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MARCELLIN YOVOGAN - PREDICTING BUSINESS FAILURE: AN APPLICATION OF ALTMAN'S Z-SCORE MODELS TO PUBLICITY TRADED BULAGARIAN COMPANIES

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Being able to predict firm in financial destress and potential has always been one of the main tasks for financial analysts, managers and owners. There are tremendous academic researches on predicting bankruptcy. However, Altman's Z-score, is widely applied in assessing firm's insolvency and is also as a basic indicator for such risk.

The aim of this paper is an attempt of application of the Altman's model to publicly traded companies on the Bulgarian stock exchange. The companies have been selected from different industries (manufacturing, non-manufacturing), following the approach suggested by the models.

The results showed, that whatever the industry, the model seems to reflect the financial health of the company and could be used in forecasting a potential downfall in the financial performance of a business. However, as accounting data are still used, it could be wise to consider the quality of the accounting information, policy and standards applied.

Keywords*: Altman's Z-score, bankruptcy, public companies*

Introduction

Understanding, what's behind the numbers disclosed in business financial statements has always been interesting for financial analysts, investors and academics (Shah and Butt, 2011). The globalizing world and cyclical economic and financial crisis are factors requiring in-depth analysis of the financial health of businesses. With a permanently changing environment, the accurate valuation of the firms' financial performance is vital for profitable investments (Peavler, 2017). Thus, predicting potential failure of a business would save future pains, disappointment and loss of wealth.

Several methods are applied, and the literature is abundant on how to assess the financial health of a business (Altman, 1983; 1993; 2000). In this line, the main objective of the paper is to value the risk of default of some Bulgarian firms by applying the multivariate discriminate analysis models developed by Altman.

The models are applied to companies listed on Bulgarian stock exchange. The typical selection of the companies is mainly due to availability of data. Otherwise, and in a future perspective, other companies could be included in the sample.

Even publicly traded, the names of the companies have been modified to insure confidentiality.

The remaining part of the paper consists of: the presentation of the model; the application to the selected companies; the interpretation of the results and findings; and suggestions and conclusion

1. Bankruptcy analysis and prediction models

1.1. The classics

As mentioned, there is an important literature on firm bankruptcy and default prediction. The differences among scholars are related to methods used. While some are concentrated on ratios analysis (Peavler, 2017) focusing on the data provided through the financial statements and management reports (Masson, 2018; Fridson and Alvarez, 2002) others suggest the use of macro-economic factors. This paper uses primarily Altman's models, which are rather based on ratios. After a short presentation of the models in the following section, we'll applied the models in the next section

William H. Beaver (1966)

One of the first classic works in the area of bankruptcy prediction was developed by William H. Beaver in 1966 in the article 'Financial ratios as predictors of failure'. Beaver gave the definition for bankruptcy as the incapability of the company to pay its financial obligations. He created the foundation of the discriminant analysis by developing a univariate analysis for a couple of bankruptcy predictors. In the study, Beaver compared the values of 30 financial ratios for 79 bankrupted and 79 non-bankrupted companies in 38 different industries in the period 1954-1964. Beaver also examined some ratios' predictive abilities and concluded that cash flow to total debt ratio was the best indicator of bankruptcy as the percentage of firms misclassified with it was the lowest among all ratios (Figure 1). He also stated that the univariate analysis is useful if data for at least five years is taken into consideration. Another suggestion made by Beaver in the study was that if multiple ratios are considered at the same time, this might have a better and more accurate predictive ability than single ratios. Some of the limitations of Beaver's study are the fact that it treats the predictions made by the ratio as dichotomous and that specific values of the cutoff points obtained from the sample cannot be used in a decision-making situation (Beaver, 1966).

