, in other words, even authors of these indicators know that there is a chance that the results are not correct and do not correspond with the reality. Therefore it is possible that while one indicator shows real situation, the other

one is not correct. In this point of view, it could be estimated that if two different indicators have same results, the probability of these results is higher and last indicator is incorrect one.

Secondly, it is important to know that authors of this article are using only generally available data and they have no contacts with analysed companies. It is obvious that some requested data are specific and usually not generally available, or in other words that the companies can have some additional informations, which can change some partial indicator and, consequently, the final result as well.

Thirdly, it is necessary to add that analysed companies are from very specific industrial sector, namely IT sector. It is of course possible that the conditions in this sector are very different from the other business sectors and therefore the final results have no significant predictive value. On the other hand, it is also possible to make again above mentioned partial conclusion that if the different indicators have same result, the situation of the company could be probably corresponded to this results. Moreover, if the two indicators have same results while the third indicator have different one, the overall position of the company should be probably corresponded to the result of two indicators.

Last but not least, all information is in database, but these data had to be prepared by some physical person originally. It is of course possible that these responsible person presented incorrect information either with the aim to present incorrect data or as a mistake.

## **Conclusion**

This article presents analysis and comparison of different indicators evaluating same aspect of financial health, namely three bankruptcy models (Altman Z-score, Taffler's Model, IN05). Selected companies are members of Hradec IT Cluster. In some point of view, this article continues with the analysis presented in the previous article called "The Application of the Bankruptcy Models in the Conditions of Selected Companies", which was presented on IDSE 2014.

Presented information has been calculated based on the data available in the database Albertina for the period 2010 – 2013, while results for three companies can not be calculated in 2013 because of the lack of the data in the database.

Analysis and comparison shows that even if these models used different partial indicators, different coefficients, and different zones of discriminations, the overall results are comparable for the majority of analysed companies. However, there are some exceptions, where one indicator shows different result that the other models, while this difference is



usually only for one category (either safe zone – grey zone, or grey zone – distress zone). Furthermore, it is possible to find more surprising results in 2013, where the difference is for two categories in one case (safe zone – distress zone) and each model has completely different result in three cases (safe zone – grey zone – distress zone).

Possible explanation can be accuracy of every model, where even the authors of every model admit some rate of inaccuracy; the other possible explanation can be incorrect data, where the authors of this article used generally available data for their analysis and these data can be wrong. Nevertheless, it is possible to sum this up that even if the results of different indicators evaluating same aspect of financial health are comparable for majority of companies, there are also some exceptions. Therefore, it could be recommended not use only one indicator, but evaluate one aspect of financial health with different models and compare these results in every company.

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