ALTMAN MODEL FOR PREDICTION OF FINANCIAL HEALTH WITHIN POLISH ENTERPRISES

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Abstract

In this case, database was created from financial statements using Amadeus program to determine the banker prediction. First of all, we investigated the level of individual economic indicators that capture aspects of liquidity, and profitability. When selecting companies whose data entered the database, we also considered the number of years since the company established, the size of the company, and several characteristics of the industry to be necessary. The most common causes of population indebtedness include poor financial literacy, efforts to achieve a standard of living that does not correspond to financial possibilities, and the absence of a cash reserve in the event of sudden financial distress. With the help of bankruptcy models that predict the company's future financial difficulties, we will try to discover the causes of bankruptcy. The advantage of these models is that they reduce subjectivity in the determination of indicators, and therefore the results are more credible. The first part focuses on the definition of basic concepts and procedures in the prediction of the financial health of businesses and individual authors and creators of bankruptcy models in Poland. There is an enormous number of models of financial distress prediction, and in this article, we list some sources at the state of financial distress prediction. Subsequently, we determine the methodology by which we proceed in assessing the economic recovery of Polish companies. We have identified individual companies as stable or unstable in terms of their financial health. In the case of instability, we have further considered what could have been the cause of this instability.

Keywords: financial distress, bankruptcy, Z-score model, prediction

1 INTRODUCTION

The most crucial document in the company is undoubtedly the financial statements. It provides information about the financial position of the business, its performance, and changes in the financial position of the entity. This information serves a wide range of users and should help them to make relevant economic decisions. Most of the data and information can be drawn from the balance sheet, income statement, and cash flow statement (Popescu, 2018, p. 122-127). The disadvantage of this data is that it only shows the past and does not contain data on the future development of the company. The financial and economic analysis serves to eliminate this disadvantage. It compares the obtained data among themselves and

extends their communicative ability. Financial analysis can evaluate the past, present, and predict the future development of the company. Financial analysis is thus closely related to accounting because it obtains the necessary information for the analysis (Karamzadeh, 2013, p. 2007-2011).

At present, financial analysis has become an integral part of the financial management of the company. Appreciations to this, companies gain feedback between the expected effect of managerial decisions and reality. With the help of financial analysis, companies can identify in advance negative trends in the company's management (Valaskova, et al., 2018, p. 105-121). To enable this identification, the financial and economic analysis consists of several basic methods. These include horizontal and vertical financial analysis, indicators of profitability, efficiency, debt and liquidity, an indicator of economic value-added, and many others. With the help of these methods, the company will get results, thanks to which the company can set the appropriate strategy, change the structure of current assets, adjust the arrangement of financing, and the like (Balcerzak, 2017, p. 51-70).

The word bankruptcy refers to the company bankruptcy that has gone into an economic crisis. Precisely, the perceived termination of a business, company or firm, where financial losses for investors and creditors arise, as the business is not capable of producing by which its activities and the effects of the free market economic laws and economic laws could settle its obligations to suppliers or creditors (Branch, 202, p. 39-57). Creditors who have claims against the debtor want to recover the money the debtor owes to them in all possible ways, for example, by monetizing the debtor's property within a legal framework. Specifically, the proceeding, the liquidation of the debtor's assets, and the proceeds distribution from the creditor's sale is a process enforced against the debtor by the judicial authority (Aminian, et al., 2016, p. 208). It thus plunges the debtor into deprivation and excludes him from his active participation in the economy, as the organization will definitively disappear. Fulfilling the business risk of creditors, investors, and suppliers who lose their funds and the borrower causes them a financial loss. The very word "bankruptcy" comes from the Italian word "banco roto," which means a broken table or bench and concisely expresses the bankruptcy caused by the relationship (Scarlat, Delcea, 2011, p. 19-32).

The most common reason for companies to fail is managerial incompetence. Although there are many causes, poor leadership is at the heart of the problems. The leading cause of bankruptcy is simply a lack of money. Interestingly, when a company goes bankrupt due to the economic recession, increased competition and sales are related problems. According to a study on the Canadian market, up to two-thirds of the companies that went bankrupt due to market failure also had competition problems, and more than half lost the main customers. This implies that economic factors - such as recession, increased competition, etc. – are interconnected. On the other hand, there is a tiny link between these factors and other external causes (Altman, 2017, p. 131-171).