Edward I. Altman (1968)

Following Beaver's analysis and using his univariate analysis as a foundation, Edward I. Altman developed the z-score model. The model can be described as a multivariate or multiple discriminate analysis (MDA). The questions raised in the study are which ratios are most important in detecting bankruptcy potential, what weights should be attached to those selected ratios, and how should the weights be objectively established (Altman, 1968). The research sample included a total of 66 listed companies from the manufacturing sector, 33 of which considered as 'healthy' and 33 bankrupted. The bankrupted companies were all manufacturers that filed bankruptcy under Chapter 10 (from the United States National Bankruptcy Act) in the period from 1946 to 1965. The obtained results accuracy was 95% with a 5% error when the data tested was from one year before bankruptcy. The percentage of error increased to 17 and the classification accuracy decreased to 83% when the data used was for two years before bankruptcy. The percentage of accuracy dropped with each year: 48% if data was for three years before, 29% if data was for four years before and 36% if data was five years before.

To find the appropriate ratios for the research Altman, set two criteria. The first one was the importance and predominance of the ratios in the literature and the second one, the expected significance of the ratios for this research. Apart from their individual performance, Altman also considered the ratios' corresponding correlation. In the end, after careful consideration, Altman chose five ratios

Table 3:

Percentage of firms Misclassified*: Dichotomous Classification Test

Ratic	Year beforce Failure				
	1	2	3	4	5
Cash flow Total debt	.13 (.10)	.21 (.18)	.23 (.21)	.24 (.24)	.22 (.22)
Net income Total assets	.13 (.12)	.20 (.15)	.23 (.22)	.29 (.28)	.28 (.25)
Total debt Total assets	.19 (.19)	.25 (.24)	.34 (.28)	.27 (.24)	.28 (.27)
Working capital Total assets	.24 (.20)	.34 (.30)	.33 (.33)	.45 (.35)	.41 (.31)
Current ratio	.20 (.20)	.32 (.27)	.36 (.31)	.38 (.32)	.45 (.31)
No-credit interval	.23 (.23)	.38 (.31)	.43 (.30)	.38 (.35)	.37 (.30)
Total Assets	.38 (.38)	.42 (.42)	.45 (.42)	.49 (.41)	.47 (.38)

**** The top row represents the results of the second test. The bottom row refers to the first test***

Source: (Beaver,1966)

Figure 1:

which he found as most suitable for the research. Then he developed a linear function, known as the Z-score. The function uses the weighted total of a company's profitability, liquidity, leverage, activity and solvency ratios where the weights are estimated by multiple discriminant analysis.

The first version of the Z-Score for listed manufacturing companies is:

$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.99X_5$

Where:

X1 – Working Capital / Total Assets. It measures the net liquid assets of the company compared to the total capitalization and working capital is defined as the difference between current assets and current liabilities

X2 – Retained Earnings / Total Assets. The indicator of the cumulative profitability over time.

X3 – Earnings Before Interest and Taxes / Total Assets. which measures the productivity of the company, abstracting from any tax and leverage factors.

X4 – Market Value of Equity / Book Value of Total Debt. The equity is measured by the combined market value of all shares, preferred and common, while the debt includes both current and long-term.

X5 – Sales / Total Assets. This illustrates the sales generating ability of the firm's assets.

The z-values are interpreted as follows:

If Z is equal or greater than 2.99, then the company is 'healthy' and out of risk of bankruptcy. If the Z-score falls below 1.81, this means that the company is in the bankrupted group or has a high risk of financial distress. If the value of Z is between 1.81 and 2.99, then the business is in the 'grey area'. The moderate risk of bankruptcy

The second version of the Z-Score was introduced for the analysis of non-manufacturing companies in 1995. It excludes the activity ratio of sales / total assets from the calculation in order to clear any possible distortion due to the sector specifications (Altman, Hartzell and Peck, 1995)

$Z = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$

- for Z greater than 2.6, then the firm is considered as safe from bankruptcy and out of risk.

- A company with high risk of bankruptcy will have a Z-score below 1.1;

- Finally, If the Z-score value is between 1.1 and 2.6, then the company is in the 'grey zone' and is at moderate risk of bankruptcy.

The third version of the Z-score model is supposed to be applied primarily for private firms, which considers market value rather than equity value in the fourth variable X4 (Altman, 2000).

$Z' = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4 + 0.998X_5$

The overall value of Z'score indicates as follows:

- for Z greater than 2.9, then the firm is considered as safe from bankruptcy;

- A company with high risk of bankruptcy will have a Z-score below 1.23;

- Finally, If the Z-score value is between 1.23 and 2.9, then the company is in the 'grey zone' and is at moderate risk of bankruptcy.

Other methods have been used in predicting and explaining the risk of a firm default.

In this paper will focus on the application of Altman's model

1.2. Business Failures in Bulgaria and Central and Eastern Europe

Coface stands for "*Compagnie francaise d'assurance pour le commerce exterieur*" in French. It is a specialized company in credit insurance and risk management. They provide regular publications on firms and their financial exposition to risk.

According to their study on Bulgarian credit market in 2016, the number of newly opened insolvency proceedings has declined by 21 percent reaching 440 companies, however the number of actual bankruptcies filed counts for 381 finalized cases (Coface, 2017).

The study of Central and Eastern Europe (CCE) region, pointed out that main macro-economic indicators should be leading in the analysis of the bankruptcy rates for a country. Those indicators could focus on the changes in GDP as well as changes in regulation. According to the study, there was an overall decrease in the for the region. However, there differences in level of bankrupted firms reported in each country. Bulgaria reported a 35.6% decrease in bankruptcy proceedings. According to Coface's analysis, a better understanding of the level of company failure in each country will depend on the definition given to "insolvency" and "bankruptcy". Thus, in Croatia, for instance a new law put in force in 2015, influenced strongly the figures for 2016. According to the new law, the National financial agency (FINA) is obliged to begin bankruptcy proceedings for each company whose accounts have been blocked for more than 120 days and for each company that has liquidity difficulties in paying personal expenses (employees' remunerations) for more than three months. With the application of the new regulation, more than 14 000 companies entered the insolvency procedure (Coface, 2017).

The insolvency rates have decreased in eight of the fourteen countries studied in 2016 compared to 2015. The highest decreases have been observed in

Bulgaria, Romania and Slovakia, with respectively -35.6%, -20.8% and 22.6%.

The overall picture of business failure based on the study from Coface is summarized in the following table.

Table 1: *Insolvency rates in Central Europe 2015-2016*

Country	Total insolvencies	Dynamics	Insolvency rate*	Forecast Dynamics	
	2016	2016/2015	2016	2017	2018
Bulgaria	381	-35,6%	0,10%	-4,7%	-2,8%
Croatia	14 495	**	6,73%	4,3%	-0,2%
Czech Rep.	11 800	-15,0%	0,80%	-3,8%	-3,2%
Estonia	335	-10,9%	0,16%	-2,7%	-4,6%
Hungary	22 671	56,9%	4,49%	3,4%	-2,2%
Latvia	727	-12,4%	0,30%	-5,9%	-0,9%
Lithuania	2 684	35,2%	2,58%	-4,0%	-1,6%
Poland	760	2,6%	0,04%	6,8%	-0,7%
Romania	8 053	-20,8%	1,71%	-2,7%	-1,8%
Russia	10 527	-12,6%	0,22%	-10,1%	-3,2%
Serbia	5 803	13,8%	4,43%	2,0%	-0,9%
Slovakia	345	-22,6%	0,06%	-2,0%	-0,6%
Slovenia	647	-10,9%	0,32%	-3,6%	-1,0%
Ukraine	1570	22,2%	0,26%	5,4%	-2,3%
GDP weighted average		-6,0%	0,63%	-3,9%	-2,3%

Source: Coface, 2017 Available at: http://www.coface.com/News-Publications/Publications/Central-and-Eastern-Europe-Less-business-insolvencies-despite-temporary-headwinds-in-the-construction-sector

2. Data collection, Methodology and research design

2.1. Data collection

The sample consists of the financial statements of ten (10) companies traded on the Bulgarian stock exchange. They have been selected using the following principles:

- Availability of financial information; which means the disclosed financial statements and any publicly required information;
- The companies didn't enter in any procedure of bankruptcy or insolvency in the period of the study;
- Two main groups of companies: manufacturing and non-manufacturing studied;
- The study doesn't include companies with typical financial activities (banks, insurance companies, leasing businesses, …);
- The study covered a period of 10 years, from 2007 to 2016, when the data are available and could be used with no additional adjustments. Previous and current periods have been excluded, in the perspective to have much more homogeneous data;
- When available, the date from audited individual or the consolidated accounts are used;
- Market or accounting and any useful information for the purpose of the study is taken from the websites of the companies or that of Bulgarian stock exchange;
- The actual names of the companies were modified to insure confidentiality; even, though all of them are publicly traded.