If the crisis is not identified at an early stage of development, it goes into an acute phase and is usually recorded accidentally or knowingly in the form of default. Accidental findings of the crisis are situations where an enterprise has no payments at one time, where the supplier refuses to deliver additional goods because its previous overdue receivables are not settled, when the bank warns that no loan repayment has been made or refuses to grant another loan based on previous indicators. First, a rough analysis needs to be carried out to identify the root cause or significant causes of the crisis. This means finding a vital focus of imbalance (Petrisor, Lupu, 2013, p. 154-161). The biggest problem is the length of the causal chain and its unravelling. Even if it succeeds, we cannot expect the treatment to be carried out in the short term. When crisis identifying, it is essential to take such measures as quickly as possible so as not to deepen the situation further, to eliminate the negative impact of factors, in particular on the financial condition of the company (Nica, 2018, p. 56-61).

The analysis of financial health supports to express and evaluate the overall economic situation in which the company is located. This is a comprehensive assessment that will help to determine whether the company is making a profit or loss, whether it is effectively managing the assets at its disposal, whether equity is a large part of the assets, whether the company is able to pay off the liabilities for-profit and to what extent, etc (Valaskova, et al., 2018, p. 2144). The subject of the following chapter is to define the term financial analysis theoretically, to define information sources of financial analysis, which are necessary for its implementation, to characterize absolute indicators, financial ratios, and to indicate the method of their calculation (Kliestik, et al., 2018 p. 791-803). Financial analysis is a comprehensive finding of the economic situation of a company based on the information we have. It helps us to evaluate the results achieved in the previous analysis period, which we can compare with similar companies in the industry. It determines the factors involved in the financial situation and determines the intensity of the influence of the given elements. The analysis identifies whether our company is prospering in the market and its market position. Based on positive results, we can roughly estimate the financial situation in the future and propose measures to eliminate the undesirable shortcomings that have occurred so far (Cepel, 2018, p. 21-40).

2 METHODOLOGY

The financial situation can be analysed through a set of simple and complex methods. Statistical methods are the most commonly used (mean values, time series, variability rates, regression analysis, correlation analysis, and development ratios). They are considered to be the primary tool of financial analysis of an enterprise. Mathematical methods - are a means of quantitative expression of state, relations between elements of economic phenomenon and structure. The most commonly used methods are elementary mathematics (linear algebra), mathematical analysis (differential calculus), and numerical methods. Graphical methods - are also used very often, mainly because they represent the issue. We divide the graphs according to the purpose or shape of the graphic image. Depending on the target, the charts can be divided into illustrative, analytical, control, and computational graphs.
The database was created from Polish companies that have been on the market for more than 5 years and have a turnover of over 4 000 000. It consists of 130 companies and the Altman model was used for analysis. The basic expression of the model is as follows:

$$A = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$$

The individual variables express ratios that enter the model.
X_1 represents the share of working capital in total assets
X_2 is the ratio of retained earnings to total assets
X_3 is the share of earnings before interest and taxes in total assets
X_4 expresses the share of market value of equity in book value of total liabilities
X_5 is the share of sales in / total assets
In the case of the Altman model, the conditions are set that enterprises with a resulting value greater than 2.9 are classified as prosperous enterprises. In the case of undertakings reaching values ranging from 2.9 to 1.81, they are in the grey zone, and their status is unclear. It is not possible to determine whether they are financially stable or firms in difficulty. If the resulting value is less than 1.81, then the companies are considered to be bankrupt, i.e., they are in a bad financial situation, and they are in danger of bankruptcy (Altman, 2017, p. 131-171).

Subsequently, we predicted the financial development of companies in the future through the chosen prediction method.

3 RESULTS

The results of the analysis are shown in detail in this section. The Z-score analysis was entered by 130 industrial companies whose turnover exceeded 4,000,000 and has been on the market for more than 5 years. The last 5 years have been analysed, which allows to monitor the development of individual companies over time and how the state of financial health has changed. For example, company number 12 was in the grey zone between 2014-2016, but since 2017 its financial situation has probably worsened and is in danger of bankruptcy.

Table 1. Financial health of surveyed Polish enterprises using Altman model for 2014-2018.