2.2. Methodology and research design

For each company, the two type of scores are calculated: manufacturing or non-manufacturing company. No specific classification criteria, such as: the size, the type of activity, the type of financing (equity or debt) were included as variables.

Model 1. For the manufacturing industry:

$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.99X_5$ *(Altman, 1968)*

Model 2. For the non-manufacturing industry:

$Z = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$ *(Altman, Hartzell and Peck, 1995)*

The results are presented in tables and short analysis and interpretation are provided, for better understanding of a large group of readers.

3. Results and findings

The company's activities are mainly in the advertising and printing business. It experienced a fall in shares prices at the end of 2017 with 26 % decline, compared to the average in previous year. Similarly, the results of the z-model indicated a high risk of default (Table 4).

Table 2: *Energy plc z-score*

	2009	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
WC/TA	0,384	0,371	0,345	0,300	0,282	0,122	0,181	0,206
RE/TA	0,020	-0,012	-0,023	-0,058	-0,050	-0,092	-0,106	-0,221
EBIT/TA	-0,097	-0,033	-0,026	-0,038	-0,056	-0,109	-0,092	-0,143
MC/TL	0,250	0,237	0,214	0,238	0,219	0,194	0,164	0,148
S/TA	0,247	0,323	0,391	0,414	0,393	0,348	0,405	0,197
Z- score	**0,567**	**0,787**	**0,814**	**0,711**	**0,609**	**0,121**	**0,269**	**-0,247**

As the name could inform, the company is in the manufacturing industry and its main activity is the production of power tools, welding constructions, agricultural machinery, transport and construction machinery. The company recorded steadily negative EBIT for the last 8 years and the share prices have been constantly highly volatile, which raised the question of sustainability of the firm's activity in the future. The z-score results showed that there is a risk of bankruptcy in the future as the company has always been in the riskiest zone of bankruptcy during the whole period of study.

The company is specialized in manufacturing and investments activities and experienced an average decrease of 24% in share prices in 2017. The lowest z-score was achieved in 2009. However, the remaining years showed good performance and the "Safe zone". was reached in the last three years of study (2014-2016). The scores are driven by the sales to total assets ratios, although in 2007, the 2.815 score is mainly due to the market capitalization to total liabilities ratio (Table 5).

The company operates in the manufacturing of cigarettes and other related products and is one of

Table 3: *Advertising plc. z-score for the period 2007-2016*

	2007	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
WC/TA	0.276	0.085	0.034	0.038	-0.044	-0.046	0.038	0.035	0.028	-0.009
RE/TA	0.138	0.111	0.085	0.083	0.092	0.111	0.111	0.051	0.032	-0.015
EBIT/TA	0.159	0.042	0.006	0.012	0.012	0.015	0.008	-0.066	-0.004	0.011
MC/TL	0.489	0.448	0.405	0.417	0.442	0.427	0.438	0.477	0.470	0.499
S/TA	0.687	0.422	0.421	0.399	0.410	0.469	0.491	0.578	0.606	0.659
Z-score	**2.028**	**1.088**	**0.843**	**0.851**	**0.789**	**0.874**	**0.983**	**0.759**	**0.951**	**0.965**

Table 4: *Capital plc z-score for the period 2007-2016*

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
WC/TA	0.182	0.255	0.245	0.272	0.364	0.400	0.432	0.454	0.473	0.492
RE/TA	0.169	0.099	0.128	0.128	0.064	0.077	0.097	0.079	0.096	0.111
EBIT/TA	0.142	0.093	0.000	0.099	0.148	0.120	0.095	0.104	0.093	0.104
MC/TL	2.288	0.220	0.336	0.293	0.549	0.614	0.595	0.751	0.941	0.800
S/TA	0.517	1.179	0.797	1.166	1.365	1.247	1.220	1.280	1.340	1.297
Z- score	2.815	2.063	1.472	2.175	2.710	2.600	2.545	2.727	2.915	2.867