Company/year	2018	2017	2016	2015	2014
1	Prosperous	Prosperous	Prosperous	Prosperous	Grey Zone
2	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
3	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
4	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
5	Grey Zone	Bankruptcy	Grey Zone	Grey Zone	Grey Zone
6	Grey Zone	Grey Zone	Grey Zone	Bankruptcy	Bankruptcy
7	Grey Zone	Grey Zone	Grey Zone	Grey Zone	Grey Zone
8	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
9	Grey Zone	Grey Zone	Grey Zone	Bankruptcy	Bankruptcy
10	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
11	Grey Zone	Grey Zone	Grey Zone	Grey Zone	Grey Zone
12	Bankruptcy	Bankruptcy	Grey Zone	Grey Zone	Grey Zone
13	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous

Company/year	2018	2017	2016	2015	2014
14	Prosperous	Prosperous	Grey Zone	Prosperous	Prosperous
15	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
16	Grey Zone	Grey Zone	Grey Zone	Grey Zone	Grey Zone
17	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
18	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
19	Prosperous	Prosperous	Prosperous	Grey Zone	Prosperous
20	Bankruptcy	Grey Zone	Prosperous	Grey Zone	Prosperous
21	Grey Zone	Grey Zone	Bankruptcy	Bankruptcy	Bankruptcy
22	Prosperous	Prosperous	Grey Zone	Grey Zone	Bankruptcy
23	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
24	Prosperous	Prosperous	Grey Zone	Bankruptcy	Bankruptcy
25	Prosperous	Grey Zone	Prosperous	Prosperous	Prosperous
26	Grey Zone	Bankruptcy	Grey Zone	Prosperous	Prosperous
27	Prosperous	Prosperous	Prosperous	Prosperous	Bankruptcy
28	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
29	Bankruptcy	Bankruptcy	Grey Zone	Grey Zone	Grey Zone
30	Grey Zone	Grey Zone	Grey Zone	Grey Zone	Prosperous
31	Grey Zone	Grey Zone	Grey Zone	Grey Zone	Prosperous
32	Prosperous	2,896521	Prosperous	Prosperous	Prosperous
33	Bankruptcy	Bankruptcy	Grey Zone	Grey Zone	Bankruptcy
34	Prosperous	Grey Zone	Grey Zone	Prosperous	Grey Zone
35	Grey Zone	Grey Zone	Grey Zone	Grey Zone	Grey Zone
36	Grey Zone	Prosperous	Prosperous	Grey Zone	Prosperous
37	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
38	Grey Zone	Grey Zone	Bankruptcy	Bankruptcy	Bankruptcy
39	Prosperous	Prosperous	Prosperous	Bankruptcy	Prosperous
40	Grey Zone	Bankruptcy	Bankruptcy	Grey Zone	Grey Zone
41	Prosperous	Prosperous	Prosperous	Prosperous	Bankruptcy
42	Grey Zone	Grey Zone	Grey Zone	Grey Zone	Grey Zone
43	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
44	Grey Zone	Prosperous	Prosperous	Prosperous	Prosperous
45	Grey Zone	Grey Zone	Bankruptcy	Grey Zone	Bankruptcy
46	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Grey Zone
47	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Grey Zone
48	Grey Zone	Prosperous	Prosperous	Prosperous	Prosperous
49	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
50	Grey Zone	Bankruptcy	Grey Zone	Bankruptcy	Bankruptcy
51	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
52	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
53	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
54	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
55	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
56	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous

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Company/year	2018	2017	2016	2015	2014
57	Grey Zone	Grey Zone	Bankruptcy	Bankruptcy	Grey Zone
58	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
59	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
60	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
61	Prosperous	Prosperous	Prosperous	Prosperous	Bankruptcy
62	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
63	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
64	Grey Zone	Grey Zone	Grey Zone	Grey Zone	Grey Zone
65	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
66	Bankruptcy	Bankruptcy	Bankruptcy	Grey Zone	Bankruptcy
67	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
68	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
69	Prosperous	Grey Zone	Bankruptcy	Bankruptcy	Bankruptcy
70	Prosperous	Prosperous	Prosperous	Prosperous	Grey Zone
71	Bankruptcy	Bankruptcy	Grey Zone	Prosperous	Prosperous
72	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
73	Prosperous	Prosperous	Grey Zone	Prosperous	Prosperous
74	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
75	Prosperous	Prosperous	Prosperous	Bankruptcy	Bankruptcy
76	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
77	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
78	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
79	Grey Zone	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
80	Bankruptcy	Grey Zone	Grey Zone	Prosperous	Grey Zone
81	Bankruptcy	Bankruptcy	Bankruptcy	Grey Zone	Grey Zone
82	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
83	Bankruptcy	Grey Zone	Grey Zone	Grey Zone	Grey Zone
84	Grey Zone	Grey Zone	Bankruptcy	Bankruptcy	Bankruptcy
85	Prosperous	Grey Zone	Grey Zone	Grey Zone	Grey Zone
86	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
87	Grey Zone	Prosperous	Prosperous	Prosperous	Bankruptcy
88	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
89	Grey Zone	Prosperous	Prosperous	Prosperous	Prosperous
90	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Grey Zone
91	Grey Zone	Grey Zone	Bankruptcy	Bankruptcy	Bankruptcy
92	Grey Zone	Bankruptcy	Grey Zone	Grey Zone	Grey Zone
93	Grey Zone	Grey Zone	Grey Zone	Grey Zone	Grey Zone
94	Grey Zone	Grey Zone	Grey Zone	Grey Zone	Grey Zone
95	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
96	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
97	Prosperous	Grey Zone	Prosperous	Grey Zone	Prosperous
98	Prosperous	Grey Zone	Grey Zone	Grey Zone	Grey Zone
99	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous

Company/year	2018	2017	2016	2015	2014
100	Grey Zone	Grey Zone	Bankruptcy	Bankruptcy	Grey Zone
101	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
102	Grey Zone	Grey Zone	Grey Zone	Prosperous	Prosperous
103	Prosperous	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
104	Grey Zone	Grey Zone	Grey Zone	Grey Zone	Prosperous
105	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
106	Grey Zone	Grey Zone	Grey Zone	Prosperous	Prosperous
107	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
108	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
109	Prosperous	Prosperous	Bankruptcy	Prosperous	Bankruptcy
110	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
111	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
112	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
113	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
114	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Grey Zone
115	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
116	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
117	Grey Zone	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
118	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
119	Grey Zone	Bankruptcy	Grey Zone	Bankruptcy	Grey Zone
120	Grey Zone	Grey Zone	Prosperous	Bankruptcy	Bankruptcy
121	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
122	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
123	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
124	Bankruptcy	Grey Zone	Grey Zone	Grey Zone	Prosperous
125	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy	Bankruptcy
126	Grey Zone	Prosperous	Grey Zone	Grey Zone	Prosperous
127	Prosperous	Prosperous	Grey Zone	Grey Zone	Grey Zone
128	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
129	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous
130	Prosperous	Prosperous	Prosperous	Prosperous	Prosperous

Quantitative causes are represented by financial causes (volume of sales, amount of current assets, mobility of wage and personnel costs), structural causes and macroeconomic causes. In addition to forecasting the financial situation of a company, quantitative indicators are often used to measure the financial performance of enterprises. The following indicators were used in the research so far: return on assets, return on assets, net sales per employee, average revenue growth, EBITDA per employee. It is advisable to take advantage of changes in sales and market share to measure business performance.

On the other hand, it should be noted that qualitative causes cannot be identified through financial statements or changes in macroeconomic indicators. The qualitative causes are the result of the expert group's judgment and relate to specific problems. Their characteristic feature is considerable subjectivity in identifying causes. The qualitative causes of business failures should be covered by the content of the research in further studies. For example, Chen et al. (2009) analysed 19 qualitative indicators in similar studies that, with greater or lesser success, may indicate impending financial problems in the business. The most important causes are: the level of customer relationships; the ability to identify, create, allocate and

preserve scarce resources that differentiate an enterprise from competitors; IT infrastructure; the ability of an undertaking to create a competitive advantage; the ability of the enterprise to benefit from social relationships; the degree of competitiveness of internal resources; customer perception of services; the ability of the enterprise to respond to changing environments; intensity of innovation potential; customer involvement in business processes; professionalism of employees, their ability and willingness to learn; type and intensity of leadership.

4 CONCLUSIONS

The aim of the present paper was to analyse the financial health of selected industrial Polish enterprises and the causes of corporate bankruptcies, characteristics of these enterprises and. This topic is very topical nowadays, as one of the consequences of the global financial crisis was the enormous increase in business failures. The main problem in preventing these bankruptcies is the unpreparedness of business risk management and the lack of tools for preventive measures. One such measure is the predictive bankruptcy models, which are likely to detect in time the impending financial problems of the company.

Business failure can be a long-term process of business crisis or it can suddenly go bankrupt. In the case of bankruptcy, which is the last phase of a long-term crisis in a company, the bankruptcy is caused by several reasons, while on the other hand, the sudden bankruptcy of the company is caused by one unexpected cause to which management failed to respond adequately. If there are several causes of bankruptcy, it is possible to use bankruptcy prediction models that can predict possible problems in the future by using a suitable combination of financial indicators.

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