Table 5: *Tobacco plc z-score for the period 2007-2016*

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
WC/TA	0.228	0.295	0.263	0.310	0.224	0.264	0.177	0.100	-0.004	0.007
RE/TA	0.302	0.334	0.306	0.356	0.354	0.400	0.146	0.445	0.354	0.305
EBIT/TA	0.007	0.037	0.006	0.037	0.002	0.161	0.133	0.020	-0.033	-0.022
MC/TL	0.019	0.020	0.025	0.042	0.031	0.030	0.021	0.026	0.022	0.018
S/TA	0.504	0.465	0.461	0.561	0.705	0.832	1.000	0.755	0.732	0.470
Z- score	**1.233**	**1.420**	**1.240**	**1.578**	**1.493**	**2.260**	**1.867**	**1.578**	**1.127**	**0.844**

the biggest in the country in terms of volume of sales and total amount of assets.

In 2017, it suffered 17% decrease in the share prices.

The z-scores are declining from 2012 to 2016 and fluctuating during the previous years of studied period and the last two years are the riskiest according to the applied model.

The core activity of the company includes the geological research and production for petroleum industry. The average share price has decreased for approximately 15% in 2017.

Table 6: *Oil plc z-score for the period 2007-2016*

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
WC/TA	0.350	0.372	0.265	0.338	0.438	0.467	0.396	0.302	0.311	0.406
RE/TA	0.120	0.128	0.079	0.081	0.143	0.113	0.122	0.084	0.076	0.083
EBIT/TA	0.077	0.092	0.073	0.072	0.142	0.109	0.118	0.065	0.044	0.037
MC/TL	0.516	0.542	0.298	0.400	0.425	0.463	0.416	0.407	0.417	0.622
S/TA	0.418	0.496	0.231	0.247	0.259	0.244	0.254	0.230	0.280	0.319
Z- score	1.57	1.752	1.081	1.241	1.708	1.600	1.539	1.170	1.154	1.415

Except in 2008 and 2011, with a slightly better z-score, all the remaining years showed the company in a highly risky zone of bankruptcy.

Table 7: *Energy appliances plc z-score for the period 2007-2016*

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
WC/TA	0.469	0.273	0.250	0.190	0.143	0.132	0.235	0.344	0.260	0.302
RE/TA	0.163	0.167	0.080	0.055	0.070	0.074	0.129	0.129	0.187	0.205
EBIT/TA	0.153	0.190	0.081	0.055	0.070	0.074	0.100	0.095	0.088	0.092
MC/TL	0.526	0.799	0.571	0.534	0.488	0.421	0.451	0.413	0.256	0.220
S/TA	1.140	1.068	0.625	0.813	0.868	0.971	0.990	0.861	0.908	0.799
Z- score	**2.751**	**2.737**	**1.646**	**1.618**	**1.663**	**1.732**	**2.054**	**2.016**	**1.924**	**1.885**

The main producer of lead-acid batteries. It reported a total revenue of approximately 175 million of euros in 2016, representing an increase of nearly 17% compared to 2016.

The z-score results showed a moderate risk of bankruptcy during almost, the whole period of study, except in 2007, where the score is a bit higher.

With the main activity in the production of cosmetics and related products, it reached the highest z-score in 2009, which is mainly due to the increased EBIT together with the Market Value of Equity/Total Liabilities ratio.

The analysis is limited to this period due to consistency in the calculations.

Table 9: *Pharmacy plc z-score for the period 2010-2016*

	2010	2011	2012	2013	2014	2015	2016
WC/TA	0.199	0.158	0.143	0.130	0.174	0.142	0.150
RE/TA	0.210	0.228	0.239	0.251	0.249	0.266	0.303
EBIT/TA	0.077	0.067	0.058	0.048	0.036	0.033	0.072
MC/TL	0.475	0.425	0.373	0.357	0.343	0.357	0.366
S/TA	0.960	0.953	0.924	0.971	1.028	1.047	1.021
Z- score	2.03	1.94	1.84	1.85	1.91	1.91	2.08

Pharmacy plc is one of the largest pharmaceutical companies in the region. It reported more than a

Table 8: *Cosmetics plc z-score for the period 2007-2016*

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
WC/TA	0,314	0,332	0,332	0,287	0,200	0,111	0,117	0,128	0,165	0,199
RE/TA	0,064	0,066	0,095	0,087	0,183	0,080	0,079	0,085	0,082	0,125
EBIT/TA	0,078	0,027	0,040	0,005	0,009	0,028	0,037	0,046	0,050	0,051
MC/TL	0,698	1,446	1,919	1,700	1,278	0,900	0,953	1,249	1,263	1,258
S/TA	0,841	0,848	0,854	0,704	0,802	0,717	0,688	0,779	0,794	0,768
Z- score	1,98	2,30	2,68	2,21	2,10	1,60	1,63	1,95	2,03	2,10

billion of sales revenue in 2017. The z-score results can be interpreted as almost constant during the period of study.

This particular company needs further in-depth study, which could be subject of a near future paper.

ing construction. The z-score in 2014 reached exceptionally 2.87, putting the company into the "safe area", which could be explained mainly with the increase in sales to total assets ratio. The following years; 2015 and 2016 showed a substantial

Table 10: *Tourist plc z-score for the period 2007-2016*

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
				-	-	-	-	-	-	-
WC/TA	0.010	0.000	0.019	0.032	0.037	0.022	0.034	0.029	0.025	0.009
RE/TA	0.147	0.096	0.082	0.079	0.082	0.088	0.111	0.163	0.165	0.210
EBIT/TA	0.061	0.031	0.069	0.025	0.020	0.038	0.032	0.014	0.012	0.016
MC/TL	0.027	0.023	0.027	0.029	0.034	0.040	0.041	0.032	0.031	0.036
S/TA	0.236	0.225	0.194	0.196	0.208	0.208	0.219	0.183	0.163	0.189
Z- score	0.67	0.48	0.53	0.37	0.36	0.46	0.47	0.44	0.42	0.55

The business is the largest in the tourism sector and operates three important resorts on the Black Sea coast and beaches.

The z-scores showed a highly risky company and a forthcoming failure. However, it has been operating since 1969 and is one of those companies, which didn't experience high volatility of their share prices in the last years, and which have an "acceptable" dividend policy.

decrease of the score due once to the decrease in sales revenue and the negative EBIT (Table 12)

Machinery plc is a major manufacturer of heavy machinery and equipment since 1963.

It is the only company from the studied, showing a high level of z-scores during the entire period of study except 2007 and 2009, where the results are below the 2.67 advised by the model. However, the following questions required to be raised:

Table 11: *Road plc z-score for the period 2007-2016*

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
WC/TA	1.00	0.076	0.031	0.029	0.048	0.014	0.102	0.138	0.093	0.029
RE/TA	0.061	0.005	0.046	0.059	0.033	0.008	0.067	0.060	0.038	-0.046
EBIT/TA	0.076	0.033	0.027	0.066	0.034	0.007	0.076	0.073	0.047	-0.044
MC/TL	0.034	0.023	0.013	0.012	0.172	0.194	0.163	0.180	0.148	0.164
S/TA	1.123	0.748	0.913	1.324	1.719	1.474	1.319	2.273	0.964	1.090
Z- score	1.75	0.97	1.11	1.67	2.04	1.64	1.88	2.87	1.37	1.01

The company carries major public projects in the field of infrastructure, environment, public works and hydro-technical construction, energy and build-

- Is that enough to conclude that the company doesn't face any risk of default in the future?

Table 12: *Machinery plc z-score for the period 2007-2016*

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
WC/TA	0.202	0.240	0.208	0.245	0.396	0.431	0.432	0.421	0.388	0.400
RE/TA	0.144	0.182	0.209	0.295	0.212	0.154	0.133	0.143	0.118	0.153
EBIT/TA	0.088	0.134	0.001	0.146	0.231	0.172	0.149	0.160	0.132	0.170
MC/TL	0.655	0.759	1.069	1.004	0.913	1.301	1.122	3.376	3.901	3.344
S/TA	1.368	1.420	0.756	1.096	1.320	1.140	1.175	1.186	1.183	1.210
Z- score	2.49	2.86	1.94	2.89	3.40	3.22	3.05	4.44	4.59	4.47

- Is the model totally applicable to any company in any context, specific market or any stage of economic development?

We have seen that industry and size could matter, when it's turned out to assess the risk of bankruptcy of a firm, as mentioned by the researches carried by the pioneers in business default analysis.

4. Limitations

This study is an attempt of the simple application of the z-score model developed by Altman in the specific context of Bulgaria market. The research suffers of many limitations:

- The illiquidity of the capital market could lead to some abnormal results, which have not been considered in the study;
- As far as accounting numbers are used, the results will be affected by the accounting policy and its quality;
- The sample could include more companies;
- Other models could be applied to insure comparability;
- The non-homogeneous of the period of study (the study covers different periods for different companies) limits comparability;
- The general limitations of ratios analysis (Wahlen, Baginski and Bradshaw, 2010; Shah, Butt and Tariq, 2011; Tyndall, 2019)
- The research doesn't include the last years, for which the data were disclosed latter.

Suggestions and conclusion

Further research is undergoing for a better understanding of the processes of business failure in Bulgaria. This is expecting to include as well private, public, large as SMEs, which have not been included in the current.

Most of the studies on Central European Economies are conducted using the already established methods or models. It might be interesting and may be useful to adapt these methods to the particularities of those economies, which had experienced many years of central planification, and a long period of transition to free-market economy.

The key purpose of financial analysis is to provide decision-makers with the accurate financial indicators, which will guide them in making informed and efficient decisions (Berk and DeMarzo, 2014).

Having a correct knowledge of the financial health of a business is crucial for an efficient investment and financing decisions (Mohana, 2011).

The study highlighted that Altman's z-score could be used in assessing firm's risk of bankruptcy. However, a better understanding of the numbers disclosed through the financial statements and the capital market, in which the company operates, its activities and stage of development are also important.

Although the regulations are encouraging best practices in accounting and financial management, it's possible to conclude that, the Bulgarian capital market is not yet efficient enough, due to it small size and the volume of transactions operated on Bulgarian stock exchange.

Ratios analysis is a simple and fast tool of measuring business health. It then required to be handled carefully to avoid misinterpretations and distortions, which might be raised with the usage of accounting numbers and creative accounting.◆

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Summary

Có thể dự đoán nguy cơ và khó khăn tài chính của doanh nghiệp luôn là một trong những nhiệm vụ quan trọng của các chuyên gia tài chính, nhà quản trị và chủ sở hữu doanh nghiệp. Đã có nhiều nghiên cứu về dự đoán nguy cơ phá sản. Trong số đó, mô hình Z-score (mô hình điểm Z) của Altman được sử dụng rộng rãi trong đánh giá nguy cơ mất khả năng thanh toán của doanh nghiệp và cũng là một chỉ số cơ sở để đo lường rủi ro đó.

Mục tiêu của nghiên cứu này là ứng dụng mô hình của Altman đối với các công ty niêm yết trên thị trường chứng khoán Bulgarie. Các công ty được lựa chọn đến từ nhiều lĩnh vực khác nhau (sản xuất, phi sản xuất), theo đường hướng mà mô hình đề xuất.

Kết quả cho thấy cho dù hoạt động trong lĩnh vực nào thì mô hình này cũng giúp phản ánh tình hình tài chính của doanh nghiệp và có thể được sử dụng để dự đoán rủi ro suy giảm năng lực tài chính của doanh nghiệp. Tuy nhiên, do các dữ liệu kế toán vẫn được sử dụng nên vẫn cần xem xét chất lượng thông tin, chính sách và tiêu chuẩn kế toán được áp dụng